Abstracts for the 67th Cardiac Society of Australia and New Zealand Annual Scientific Meeting, the International Society for Heart Research Australasian Section Annual Scientific Meeting and the 13th Annual Australia and New Zealand Endovascular Therapies Meeting, 8–11 August 2019, Adelaide, Australia

Ralph Reader Prize Finalists – Basic Science (001–003)

001

Fibulin-3 is Necessary for the Formation of Infarct-Induced Cardiac Fibrosis

L. Murtha [1,*], N. Mabotuwana [1], S. Hardy [1], M. Bigland [1], B. Coulter [1], J. Hwang [2], J. Ye [2], R. Hume [3], J. Chong [3,4], R. Lee [2], A. Boyle [1,2,5]

[1] Hunter Medical Research Institute, The University of Newcastle, Newcastle, Australia
[2] Cardiovascular Research Institute, Edyth and Eli Broad Center for Regenerative Medicine and Stem Cell Research, Department of Medicine, Division of Cardiology, University of California San Francisco, San Francisco, USA
[3] Centre for Heart Research, Westmead Institute for Medical Research, The University of Sydney, Sydney, Australia
[4] Department of Cardiology, Westmead Hospital, Sydney, Australia
[5] Department of Cardiovascular Medicine, John Hunter Hospital, Newcastle, Australia

Background: Cardiac fibrosis is the final stage of every cardiac disease. Despite its prevalence, there are limited effective treatments. Understanding the underlying mechanisms is essential if effective therapies are to be discovered. We hypothesised that fibulin-3 is pro-fibrotic. Here, we aimed to characterise the role of fibulin-3 in ischaemic cardiac fibrosis.

Methods: Fibulin-3 treated human cardiac fibroblasts were analysed for collagen production, myofibroblast conversion, and downstream signalling pathways. Fibulin-3 knockout ($Efemp1^{-/-}$) and wildtype (WT) mice were subjected to myocardial infarction $\pm$ recombinant fibulin-3 myocardial injection. Infarct size, echocardiography and collagen/MMP mRNA expression were analysed. Scar tissue was imaged with second-harmonic generation two-photon imaging.

Results: Fibulin-3 treated cardiac fibroblasts demonstrated significantly increased collagen-I production (2-fold, $p < 0.005$), myofibroblast conversion (7% vs 11%, $p < 0.005$) and Erk1/2 and AKT pathway activation (3- and 2-fold, respectively, $p < 0.005$), compared to untreated cells. $Efemp1^{-/-}$ mice had a significantly higher rate of cardiac rupture post-infarct (32% vs 6%, $p < 0.01$), with evidence of significant ventricular remodelling at 28 days post-MI. This was significantly improved with fibulin-3 myocardial injection. At 3 days post-infarct, no difference in infarct size, or collagen mRNA was seen between $Efemp1^{-/-}$ and WT mice, however MMP-9 was significantly higher (2-fold, $p < 0.05$) and collagen structure was compromised in the $Efemp1^{-/-}$ mice, (distinct holes, fibre alignment and fibre irregularities).

Conclusions: This data suggest that fibulin-3 is pro-fibrotic and plays a vital role in cardiac fibrosis formation, potentially affecting the quality of the scar. Further research is needed to elucidate the potential for fibulin-3 as a therapeutic target.

002

Genetic Susceptibility to Atrial Fibrillation at the chr 4q25 Locus is Associated with Left Atrial Electrical Remodelling

G. Wong [1,*], C. Nalliah [1], A. Voskoboinik [2],
G. Lee [1], S. Prabhu [2], H. Sugumar [2],
R. Parameswaran [1], R. Anderson [1],
A. McLellan [1], L. Ling [2], J. Morton [1],
R. Johnson [3], P. Kistler [2], D. Fatkin [3],
J. Kalman [1]

[1] *Royal Melbourne Hospital, Melbourne, Australia*
[2] *Alfred Hospital, Melbourne, Australia*
[3] *Victor Chang Cardiac Research Institute, Sydney, Australia*

Background: Genome-wide association studies of atrial fibrillation (AF) have identified a highly significant locus on chr4q25 but the disease-associated phenotype at this locus is unknown.

Methods: 85 consecutive unrelated patients (aged 61 ± 9 years, 67% male) undergoing pulmonary vein isolation procedures for paroxysmal or persistent AF were genotyped for the AF-associated single nucleotide variant (SNV), rs2200733, by PCR and Sanger sequencing. Study subjects were evaluated by high-density left atrial (LA) electroanatomic mapping using multipolar catheter during distal coronary sinus pacing at 600 ms. Bipolar voltage, conduction velocity (CV), CV heterogeneity and fractionated signals of 6 left atrial segments were determined (blinded to SNV status).

Results: 31 patients (36%) were SNV carriers (28 heterozygous, 3 homozygous). Compared with non-carriers, SNV carriers had significantly greater CV heterogeneity (46.2 ± 8.7 vs $38.4 \pm 6.2\%$, $p = 0.003$), more complex fractionated signals (9.5 ± 3.3 vs $6.0 \pm 1.2\%$, $p = 0.008$), and greater regional differences in the proportion of points with slowing or conduction block in the lateral (48.8 ± 32.6 vs $24.5 \pm 30.9\%$, $p = 0.003$) and posterior (39.8 ± 32.3 vs $22.8 \pm 27.0\%$, $p = 0.022$) walls. There were no significant differences in overall CV, bipolar voltage, atrial effective refractory periods or sinus node function. On multivariate analysis, SNV carrier status ($p = 0.008$) and persistent AF ($p = 0.02$) were independently associated with increased CV heterogeneity.

Conclusion: These data provide the first evidence that the rs2200733 SNV haplotype predisposes to AF by effects on LA electrical remodelling. The molecular mechanisms underpinning these changes warrant further investigation.

003

Inhibition of Nitric Oxide Synthase: Impact on Cardiovascular Injury and Mortality in a Model of Takotsubo Syndrome

S. Surikow [1,2,*], T. Nguyen [1,2], I. Stafford [2],
J. Horowitz [1,2]

[1] *University of Adelaide, Adelaide, Australia*
[2] *The Queen Elizabeth Hospital, Woodville, Australia*

Background: Takotsubo syndrome (TTS) is often precipitated by stressful circumstances, with associated with catecholamine release. In rodent models, isoprenaline (ISO) injection triggers apical left ventricular ballooning and associated nitrosative stress. We aimed to evaluate whether NG-nitro-L-arginine methyl ester (L-NAME), a nonselective inhibitor of nitric oxide synthase (NOS), might reduce contractile dysfunction, inflammatory changes, secondary vascular pathology and mortality.

Methods: To induce TTS-like changes, an intraperitoneal bolus (i.p) injection of isoprenaline was injected into female Sprague-Dawley rats ($n = 31$). In a further 17 rats, L-NAME was injected i.p 30 minutes pre-ISO. Indices of contractile and cardiac biochemistry were quantitated via paired echocardiography and cardiac immunohistochemistry/immunoblotting, respectively, while vascular contractile responsiveness and endothelial function of thoracic aortic rings were evaluated post sacrifice.

Results: ISO rat mortality was 36%, versus 0% with ISO/L-NAME ($p = 0.004$). L-NAME had no marked impact on echocardiographic markers of cardiac function but reduced myocardial monocyte/macrophage infiltration and increased thioredoxin-interacting protein content (TXNIP: $p < 0.0001$). L-NAME increased ($p < 0.0001$) vasoconstrictor responses to noradrenaline, and impaired ($p < 0.05$) dilator responses to acetylcholine.

Conclusions: In this model of TTS, L-NAME reduced ISO-induced cellular pro-inflammatory infiltrate, but increased expression of TXNIP, an inflammatory activator. There was minimal effect on apical LV systolic dysfunction, while arterial function was altered to accentuate vasoconstrictor responses, with impairment of endothelial function. Early mortality was markedly reduced. If these results can be extrapolated to clinical TTS, there is an implication of reduced early mortality risk, at the expense of prolonged (TXNIP-initiated) myocardial inflammatory activation.

004

Alcohol Abstinence in Moderate Drinkers with Atrial Fibrillation: Results from the Alcohol-AF Randomised Controlled Trial

A. Voskoboinik [1,2,3,*], J. Kalman [2,4], T. Nicholls [1], S. Nanayakkara [1], G. Wong [2], S. Prabhu [1,2,3], C. Nalliah [2], H. Sugumar [1,2,3], D. Stub [1,6], D. Kaye [1,6], M. Wong [5], E. Kotschet [7], A. Taylor [1,6], P. Kistler [1,3,4]

[1] Alfred Hospital, Melbourne, Australia
[2] Royal Melbourne Hospital, Melbourne, Australia
[3] Baker Heart & Diabetes Institute, Melbourne, Australia
[4] University of Melbourne, Melbourne, Australia
[5] Western Health, Melbourne, Australia
[6] Monash University, Melbourne, Australia
[7] Monash Health, Melbourne, Australia

Aim: To investigate the impact of alcohol abstinence in atrial fibrillation.

Methods: We undertook a randomised controlled trial at 6 hospitals. Adults consuming ≥ 10 standard drinks/week (1 SD $\sim$ 12 g alcohol) with a history of paroxysmal or persistent AF were assigned 1:1 to alcohol abstinence or usual consumption. Primary endpoints at 6 months were time to AF recurrence and AF burden

Results: 140 patients (age 62 ± 9 yrs, 63% PAF, intake 17 ± 7 SDs/week) were randomised to Abstinence ($n = 70$) or Control ($n = 70$). Recurrent AF was documented in 37 patients in the Abstinence arm and 51 patients in the Control arm (52.9% vs 72.9%; $p = 0.01$). The Abstinence arm had longer AF-free survival (log-rank $p < 0.01$) and lower AF burden (median burden 0.5%, IQR 0–3% vs 1.2%, IQR 0–10%; $p = 0.01$). At 6 months, the Abstinence arm had lower moderate-severe AF symptoms (10.1% vs 32.4%; $p = 0.002$), Δweight (-2.7 ± 3.3 vs $+0.8 \pm 3.0$ kg; $p < 0.01$) and Δsystolic blood pressure (-12.4 ± 12.8 vs -1.0 ± 12.5 mmHg; $p = 0.02$).

Conclusion: Significant reduction in alcohol intake should be part of the lifestyle intervention in moderate drinkers with AF.
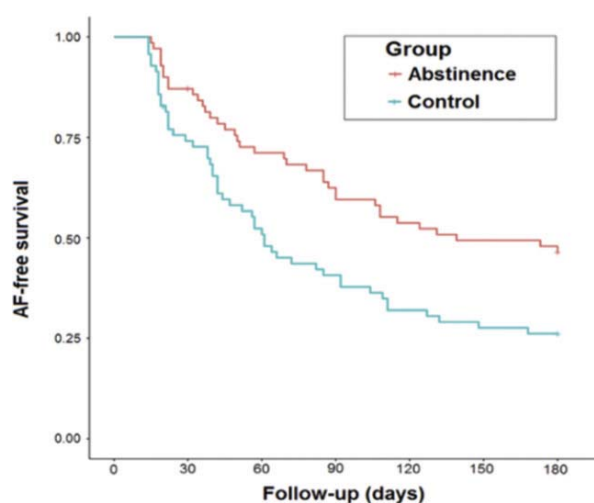
005

Coronary Artery Calcium Score in a Post-Mortem Population: Feasibility and Clinical Utility

E. Paratz [1,2,3,*], B. Costello [1,2,3], L. Rowsell [1], N. Morgan [4], K. Smith [5], T. Thompson [6], C. Semsarian [7], A. Pflaumer [8,9], P. James [6], D. Stub [1,2,5], A. La Gerche [1,2,3], D. Zentner [6], S. Parsons [4]

[1] Baker Heart & Diabetes Institute, Melbourne, Australia
[2] Alfred Hospital, Melbourne, Australia
[3] St Vincent's Hospital, Melbourne, Australia
[4] Victorian Institute of Forensic Medicine, Melbourne, Australia
[5] Ambulance Victoria, Melbourne, Australia
[6] Royal Melbourne Hospital, Melbourne, Australia
[7] Centenary Institute, Sydney, Australia
[8] Royal Children's Hospital, Melbourne, Australia
[9] Murdoch Children's Research Institute, Melbourne, Australia

Background: Post-mortem computed tomography (PMCT) may be considered as an adjunct to post-mortem examination. Coronary artery calcium (CAC) scores in living patients are known to reclassify cardiac risk.

Methods: CAC score was calculated in a blinded manner from PMCTs of one hundred consecutive cases (18–50 years old) experiencing sudden death (ischaemic heart disease = 50, trauma/unascertained = 50). All patients subsequently underwent a post-mortem, with full cardiac results and demographics collected.

Results: Cases were classified according to CAC score (CAC score 0, $n = 58$; CAC score 1–100, $n = 17$; CAC score 101–400, $n = 15$; CAC score >400, $n = 7$). CAC scores were assessable for ninety-seven cases (feasibility 97%). CAC score increased with age ($p = 0.0004$). Elevated CAC score correlated

with pathological post-mortem cardiac changes including cardiac mass ($p < 0.0001$), biventricular wall thickness ($p < 0.0001$ left ventricle, $p = 0.001$ right ventricle), presence of any coronary disease ($p = 0.005$) and severe coronary disease ($p < 0.0001$). CAC score >zero had positive predictive value of 89.7% for severe coronary stenosis, and specificity of 91.5%. Sensitivity of CAC score > zero for severe stenosis was only 70%. Of cases with CAC score of zero, 25.9% had severe coronary disease ($p < 0.0001$).

Conclusion: PM CAC scoring is highly feasible. Elevated CAC score in 18–50 years old with sudden death has high positive predictive value and specificity for coronary cause of death. However, CAC score of zero does not exclude a cardiac cause. PM CAC score assessment may be considered as a further tool to determine cause of death when there is objection to post-mortem.

006

Truncating Variants in the Desmoplakin Gene Cause a Distinct Arrhythmogenic Cardiomyopathy

C. Burns [1,*], E. Hoorntje [2], B. Corden [3], V. Parikh [4], T. Thompson [5], L. Marsili [2], B. Gray [1], C. Reuter [4], R. Bagnall [1], G. Correnti [6], J. Duflou [7], D. Fatkin [8], M. Fietz [9], E. Haan [6], L. Lam [1], J. Goldblatt [10], H. McCarthy [11], N. Pachter [10], J. Vohra [5], N. Whiffin [3], D. Zentner [5], M. Wheeler [4], E. Ashley [4], C. Semsarian [1], J. Ware [3], P. van Tintelen [2], J. Ingles [1]

[1] Molecular Cardiology Program, Centenary Institute, Newtown, Australia
[2] Department of Genetics, University Medical Center Groningen, University of Groningen, Groningen, The Netherlands
[3] Cardiovascular Research Centre, Royal Brompton & Harefield Hospitals NHS Trust, London, UK
[4] Stanford Centre for Inherited Cardiovascular Disease, Stanford Health Care, USA
[5] Department of Cardiology and Department of Genomic Medicine, Royal Melbourne Hospital, Melbourne, Australia
[6] South Australian Clinical Genetics Service, Royal Adelaide Hospital, Adelaide, Australia
[7] Faculty of Medicine and Health, University of Sydney, Australia
[8] Victor Chang Cardiac Research Institute, Sydney, Australia
[9] Department of Diagnostic Genomics, PathWest Laboratory, Medicine WA, Redlands, Australia
[10] Genetic Services of Western Australia, Perth, Australia
[11] Department of Clinical Genetics, Children's Hospital Westmead, Sydney, Australia

Background: Variants in *DSP* cause arrhythmogenic cardiomyopathy (ACM) and phenotype data derived largely from arrhythmogenic right ventricular cardiomyopathy (ARVC) patient cohorts. We hypothesised that patients with *DSP* truncating variants (*DSP*tv) express a wider phenotype spectrum. We report penetrance, phenotype spectrum and genetic architecture of *DSP*tv.

Methods and Results: Unrelated patients with a *DSP*tv and any cardiac phenotype were sought from international centres ($n = 98$). Primary diagnosis for $n = 32$ included dilated cardiomyopathy ($n = 19$), ARVC ($n = 10$), ACM ($n = 1$), unexplained VF ($n = 1$) and Carvajal syndrome ($n = 1$). Fifteen (47%) experienced sudden cardiac death (SCD) events, including 7 (22%) with SCD as the presenting symptom. All had left ventricular (LV) involvement. A family history was reported in 22 (69%). In the total cohort ($n = 98$), there were 68 unique *DSP*tv (29 frameshift, 25 nonsense, 12 splice, two insertion/deletions) classified using ACMG criteria (5 pathogenic, 62 likely pathogenic, 1 uncertain significance). We investigated localisation of *DSP*tv to key functional gene regions (G1, CR and G2) in cases compared to controls. Case variants were more common in G1 and CR (84–72% vs 16–28%) while control variants were more frequent in G2 (58% vs 42%) ($p < 0.0001$). Event-free survival from SCD events was worse when *DSP*tv occurred in G1/CR, compared to G2 (log-rank $p = 0.016$).

Conclusion: In the largest series of *DSP*tv carriers, we show a wide phenotype spectrum. It should be considered a distinct gene-specific cardiomyopathy characterised by LV dysfunction with high risk of ventricular arrhythmias. *DSP*tv are highly penetrant and gene location is associated with worse clinical outcomes.

Allied Health Technology Prize Finalists (007–010)

007

A Technical Perspective of Improving Detail and Consistency in the Performance and Reporting of Echocardiography: An Eight–Year Trend from a National Database

S. Oosthuizen*, P. Srivastava, D. Eccleston, L. Kearney

Genesis Care, Mulgrave, Australia

Introduction: Despite the available technology and potential for detailed information to be obtained for non-invasive cardiac assessment, the American College of Cardiology (ACC) note that there has been limited agreement on quality standards for imaging. This can lead to a lack of consistency, detail and quality of echocardiographic reports. The ACC proposed data standardisation, structured reporting with key data elements and imaging registries to address such deficits. These changes were examined in the largest national echocardiographic registry in Australia

Methods: Between 2010 and 2014, there was implementation of direct online entry of echocardiographic studies into an electronic database, identification and auditing of six key data elements (LVEF, AV peak velocity, E/e', LA area, RVSP and rhythm) along with pathways to improve quality and maximise the completeness of data acquisition and reporting

nationwide. We assessed the completeness of the six key data elements by time and state using deidentified data

Results: 464,688 echocardiographic procedures were recorded between 2011 and 2018.

LVEF measurement complience by Practice and Year
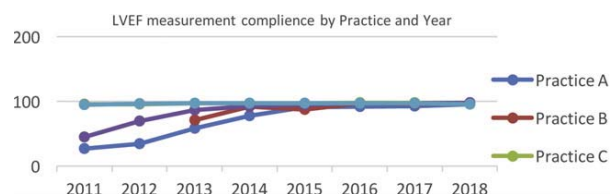
There was a significant improvement in the completeness of the six key elements data from 2011–2018 ($72.0 \pm 26.8\%$ vs $88.2 \pm 13.5\%$ $p = 0.02$). Inter-practice variability for LVEF fell from 2011 to 2018 ($p < 0.02$)

Conclusion: Identification of key data elements as well as systematic capture and auditing significantly improved the consistency, detail and quality of echocardiographic reports. A rapid adoption of local quality improvements could be made utilising a national database.

008

Evaluating Risk Factors for Sonographer Injuries – Lessons for Safer Scanning

M. Cursaro [1,*], K. McInnes [1], G. Wong [2], R. Roberts-Thomson [1], N. Reid-Smith [1]

[1] *Central Adelaide Local Health Network, Adelaide, Australia*
[2] *Royal Melbourne Hospital, Melbourne, Australia*

Aim: Performing echocardiography is associated with an elevated risk of injury amongst sonographers. There are guidelines for reducing sonographer injuries. We set out to investigate which of the guidelines had the greatest impact in preventing sonographer injuries.

Method: Following ethics approval, a confidential electronic survey was widely distributed through professional networks. Sonographers were asked to document work injuries, and how well they complied with published guidelines for sonographer safety. The results were then separated into two groups: "pain" and "pain-free".

Results: 1494 sonographers completed the survey, with 84.3% reporting pain from scanning. The greatest impact on injury prevention was having regular breaks from scanning (37.5%). Other factors included having a supervisor assess scanning technique (36.7%), having a flexible room for ambidextrous scanning (22.5%), and daily stretching (22.2%).

%	Intervention:	%	Intervention:
37.5	Regular breaks from scanning	17.1	Monitoring posture/arm abduction
36.7	Supervisor assess scanning technique	16.7	Policy to limit the number of scans performed
22.5	Flexible room for L and R scanning	13.3	Uncluttered room
22.2	Daily stretching	12.5	Orientation procedure for new employees
20.8	Ability to perform a variety of tasks	11.8	Maintaining reasonable fitness levels
20.0	Process of reporting pain/discomfort	11.3	Displaying posters to encourage stretching/posture

Table 1. Reduction in sonographer injury risk for each recommendation.

Conclusion: We were able to demonstrate the individual benefit of different recommendations on sonographer's risk of injury. These results can be used to further tailor ergonomic recommendations to improve the risk profile of sonographers.

009

Exercise Cardiac MRI Unmasks Cardiac Dysfunction in Childhood and Adolescent Cancer Survivors with Reduced Cardiopulmonary Fitness

S. Foulkes [1,2,*], B. Costello [1], E. Howden [1], D. Elliott [3], R. Conyers [4], A. La Gerche [1,5]

[1] *Baker Heart and Diabetes Institute, Melbourne, Australia*
[2] *Institute for Physical Activity and Nutrition, Deakin University, Geelong, Australia*
[3] *Cardiac Development Laboratory, Murdoch Children's Research Institute, Melbourne, Australia*
[4] *Children's Cancer Centre, The Royal Children's Hospital, Melbourne, Australia*
[5] *Cardiology Department, St Vincent's Hospital, Melbourne, Australia*

Background: Young cancer survivors are at increased risk of reduced fitness and heart failure. Assessment of exercise cardiac reserve may reveal sub-clinical abnormalities that cannot be detected by resting measures of cardiac function.

Methods: 11 patients (age 9 to 24) with recent anthracycline treatment completed a maximal cardiopulmonary exercise test (VO_2peak), and assessment of left-ventricular ejection fraction (LVEF), stroke volume (SV) index, heart rate (HR) and cardiac index (CI) measured at rest and peak exercise using exercise cardiac MRI (exCMR). Participants were classified by normal VO_2 peak ($n = 6$; $99 \pm 15\%$ predicted) or impaired VO_2 peak ($n = 5$; $60 \pm 20\%$ predicted) defined as VO_2peak $\geq 85\%$ age-predicted values.

Results: There was no difference in resting LVEF between the normal or impaired fitness groups ($53.5 \pm 4.4\%$ vs $52.4 \pm 8.0\%$, $P = 0.78$). In contrast, exCMR revealed participants with impaired fitness had a blunted increase in CI during exercise (Fig. 1A) due to a reduced SV and blunted augmentation from rest to peak exercise (Fig. 1B), with no difference in HR response (Fig. 1C).
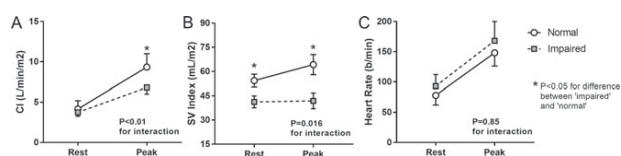

Fig. 1. *exCMR derived changes in haemodynamic response to exercise for young cancer patients with normal and impaired fitness.*

Conclusion: Reduced exercise capacity is associated with impairments in cardiac reserve in young cancer survivors. These measures may aid in the early identification of survivors at increased risk of heart failure.

010

Traditional Markers of Myocardial Dysfunction Fail to Detect Marked Reductions in Physical Fitness Among Chemotherapy Patients

E. Howden[1,*], S. Foulkes[1,2], L. Wright[1], F. Sully[1], K. Janssens[1], H. Dillon[1], B. Costello[1], A. La Gerche[1]

[1] Baker Heart and Diabetes Institute, Melbourne, Australia
[2] Institute for Physical Activity and Nutrition Deakin University, Geelong, Australia

Left ventricular ejection fraction (LVEF) is the current standard of care for evaluating chemotherapy-associated cardiotoxicity. But changes in LVEF are poorly associated with outcomes and long-term heart failure (HF) risk. We sought to compare a more global measure of integrative CV function (VO_2peak) that is strongly associated with HF and early mortality risk with LVEF, global longitudinal strain (GLS) and cardiac biomarkers.

Methods: 95 patients who were due to commence anti-cancer treatment ($n = 58$ anthracycline chemotherapy for breast cancer; $n = 25$ Bruton's tyrosine kinase inhibitor and $n = 12$ allogeneic stem cell transplant for haematological cancers) completed a pre-treatment and follow-up assessment within 6 months of initiating treatment. Changes in echocardiographic measures of LV function (LVEF, GLS), cardiac biomarkers (troponin and BNP) and cardiopulmonary exercise test (CPET, VO_2peak) were measured.

Results: LV function was normal prior to treatment (LVEF $61.5 \pm 5.9\%$; GLS -19.4 ± 2.3) but VO_2peak (23.4 ± 6.5 ml/kg/min) was only $83 \pm 21\%$ (range 47–146%) of age-predicted. After treatment, we observed marked reductions in VO_2peak ($\Delta-2.1 \pm 3.7$ ml/kg/min or $-9 \pm 15\%$, $P < 0.001$), which was associated with small non-clinically significant changes in LV function (LVEF Δ-2.4 $\pm$ 6.4% $P = 0.001$; GLS Δ-0.5 $\pm$ 1.9 $P = 0.018$). Troponin was increased significantly (4.0 ± 5.5 to 23.5 ± 22.5 ng/ml, $P < 0.001$), with no change in BNP (37.5 ± 31.4 to 32.7 ± 22.0 pg/ml, $P = 0.87$). Current diagnostic criteria for cardiac toxicity were not met in any patient despite 27% developing disabling reductions in functional capacity (VO_2peak ≤ 18 ml/min/kg).

Conclusion: Chemotherapy treatment further impaired exercise CV function with minimal impact on resting measures of LV function. The assessment of CV function using CPET prior to and following chemotherapy may be a more sensitive means of identifying patients at increased risk of HF.

Cardiac Imaging Prize Finalists (011–014)

011

Identification of Carditis in Acute Rheumatic Fever with Myocardial T1 Mapping

S. Gutman[1,2,3,*], B. Costello[1,2,3], M. Van Leeuwen[4], L. Wright[1], S. Varghese[4], S. Brady[4], C. Wong[5], W. Naughton[4], C. Woods[4], G. Maguire[6], T. Marwick[1,2,3], A. Taylor[1,2,3]

[1] The Baker Heart And Diabetes Institute, Melbourne, Australia
[2] The Alfred Heart Centre, Melbourne, Australia
[3] Monash University, Clayton, Australia
[4] Alice Springs Hospital, Alice Springs, Australia
[5] Royal Adelaide Hospital, Adelaide, Australia
[6] Western Health, Footscray, Australia

Background: The pathogenesis of acute rheumatic fever (ARF) is incompletely understood. Valvulitis is used as part of the diagnostic criteria, while pancarditis has only been demonstrated at autopsy.

Purpose: To identify carditis in patients with ARF using T1 mapping on cardiac magnetic resonance (CMR) imaging and echocardiographic global longitudinal strain (GLS). We hypothesised that prolonged native T1 time, consistent with myocardial inflammation, would be present in ARF patients compared to controls.

Methods: We prospectively recruited 36 patients; 15 fulfilling the Australian modified Jones Criteria for the diagnosis of ARF, 12 controls with an inflammatory condition without major criteria for ARF and 9 healthy controls. All patients underwent CMR with assessment of non-contrast myocardial T1 mapping as well as echocardiography for GLS. The primary outcome was differences in T1 time between the groups.

Results: Patients with ARF had evidence of carditis demonstrated by markedly elevated T1 times [976 (± 167 ms)] compared to those with non-cardiac inflammatory conditions [841 (± 50 ms)] and healthy controls [811 (± 54 ms)], $P = 0.002$ (Fig. 1). There was no difference in global longitudinal strain between the groups (-19.4% vs -19.5% vs -20.4%, $P = 0.66$).
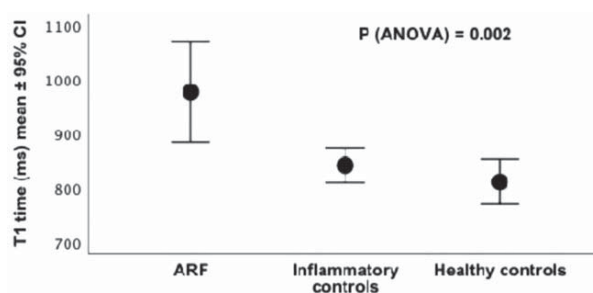

Fig. 1.

Conclusions: Patients with ARF have markedly elevated myocardial T1 times on CMR, consistent with active inflammation from carditis. In contrast, GLS was normal in ARF

patients. Incorporating CMR T1 mapping into the diagnostic algorithm for ARF may improve diagnostic certainty and lead to more effective delivery of secondary penicillin prophylaxis.

012

Impact of Disease Stage on Performance of Strain Markers for Prediction of Atrial Fibrillation

S. Ramkumar [1,2,*], F. Pathan [4],
H. Kawakami [1], A. Ochi [4], H. Yang [4],
E. Potter [1,3], T. Marwick [1,3]

[1] *Baker Heart And Diabetes Institute, Keysbororugh, Australia*
[2] *Monash Heart, Monash Health, Clayton, Australia*
[3] *School of Public Health and Preventative Medicine - Monash Univeristy, Clayton, Australia*
[4] *Menzies Institute for Medical Research, Hobart, Australia*

Background: There is interest in AF prediction in primary prevention (PP; patients with risk factors) and secondary prevention (SP; patients with possible AF complications). These pts have different risk levels; we sought whether that influenced the predictive value of LV dysfunction (measured as global longitudinal strain, GLS) or LA dysfunction (LA reservoir strain).

Methods: The PP cohort comprised 351 community-based pts ≥ 65 years with ≥ 1 risk factor for AF (age 70 ± 4 years, 43% male, median follow-up 22 months) and the SP cohort comprised 532 pts after transient ischaemic attack or stroke (age 68 ± 12 y, 51% male, median follow-up 36 months). GLS/LA strain were measured offline (Image Arena-Tomtec, Germany). AF was diagnosed by 12-lead ECG, Holter or by single-lead monitor. Nested Cox-regression models were used to assess for independent and incremental predictive value of LA strain/GLS in both cohorts.

Results: Compared to SP, PP had higher clinical AF risk (CHARGE-AF $5.6 \pm 5.5\%$ vs $4.7 \pm 12.1\%$, $p = 0.02$) but a lower thromboembolic risk (CHA$_2$DS$_2$-VASC 3 ± 2 vs. 4 ± 2, $p < 0.001$). AF developed in 42 PP pts (12%) and 61 SP pts (12%). AF patients were older, with higher CHARGE-AF score, LA volume and LV mass. Pts developing AF had reduced GLS ($17 \pm 4\%$ vs. $20 \pm 3\%$, $p < 0.001$), reservoir ($28 \pm 11\%$ vs. $35 \pm 8\%$, $p < 0.001$) and pump strain ($13 \pm 7\%$ vs. $17 \pm 5\%$, $p < 0.001$). GLS and LA strain had greater AUC in SP (0.84 vs. 0.58 for GLS and 0.85 vs. 0.57 for reservoir strain, both $p < 0.001$). Nested cox-regression models showed that LA reservoir strain was independently associated with AF in both cohorts ($p < 0.05$). GLS was only independently associated with incident AF in SP.

Conclusion: LA reservoir strain is independently associated with AF in different risk cohorts and its effect is incremental to clinical parameters and LA volume. GLS may be more useful in AF risk assessment in those in SP.

013

Impaired Cardiac Reserve on Dobutamine Stress Echocardiography Predicts Development of Hepatorenal Syndrome

A. Koshy [1,*], B. Cailes [1], A. Testro [2],
J. Ramchand [1], J. Sajeev [1], H. Han [1],
P. Calafiore [1], E. Jones [1], P. Srivastava [1],
H. Salehi [1], A. Teh [1], H. Lim [1], P. Gow [2],
O. Farouque [1]

[1] *Austin Health & University of Melbourne, Melbourne, Australia*
[2] *Victorian Liver Transplant Unit, Austin Health, Heidelberg, Australia*

Background: The role of cardiac dysfunction in the genesis of hepatorenal syndrome (HRS) is poorly understood. We studied cardiovascular haemodynamics in HRS and assessed whether a diminished cardiac reserve with stress testing predicted the development of HRS.

Methods: Consecutive patients without known cardiac disease undergoing liver transplant workup with dobutamine stress echocardiogram (DSE) were included. Cardiac output (CO) was measured at baseline and during low-dose dobutamine infusion at $10 \, \mu g/kg/min$. HRS was diagnosed using guideline-based criteria.

Results: Overall, 560 patients underwent DSE of whom 488 were included following preliminary assessment. There were 64 (13.1%) patients with established HRS. The HRS cohort had higher baseline CO (8.0 ± 2 vs 6.9 ± 2 L/min; $p < 0.001$) but demonstrated a blunted response to low-dose dobutamine (ΔCO $29.2 \pm 22\%$ vs $44.4 \pm 32\%$, $p < 0.001$) driven by inotropic incompetence. Optimal cut-point for % ΔCO in HRS patients was determined to be <25%, which was used to define a low cardiac reserve. Among the 424 patients without HRS initially, 85 (20.0%) developed HRS over a mean follow-up of 1.5 years. A significantly higher proportion with low cardiac reserve developed HRS [47 (55.0%) vs 38 (11.2%); $p < 0.001$]. After adjusting for clinical and echocardiographic covariates in a Cox model, low cardiac reserve remained the strongest predictor for development of HRS (HR 3.9; 95% CI 2.2–7.0; $p < 0.001$).

Conclusion: A low cardiac reserve was an independent predictor for development of HRS. Assessment of cardiac reserve with DSE may provide a novel non-invasive marker of risk for developing HRS in patients with advanced liver disease.

014

Left Atrial 2D Speckle Tracking Echocardiography as a Prognostic Marker in Patients With Chronic Kidney Disease

G. Gan [1,2,4,5,*], K. Kadappu [3,4], A. Bhat [1,4,5],
L. Cai [4], K. Gu [1,5], F. Fernandez [1,5],
S. Eshoo [1,5], L. Thomas [2,3,4]

[1] Department of Cardiology Blacktown Hospital, Sydney, Australia
[2] Department of Cardiology Westmead Hospital, Sydney, Australia
[3] Department of Cardiology Liverpool Hospital, Sydney, Australia
[4] University of New South Wales, Sydney, Australia
[5] Western Sydney University, Sydney, Australia

Background: Patients with chronic kidney disease (CKD) are at increased risk of cardiovascular events that is underestimated by traditional risk stratification algorithms. We evaluated clinical and echocardiographic parameters that would determine long-term adverse outcomes in CKD patients.

Methods: Patients with Stage 3/4 CKD without previous cardiac disease were prospectively recruited. Participants underwent a comprehensive transthoracic echocardiogram with detailed assessment of left ventricular (LV) and left atrial (LA) size and function including strain analysis; a stress echocardiogram was additionally performed to rule out latent ischaemia. Participants were followed annually for 5 years for adverse events, corroborated with hospital records and registry data. The primary end point was a composite of all-cause death and major adverse cardiovascular events (MACE).

Results: A total of 243 patients (male 63%; mean age 59.23 ± 14.44 years) were followed for a median of 46.90 ± 32.56 months. 69 patients met the composite endpoints of death and MACE; these patients were older with history of DM. On Kaplan Meier analysis, age ($p < 0.01$), DM ($p < 0.01$), LV mass ($p < 0.01$), LV GLS ($p < 0.01$), LAVI ($p < 0.01$) and LA GLS ($p < 0.01$) were independent predictors for death and MACE. On multiple Cox proportional hazards analysis, LA GLS ($p < 0.01$) was the only significant predictor for death and MACE in a model accounting for the effect of age, DM, LV mass, LV GLS, E/e' and LAVI.

Conclusions: LA GLS is an independent predictor of death and adverse cardiovascular events in patients with CKD. LA GLS is a potential prognostic biomarker, possibly reflecting alterations in diastolic function with CKD.

Cardiovascular Genetics Diseases Prize Finalists (015–018)

015

Familial Factors Predispose to Increased Risk of Ventricular Arrhythmias in Patients with Hypertrophic Cardiomyopathy

F. Stafford [1,2,3,*], A. Butters [1], C. Burns [1,2,4],
C. Medi [4], C. Semsarian [1,2,4], J. Ingles [1,2,4]

[1] Agnes Ginges Centre for Molecular Cardiology, Centenary Institute, Sydney, Australia
[2] Sydney Medical School, University of Sydney, Sydney, Australia
[3] University of New South Wales, Sydney, Australia
[4] Department of Cardiology, Royal Prince Alfred Hospital, Sydney, Australia

Background: Hypertrophic cardiomyopathy (HCM) exhibits extreme genetic and clinical heterogeneity. Currently, family history of sudden cardiac death (SCD) in a first-degree relative forms part of risk-stratification, however it is unknown whether similar events (e.g. resuscitated cardiac arrest), or events in more distant relatives, confer similar risk.

Objectives: To investigate whether other SCD events in a family predispose to greater risk of ventricular arrhythmias in the proband.

Methods: Consecutive HCM probands who attended a specialised multidisciplinary clinic were included in this retrospective cohort study. A ventricular arrhythmia composite outcome included SCD, resuscitated cardiac arrest (RCA) and appropriate implantable cardioverter defibrillator (ICD) shock. A multivariate regression model was used to adjust for known risk factors, and survival analysis used to examine event-free survival.

Results: 916 probands were included (mean age 57.8 ± 17.7 years, 64.6% male). There were 62 (6.9%) probands who experienced ventricular arrhythmias, including 24 (2.6%) SCD, 25 (2.8%) RCAs and 15 (1.7%) appropriate ICD shocks. This group was associated with positive family history of SCD events (OR = 2.27, 95% CI 1.04–4.96, $p = 0.040$), greater left ventricular (LV) hypertrophy (OR = 1.06, 95% CI 1.00–1.12, $p = 0.048$) and LV end-systolic diameter (OR = 1.06, 95% CI 1.01–1.11, $p = 0.020$). Event-free survival from ventricular arrhythmias was significantly worse in probands with a family history of SCD events compared to those without ($p < 0.001$).

Conclusions: After adjusting for known risk factors, a family history of SCD events in any-degree relative was found to increase risk of ventricular arrhythmias in the proband, highlighting the importance of a detailed family history in clinical management of patients.

016

Frequency of RASopathy Gene Variants in Patients with Inherited Cardiomyopathies

P. D'Ambrosio [1,*], N. Nowak [2], F. Collins [4,5], R. Bagnall [2], L. Yeates [1,2], J. Hayward [1,2], C. Semsarian [1,2,3], J. Ingles [1,2,3]

[1] Department of Cardiology, Royal Prince Alfred Hospital, Sydney, Australia
[2] Agnes Ginges Centre for Molecular Cardiology at Centenary Institute, The University of Sydney, Sydney, Australia
[3] Faculty of Medicine and Health, The University of Sydney, Sydney, Australia
[4] Medical Genomics Department, Royal Prince Alfred Hospital, Sydney, Australia
[5] Disciplines of Genomic Medicine, Paediatrics and Child Health, Sydney University Medical School, Sydney, Australia

Background: RASopathies, including Noonan syndrome, are multi-system inherited disorders caused by gene variants in the RAS-MPK pathway. They are characterised by distinct facial features, short stature and cardiac disease.

Objectives: We aimed to describe the frequency of RASopathy gene variants in a cohort of patients with inherited cardiomyopathies.

Methods: Patients attending a specialised multidisciplinary inherited cardiomyopathy clinic with non-diagnostic prior exome or genome sequencing were included. Reanalysis of the RASopathy genes *PTPN11, RAF1, RIT1* and *LZTR1* was performed. Variants were classified according to RASopathy-modified ACMG/AMP criteria. Extra-cardiac clinical phenotype was characterised by a clinical geneticist.

Results: Of 347 patients, 9 (2.6%) were identified to carry RASopathy gene variants. Two had overt clinical features of Noonan syndrome and non-obstructive HCM. At least 3 probands had subtle extra-cardiac features and were misdiagnosed as HCM. There were 4 variants in *RAF1*, 2 in *RIT1*, 2 in *PTNP11* and 1 in *LZTR1*. Three variants were pathogenic, 2 likely pathogenic and 4 were variants of uncertain significance. In 2 probands the variants were shown to be *de novo*. Of the 5 with causative variants, 4 had ventricular arrhythmias including 2 sudden cardiac deaths (aged 14 and 16 years), VF on device interrogation and non-sustained VT on Holter monitoring, while the other had paroxysmal atrial fibrillation.

Conclusions: Awareness of phenotypic features associated with RASopathy syndromes is important for clinicians managing patients with inherited cardiomyopathies. We have shown that RAS-MPK variants may account for up to 2.6% of inherited cardiomyopathy cases, with high risk for arrhythmias and potential for misdiagnosis.

017

Genetic Testing Predicts Adverse Outcomes in Hypertensive Patients with Low and Intermediate Coronary Artery Calcium Scores in the SCOT-HEART Trial

N. Gahungu [1,*], D. Newby [2], M. Williams [2,3], P. Adamson [4], A. Roy [4], G. Morahan [5], G. Dwivedi [5,6]

[1] Royal Perth Hospital, Perth, Australia
[2] University of Edinburgh/British Heart Foundation Centre for Cardiovascular Science, Edinburgh, United Kingdom
[3] Christchurch Heart Institute, University of Otago, Christchurch, New Zealand
[4] All India Institute of Medical Sciences, New Delhi, India
[5] Harry Perkins Institute of Medical Research, The University of Western Australia, Australia
[6] Fiona Stanley Hospital, Australia

Introduction: A high coronary artery calcium (CAC) score (>400) on cardiac Computed Tomography (CT) strongly predicts adverse cardiovascular events. However, the prognostic value of low (<100) and low-to-intermediate (<400) CAC scores is uncertain. We evaluated whether genetic testing could identify which patients having low to intermediate CAC scores were at increased risk of adverse outcomes.

Methods: 342 hypertensive patients who underwent CAC score assessment in the SCOT-HEART Trial were tested for genetic variants previously identified by us, and were assigned a genetic risk score (high vs low). Based on their CAC scores, patients were also classified into low (<100), low-to-intermediate (<400), and high (>400) risk groups. The association between a genetic risk and 5-year adverse cardiac events following cardiac CT was assessed in each group. An adverse cardiac event was defined as the occurrence of nonfatal myocardial infarction, late revascularisation, or coronary heart disease death.

Results: Patients with low-to-intermediate CAC scores who were in the high genetic risk group had an increased risk of adverse events (RR 2.70 [95% CI: 1.33 to 5.52; $p = 0.006$]). A similar outcome was observed in the low calcium score patients, with more adverse cardiac events occurring in the high genetic risk group (12.9% vs 4.1%; $p = 0.05$).

Conclusion: Genetic testing identifies patients with low to intermediate CAC scores who may benefit from intensive primary preventative therapies.

Penetrance of Dilated Cardiomyopathy in Families with Truncating TTN Variants: a National Perspective

R. Johnson [1,*], S. Peters [1,3], J. Ingles [4],
G. Correnti [5], A. Ingrey [6], H. Mountain [7],
D. Zentner [3], T. Thompson [3], E. Oates [8],
A. Ronan [6], N. Pachter [7], E. Haan [5],
K. Van Spaendonck-Zwarts [9], C. Semsarian [4],
J. McGaughran [9], J. Atherton [9], P. James [3],
D. Fatkin [1,2]

[1] Victor Chang Cardiac Research Institute, Darlinghurst, Australia
[2] St Vincent's Hospital, Sydney, Australia
[3] Royal Melbourne Hospital, Parkville, Australia
[4] Centenary Institute, Sydney, Australia
[5] Royal Adelaide Hospital, Adelaide, Australia
[6] Hunter Genetics Unit, Waratah, Australia
[7] Genetics Services of Western Australia, Subiaco, Australia
[8] Children's Hospital Westmead, Westmead, Australia
[9] Royal Brisbane and Women's Hospital, Brisbane, Australia

Truncating variants in the *TTN* gene (*TTN*tv) are common in dilated cardiomyopathy (DCM) patients (15–20% cases) but are also present in unaffected individuals in DCM families and in the general population. Interpreting the clinical significance of these variants is challenging.

Our aim was to determine DCM penetrance in a large cohort of kindreds with *TTN*tv-related familial DCM that were identified by a network of investigators in the Australian Genomics Cardiac Flagship. Eligible families were required to carry a high-impact *TTN*tv, with genetic testing offered in an unbiased way to affected and unaffected relatives.

Probands from 65 families were identified from 8 clinical genetic testing or research services. 457 individuals were genotyped (mean age 52 years, range 13 to 93; 51% males). There were no differences in the relative distribution of *TTN*tv positive ($n = 228$, 50%) and *TTN*tv negative ($n = 229$, 50%) individuals, or in the numbers of male ($n = 234$, 51%) and female ($n = 223$, 49%) participants. The median age of DCM onset in *TTN*tv carriers was 51 years with DCM penetrance increasing from 34% at 40 years to 93% at 80 years. Male *TTN*tv carriers had a higher DCM penetrance ($p < 0.0001$; 59% vs 33% at 50 years) and lower median age of onset (45 vs 55 years) compared to females.

Our data show that the overall penetrance of DCM in *TTN*tv carriers is high, but that a substantial proportion of relatives, particularly females, can remain asymptomatic until late in life. These findings have implications for screening surveillance and genetic counselling of asymptomatic *TTN*tv carriers.

An Internet-Based Intervention Integrated with the Primary Care Electronic Health Record to Improve Cardiovascular Disease Risk Factor Control: a Mixed-Methods Evaluation of Acceptability, Usage Trends and Persuasive Design Characteristics

G. Coorey [1,2,*], D. Peiris [1,3], T. Usherwood [4],
L. Neubeck [5], J. Mulley [1], J. Redfern [4]

[1] The George Institue For Global Health, Sydney, Australia
[2] The University of Sydney, Faculty of Medicine and Health, Sydney School of Public Health, Sydney, Australia
[3] The University of New South Wales, Faculty of Medicine, Sydney, Australia
[4] The University of Sydney, Faculty of Medicine and Health, Department of General Practice, Sydney, Australia
[5] Edinburgh Napier University, School of Health and Social Care, Edinburgh, United Kingdom

Introduction: eHealth interventions may benefit patients engaging with their health management, including developing healthier lifestyles. This study evaluated a web portal integrated with the electronic health record (EHR) for key trends in portal activity, effective persuasion characteristics, and user preferences for future strategies.

Methods: Mixed methods study within an eHealth RCT with 12 months of follow-up. Participants were patients with, or at moderate-high risk of, cardiovascular disease (CVD), and their general practitioners (GPs). Data sources included (i) surveys, (ii) software analytics, (iii) interviews, and (iv) focus groups. Quantitative data were analysed with descriptive statistics. Qualitative data were coded and analysed for themes.

Results: Usage data for 451 patients showed most logins in months 1–2, declining to 70–100 unique users/month who each logged in on average 3–4 times/month. Intensity of interactive screen visits similarly declined. Goal tracking was the most accessed feature. Surveys ($n = 397$) suggested patients benefited from CVD risk score estimation (73%); goal tracking (69%) and risk factor self-monitoring (52%) – intervention features with attributes of three types of persuasive software design. Patients reported improved medication adherence (22%), mental well-being (40%), physical activity (47%); and healthier eating (61%). GP survey respondents ($n = 38$) reported increased patient engagement with their care. GP and patient interviewee data underscored the value of customisable, convenient, secure functions with high patient-provider interactivity, but low impact on GP workflow.

Conclusion: Portal login activity underestimates overall user responsiveness to effective intervention features. Future studies could further elucidate important digital and personal factors affecting direct interaction with EHR-integrated portals.

020

High Peak Exercise Blood Pressure in Athletes is Proportional to Exercise Capacity; Need for a New Approach to Normal Reference Values

K. Janssens [1,*], G. Claessen [1,2], S. Foulkes [1], F. Sully [1], D. Flannery [1], E. Howden [1], A. La Gerche [1]

[1] *Baker Heart And Diabetes Institute, Melbourne, Australia*
[2] *Department of Cardiovascular Sciences, KU Leuven, Leuven, Belgium*

Background: Blood pressure (BP) response to exercise is an important physiological variable associated with risk of subclinical hypertension. Reference values are poorly defined, especially amongst very active populations. Our aim was to determine reference values of BP in endurance athletes.

Methods: We included 104 current and former athletes (76% male), aged 16–80 years. BP was measured every 2 min during a maximal bicycle exercise test using a TangoM2 automated BP monitor. Relationships between systolic BP (SBP), workload and heart rate (HR) during exercise were determined by linear regression analysis using SPSS.

Results: Resting SBP (130 ± 13) increased proportional with exercise intensity to peak (216 ± 27, $P < 0.0001$) with 46% of peak exercise SBP above current guideline definitions for an abnormal response. There was a strong correlation between power output, and SBP ($r^2 = 0.90$, $P < 0.001$), defined by the linear regression equation: 0.232 (± 0.08) $\times$ W + 133 (± 17.57). A similarly strong relationship was observed between heart rate and SBP: 0.812 (± 0.27) $\times$ HR + 73 (± 32.13) ($r^2 = 0.895$, $P < 0.001$). There was no statistical difference in exercise SBP response according to gender or between young athletes aged 16–23 years and the older athletes.

Conclusion: Across the age and gender spectrum, high SBP values can be observed in athletes at peak exercise, frequently exceeding 'normal value' definitions. However, SBP increases are explained by the supra-normal exercise output, as opposed to abnormalities in vascular tone. Peak exercise SBP would be better expressed relative to exercise capacity.

021

Patient and Family Experiences of Same Day Discharge Following Percutaneous Coronary Intervention

Y. Chen [1,2,*], F. Lin [1], A. Marshall [1,2]

[1] *Griffith University, Southport, Australia*
[2] *Gold Coast University Hospital, Southport, Australia*

Background: Evaluating patient and family experiences of care received is increasingly important in healthcare. Despite same day discharge (SDD) following percutaneous coronary intervention (PCI) being a safe option and acceptable to patients and families, their experiences have not been well examined.

Objectives: The aim of this study was to explore patient and family experiences during SDD process.

Methods: This mixed-methods interpretative study was undertaken in the cardiac service of an Australian tertiary hospital. Semi-structured phone interviews with 31 patients and 23 families were conducted. Binary responses were coded and quantified in numbers (percentages). Content analysis was used to analyse the qualitative data.

Results: Thirty-one patients who were initially eligible for SDD before the procedure participated in the study, of whom, 17 went home the same day. Approximately 50% patients and families were informed of the possibility of SDD. Two-thirds of patients received discharge instructions while most families did not. Content analysis revealed that most patients and families regarded SDD as a preferred option because of being more comfortable at home and more convenient. Several SDD patients and families expressed uncertainty towards SDD as feeling nervous and apprehensive. Only those patients who were initially eligible for SDD but subsequently required overnight admission following PCI and their families related negative experiences of SDD due to the fear of complications.

Conclusion: Most patients and families perceived SDD as a good option. The identified experiences provide guidance for healthcare providers in developing strategies to promote positive hospital experiences of SDD for patients and families.

022

The Longitudinal Association Between Food Groups, Memory Loss and Comorbidity of Heart Disease in Older People: Results from the 45 and Up Study

X. Xu [*], D. Parker, S. Inglis

The University of Technology Sydney, Ultimo, Australia

While there is literature to indicate the benefits of single food in peoples' health conditions, little is known about the association between food groups and medical comorbidities of memory loss. The aim of this study was to explore the longitudinal association between food groups, memory loss, and comorbidity of heart disease.

We used Australia New South Wales 45 and Up Study baseline (2006–2009) and follow-up data (2012–2015). A total of 142,503 participants, aged 45 years and over, were included in the analysis. The frequency of dietary consumption, and heart disease were self-reported; and memory status was self-rated. The longitudinal associations between foods and memory loss, and comorbidity of heart disease, were examined using Generalized Estimating Equation model.

As age increased, older people consumed more fruits, vegetables, meat and protein food alternatives, but had less cereals, milk and milk alternatives. The increased consumption of fruits and vegetables was significantly associated with deceased risk of memory loss ($p < 0.001$), and comorbidity of heart disease ($p \leq 0.01$). In addition, people older than 80 years reporting the highest level of cereal consumption had

the highest risk of poor memory (OR = 1.10, 95% CI: 1.01; 1.10), and comorbidity of heart disease (OR = 1.11, 95% CI: 1.06; 1.16).

These associations can inform preventive measures regarding healthy food choices. Understanding the impact of food choices on older people is essential to inform what can protect or contribute to memory loss and comorbidity of heart disease within the older population.

Heart Failure Prize Finalists (023–026)

023

A Novel Method for Deriving Pressure-Volume Loops in Stable cfLVAD Patients: Validation and Insights into Myocardial Oxygen Consumption, Energetics and Efficiency

P. Jain[*], K. Muthiah, S. Shehab, D. Robson, P. Jansz, P. Macdonald, C. Hayward

St Vincent's Hospital, Darlinghurst, Australia

Introduction: Assessment of left ventricular (LV) recovery under continuous-flow left ventricular assist device (cfLVAD) support is hampered by concomitant pump support. We describe derivation of non-invasive pressure-volume (PV) loops in cfLVAD patients and demonstrate an application in the assessment of recovery.

Methods: Using controller parameters and non-invasive arterial pressure waveforms, central aortic pressure, outflow conduit pressure gradient and instantaneous left ventricular pressure (LVP) were calculated. Instantaneous LV volumes (LVV) were calculated from echocardiographic left ventricular end-diastolic volume (LVEDV) accounting for the integral of pump flow with respect to time and aortic ejection volume derived from the pump speed waveform. PV loops were derived during pump speed adjustment and following bolus intravenous Milrinone to assess changes in loading conditions and contractility respectively.

Results: Fourteen patients were studied, generating 77 non-invasive PV loops. Baseline non-invasive LVEDP correlated with invasive PAWP ($r^2 = 0.57$, RMSE 5.0, $p = 0.003$). Measured non-invasively, Milrinone significantly increased LVEF (40.3 ± 13.6 vs $36.8 \pm 14.2\%$, $p < 0.0001$), maximum dPdt (623 ± 126 vs 555 ± 122 mmHg/s, $p = 0.006$), and end-systolic elastance (1.03 ± 0.57 vs 0.89 ± 0.38 mmHg/mL, $p = 0.008$), consistent with its expected inotropic effect. Milrinone reduced MVO_2 (0.15 ± 0.06 vs 0.16 ± 0.07 mL/beat, $p = 0.003$) and improved myocardial efficiency (43.7 ± 14.0 vs $41.2 \pm 15.5\%$, $p = 0.001$). Reduced pump speed caused increased LVEDV (190 ± 80 vs 165 ± 71 mmHg, $p < 0.0001$) and LVEDP (14.3 ± 10.2 vs 9.9 ± 9.3 mmHg, $p = 0.024$), consistent with a predictable increase in preload. There was increased MVO_2 (0.16 ± 0.07 vs 0.14 ± 0.06 mL/beat, $p < 0.0001$) despite unchanged stroke work ($p = 0.24$), reflecting decreased myocardial efficiency (39.2 ± 12.7 vs $45.2 \pm 17.0\%$, $p = 0.003$).

Conclusions: Non-invasive PV loops can accurately detect changes in load and contractility, and may help detect LV recovery under cfLVAD support.

024

Cognitive Domains and Post-Discharge Outcomes in Hospitalised Patients With Heart Failure

Q. Huynh[1,*], K. Negishi[2], C. De Pasquale[3], J. Hare[1], D. Leung[4], T. Stanton[5], T. Marwick[1]

[1] Baker Heart And Diabetes Institute, Melbourne, Australia
[2] Menzies Institute for Medical Research, Hobart, Australia
[3] Flinders Medical Centre, Australia
[4] University of New South Wales, Sydney, Australia
[5] University of Queensland, Brisbane, Australia

Background: Cognitive impairment (CI) is an independent marker of readmission in heart failure (HF), but the screening is time-consuming. This study sought (1) to identify HF patients at low risk of cognitive impairment (obviating screening) and (2) to simplify a predictive model of HF outcomes by only using cognitive domains that are most predictive.

Methods: Montreal Cognitive Assessment (MoCA) was performed in 1152 Australian HF patients who were followed for 12 months. One third (376/1152) of the patients were enrolled into an HF disease management plan (HF-DMP) to reduce early readmission. Post-discharge outcomes in HF included 30- and 90-day readmission or death, and days alive-and-out-of-hospital within 12 months of discharge.

Results: Cognitive impairment – present in 54% of patients – independently predicted HF outcomes. Normal cognition could be predicted with common clinical and sociodemographic factors with good discrimination (C-statistic = 0.74 [0.69–0.78]). The Visuospatial/Executive and Orientation domains were most predictive of HF post-discharge outcomes. Using either MoCA score or these two domains provided similar incremental values ($p = 0.0004$ and $p = 0.0008$ respectively) in predicting HF outcomes (both C-statistic = 0.76), and could similarly identify a group of high-risk patients who benefited most from an HF-DMP.

Conclusions: Cognitive function independently predicts HF outcomes, and may also contribute to how a patient responds to intervention. The time and resources spent on cognitive assessment for risk-stratification in HF may be minimised by (1) identifying patients with low risk of cognitive impairment and (2) simplifying the screening instrument to include only the domains that are most predictive of post-discharge outcomes in HF.

025

Impact of Sub-Clinical Systolic Dysfunction on Exercise Haemodynamics in HFpEF

S. Nanayakkara [1,2,3,*], F. Telles [1,2], A. Beale [1,2,3], S. Evans [1,2], D. Vizi [1], T. Marwick [1,2], D. Kaye [1,2,3]

[1] The Alfred, Melbourne, Australia
[2] Baker Heart and Diabetes Institute, Melbourne, Australia
[3] Monash University, Melbourne, Australia

Aims: Subclinical systolic impairment may be a contributor to the pathophysiology and outcomes of heart failure with preserved ejection fraction (HFpEF). In this study, we characterised the relationship between left ventricular mechanical function assessed by strain imaging with the key haemodynamic features of HFpEF at rest and during exercise.

Methods: Simultaneous echocardiography and exercise right heart catheterisation was performed in 90 subjects (68 HFpEF, 22 control) referred for assessment of dyspnea. HFpEF was defined as left ventricular ejection fraction (LVEF) $\geq$50% with a pulmonary capillary wedge pressure (PCWP) $\geq$15 mmHg at rest and/or $\geq$25 mmHg at maximal exertion. Measures of LV strain were taken using speckle tracking and analysed together with natriuretic peptides and rest and exercise haemodynamics.

A | Peak Cardiac Index   B | Peak Pulmonary Capillary Wedge Pressure
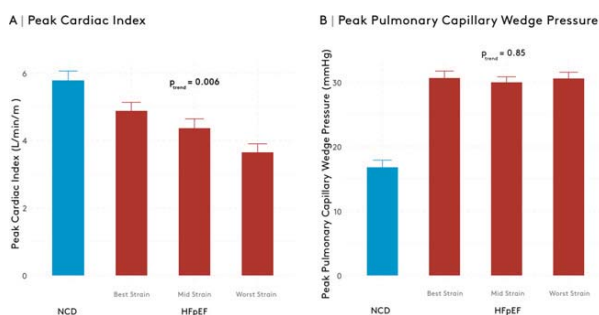
Results: At rest, HFpEF patients had impaired GLS compared to control subjects (-18.4 ± 2.5 vs $-21.2 \pm 3.5\%$, $p = \leq 0.001$. Ejection fraction was similar (62 ± 6 vs $61 \pm 6\%$, $p = 0.81$). With worsening global longitudinal strain, patients with HFpEF displayed a worse cardiac index at both rest and exercise ($p < 0.001$ for both), but similar filling pressure ($p = 0.85$). The tertile with the worst strain had the highest level of natriuretic peptide. The association of strain with peak cardiac index was independent of LVEF, BNP, age, LAVI, LVMI, and systolic blood pressure.

Conclusions: Despite a preserved ejection fraction, a proportion of patients with HFpEF display impaired GLS, which correlates with a worse cardiac output. Impaired GLS was not associated with higher filling pressures at rest or exercise.

026

The Effect of Parity on Exercise Physiology in Women with Heart Failure with Preserved Ejection Fraction

A. Beale [1,2,3,*], C. Cosentino [1,3], L. Segan [2], J. Mariani [1], D. Vizi [1], S. Evans [1], S. Nanayakkara [1,2,3], D. Kaye [1,2,3]

[1] The Alfred Hospital, Melbourne, Australia
[2] Baker Heart & Diabetes Institute, Melbourne, Australia
[3] Monash University, Melbourne, Australia

Introduction: Women are overrepresented amongst patients with HFpEF, however the underpinning mechanism for this asymmetric distribution is unclear. Pregnancy has been demonstrated to contribute to cardiovascular risk, and represents a potential gender specific risk factor for HFpEF.

Methods: Patients referred for investigation of dyspnoea with exercise right heart catheterisation from 2008–19 were included and classified as HFpEF with an ejection fraction (EF) $\geq$50% and a resting pulmonary capillary wedge pressure (PCWP) $\geq$15 mmHg or exercise PCWP $\geq$25 mmHg. All patients underwent detailed haemodynamic and echocardiographic assessment, and an obstetric history was obtained via questionnaire.

Results: 58 women were included, and categorised as having either 0–2 births, or $\geq$3 births, dividing the cohort equally. Women with $\geq$3 births had a greater rise in pulmonary capillary wedge pressure indexed to workload with exercise (0.5 [0.3–0.8] vs. 0.3 [0.2–0.5] mmHg/W, $p = 0.03$), paralleled by a greater rise in right atrial pressure (10 [8–12] vs. 7 [3–11] mmHg, $p = 0.01$). Pulmonary vascular resistance was also higher in women with $\geq$3 births (1.9 [1.6–2.4] vs. 1.6 [1.4–1.9] mmHg/L/min rest, $p = 0.046$, and 1.9 [2.4–2.4] vs. 1.4 [1–1.8] mmHg/L/min exercise, $p = 0.024$). Left ventricular EF was lower at rest (60 [57–61] vs. 63 [60–66] %, $p = 0.008$) and during exercise (65 [62–67] vs. 68 [66–70], $p = 0.038$) in women with higher parity. There were no significant differences between parity groups in baseline characteristics, comorbidities or socioeconomic status.

Conclusions: Higher parity is associated with impairments in multiple physiologic parameters of HFpEF severity in women, including diastolic reserve, pulmonary vascular resistance, and systolic function.

Heart Rhythm Prize Finalists (027–029)

027

3-D Electro-Anatomical Mapping Guided Lead Placement in CRT

D. Raja [2,3,*], U. Pandurangi [2], R. Pathak [1]

[1] *The Canberra Hospital and Health Services, Canberra, Australia*
[2] *PhD Student, Australian National University, Canberra, Australia*
[3] *The Madras Medical Mission, Chennai, India*

Background: We propose that placement of leads in the delayed activation sites as determined by 3-D electro-anatomical (EA) endocardial activation mapping may circumvent the high non-responder rate for cardiac resynchronisation therapy (CRT) in non-LBBB and wide QRS with heart failure.

Methods: 12 patients with non-LBBB conduction delay, wide QRS with refractory heart failure symptoms were subject to 3-D EA mapping study prior to CRT (Using EnSite NavX Precision[®]). We studied the latest activation sites and total activation times (AT) in the RV and LV. The lead placement was in the latest activation site of the ventricle causing the predominant delay in the total AT. We studied the narrowness of the QRS, haemodynamic response, post-CRT improvement (1 month) in LV global strain as surrogate markers of acute CRT response.

Results: Atypical BBB, RBBB was noted in four and eight patients. The mean LVEF was $36 \pm 12\%$, the mean total ATs were 126 ± 12 ms in the LV and 116 ± 22 ms in the RV. RBBB with 'masked' LBBB was noted in two patients. A significant change in mean QRS (Pre- 156 ± 22 ms VS Post- 132 ± 18 ms, $p = 0.02$), rise in systolic BP ($+10 \pm 4$ mmHg, $p = 0.03$) and change in LV global strain (Pre $-4 \pm 2\%$ VS Post $-7 \pm 3\%$, $p = 0.01$) was observed. Two patients underwent optimisation of V-V delays with the aid of 3-D EA mapping.

Conclusion: 3-D EA mapping-aided-lead placement in patients with non-LBBB resulted in better acute CRT response with respect to mean QRS changes, haemodynamic response and LV global strain.

Reference: Kunihiko Kiuchi, et al. Cardiac Resynchronization Therapy (CRT) Guided by Electroanatomical Mapping (CARTO). Circ J 2007; 71: 1599–1605.

028

Complications of Catheter Ablation for Atrial Fibrillation: a Population-Wide Study in Australia and New Zealand

L. Ngo [1,*], A. Ali [1], A. Ganesan [2],
R. Adams [1], I. Ranasinghe [1]

[1] *The University of Adelaide, Adelaide, Australia*
[2] *Flinders University, Bedford Park, Australia*

Introduction: Catheter ablation for atrial fibrillation (AF) is an increasingly common procedure, yet only few large-scale studies have evaluated the risks of complications in clinical practice or their impact and timing.

Introduction: Catheter ablation for atrial fibrillation (AF) is an increasingly common procedure, yet only few large-scale studies have evaluated the risks of complications in clinical practice or their impact and timing.

Methods: We identified all patients undergoing catheter ablation for AF between 2010–2015 using hospitalisation data in all public and most private hospitals in Australia and New Zealand. The primary outcome was the occurrence of major complications in-hospital or up to 30-days after discharge. Impact of in-hospital complications on length of stay was determined by using negative binomial regression, and time-to first post-discharge complication was evaluated using Kaplan Meier survival curve.

Results: We included 20,057 AF ablations (mean age 62.1 ± 11.6 y, 56.7% $\leq$65 y; 29.2% female; median length of stay 1 day). Major complications occurred in 6.3% procedures with 4.6% occurring in-hospital and a further 2.0% occurring in the 30-day post discharge. The most common complication was bleeding or haematoma formation (3.8%), followed by perforation (0.9%, primarily pericardial effusion). Procedure-related deaths was 0.1%. Any in-hospital complication more than doubled the length of stay (incident rate ratio [IRR]: 2.3, 95% CI 2.2–2.4) with complications requiring cardiac surgery (IRR 4.5, 95% CI 3.2–6.4) prolonged the length of stay the most. Most (67.3%) post-discharge complications occurred in the 1st week post-discharge and 95% occurred by three weeks.

Conclusions: Major complications after catheter ablation for atrial fibrillation were common. In-hospital complications doubled the length of stay, and approximately 30% complications occurred post-discharge. Efforts to reduce complications should focus on reducing the incidence of bleeding and pericardial effusion.

029

Epicardial Adipose Tissue and the Substrate for Atrial Fibrillation: Radiological, Electrophysiological, Histological and Molecular Characterisation

C. Nalliah [1,2,*], B. James [2], P. Sanders [3],
S. Binny [1], T. Watts [1], E. Lui [1,2], S. Joshi [1,2],
M. Larobina [1,2], M. O'Keefe [1,2],
J. Goldblatt [1,2], A. Royse [1,2], P. Kistler [2,4],
L. Delbridge [2], J. Kalman [1,2]

[1] *Royal Melbourne Hospital, Melbourne, Australia*
[2] *Melbourne University, Melbourne, Australia*
[3] *Royal Adelaide Hospital, Adelaide, Australia*
[4] *The Alfred, Melbourne, Australia*

Background: Epicardial adipose tissue (EAT) is associated with atrial fibrillation (AF), but its mechanistic role remains unclear.

Aim: Characterise the electrophysiologic, histologic and molecular impact of EAT on the atrial substrate.

Methods: We recruited patients without AF undergoing coronary artery bypass surgery. Following computed

tomography to quantify anterior right atrial EAT volumes, high density epicardial mapping of the anterior RA was performed (pacing @600 ms and 300 ms). The right atrial appendage including the mapped region was processed for Western blot analysis of connexin 43/40 expression, or sectioned and stained with picrosirius red/oil red o for fibrosis analysis/adipose characterisation.

Results: Nineteen patients (male 78%, age 64 ± 6, BMI 30 ± 7) with median anterior RA EAT volumes 3.10 ml (2.50–5.80) were recruited. Higher anterior RA EAT correlated with longer plaque activation times (600 ms $r = 0.49$ $p = 0.04$, 300 ms $r = 0.49$ $p = 0.03$), slower conduction velocities (600 ms $r = -0.46$ $p = 0.05$, 300 ms $r = -0.49$ $p = 0.04$), greater proportion fractionated signals (600 ms $r = 0.69$ $p = 0.001$, 300 ms $r = 0.66$ $p = 0.003$) and increased conduction heterogeneity (600 ms $r = 0.43$ $p = 0.07$, 300 ms $r = 0.42$ $p = 0.08$). Atrial tissue infiltration by EAT was heterogenous, with myocyte disruption observed in 2/3 samples. Severity of EAT infiltration correlated with conduction heterogeneity. Atrial samples had mean $16.89 \pm 2.51\%$ fibrosis content. Higher anterior RA EAT content correlated with more extensive fibrosis ($r = 0.70$ $p < 0.001$) and Cx40 expression ($r = 0.45$ $p = 0.06$). Fibrosis content was strongly associated with increased expression of $C \times 40$ ($r = 0.55$ $p = 0.02$). No difference in the expression or phosphorylation status of Cx43 was observed.

Conclusion: EAT impacts local electrophysiologic properties by tissue infiltration, fibrosis and gap junction remodelling. These changes may facilitate AF.

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Indigenous Health Prize Finalists (030–032)

030

Clinical Utility of Stress Echocardiography in Remote Indigenous and Non-Indigenous Populations: A 10-Year Study in Central Australia

S. Ratwatte [1,2,3,*], B. Costello [4,5],
N. Kangaharan [6], K. Bolton [6], A. Kaur [6],
W. Corkhill [6], B. Keupper [6], P. Sanders [7,8],
C. Wong [7,8]

[1] Concord Repatrician General Hospital, Concord, Australia
[2] University of Newcastle, Callaghan, Australia
[3] Royal Prince Alfred Hospital, Camperdown, Australia
[4] Baker IDI Heart & Diabetes Institute, Melbourne, Australia
[5] The Alfred Hospital, Melbourne, Australia
[6] Department of Cardiology, Alice Springs Hospital, Alice Springs, Australia
[7] Department of Cardiology, Royal Adelaide Hospital, Adelaide, Australia
[8] University of Adelaide, Adelaide, Australia

Objectives: Stress echocardiography has been extensively validated as a long-term prognostic tool. However, there are no prior studies assessing its utility in remote Indigenous populations to our knowledge.

Method: Consecutive individuals undergoing stress echocardiography in Central Australia between 2007 and 2017 were included. Stress echocardiography was performed and reported via standard protocols. Individuals were followed up for the primary outcome of all-cause mortality.

Results: One-thousand and eight patients (54% Indigenous Australian) were included. After a mean follow up of 3.5 ± 2.4 years, 54 (5%) patients were deceased; 14% of patients underwent revascularisation and were censored from follow-up. Overall, 797 (79%) patients had no abnormalities during rest or stress echocardiography, with no difference according to ethnicity ($p > 0.05$). In patients with a normal test, overall annual mortality averaged 1.3% over 5 years of follow up, with annual mortality significantly higher in Indigenous compared to non-Indigenous individuals (2.0% vs 0.6% respectively). Increasing age (HR 1.04 [95% CI 1.01–1.08]), chronic kidney disease (HR 4.83 [1.79–13.02]), and lack of ACEI/ARB use (HR 0.19 [95% CI 0.09–0.42]) were associated with all-cause mortality. Although Indigenous ethnicity was a univariate predictor of mortality, this association was attenuated and non-significant in multivariate analyses.

Conclusion: A normal stress echocardiogram in remote Indigenous individuals was able to identify a lower risk group of patients in whom ongoing local medical management and focusing on cardiometabolic risk factor reduction is likely to be appropriate. Although Indigenous individuals had a higher annual rate of mortality, this association appeared to be mediated by comorbid conditions.

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031

Echocardiography in Pregnant Indigenous Australians: Need for Screening?

J. Marangou [1,2,3,*], D. Ferguson [2,3],
M. Ilton [2,3], B. Remenyi [2,3]

[1] Fiona Stanley Hospital, Murdoch, Australia
[2] Royal Darwin Hospital, Darwin, Australia
[3] NT Cardiac, Darwin, Australia

The Indigenous population of Australia has one of the highest rates of rheumatic heart disease (RHD) globally. RHD is more common in females and peak incidence corresponds with child-bearing age. Significant valvular disease can complicate pregnancy. In the Northern Territory, pregnant women are referred for echocardiogram if there are signs or symptoms of cardiac pathology or a history of RHD.

To assess the current practice of echocardiography in pregnant women in a region with a high prevalence of RHD.

A retrospective review of all echocardiograms performed between 2014–2018 for an indication relating to pregnancy was completed. Data included indication, clinical history, echocardiographic findings and location of delivery.

A total of 322 cases with echocardiography during pregnancy were reviewed, 195 Indigenous and 127 non-indigenous women (mean age 25 vs 30 years, p-value <0.01). Indigenous women had significantly higher rates of abnormal echocardiograms (35.9% vs 10%, p-value <0.01) and higher burden of rheumatic fever/RHD (39.4% vs 0.8% p-value <0.01). Moderate or severe valve lesions were detected

in 26 (13.3%) indigenous women and 11 (5.6%) had previous cardiac surgery. Transfer to a tertiary centre with valve intervention services available was required for 12 (6.2%) Indigenous women.

In the Northern Territory, Indigenous pregnant women have significantly higher rates of abnormal echocardiograms compared with non-indigenous counterparts. This is mainly due to RHD. Data suggests that Indigenous pregnant women are being under serviced by the current referral practices. Guidelines are urgently needed in relation to echocardiography and pregnancy in populations that are burdened by RHD.

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032

Late Presentation of Rheumatic Heart Disease during Pregnancy: A common occurrence in the NT

E. Wing-Lun *, S. Myers, M. Ilton, J. Marangou, N. Kangaharan, H. Tayeb, W. Choo, A. Kaethner, B. Piper

Royal Darwin Hospital, Lyons, Australia

Rheumatic heart disease remains an undertreated and underdiagnosed entity in Australia. As 98% of acute rheumatic fever and rheumatic heart disease occurs in the Indigenous population and as females represent two thirds of rheumatic heart disease, our most vulnerable population suffers from this disease the most. This is a disease of the socially disadvantaged: social, cultural, physical barriers exist between this population and appropriate prevention, diagnoses and management.

We present here 6 years of data, equating to 60 females, diagnosed with rheumatic heart disease during pregnancy. Approximately one third with moderate to severe valvular disease and 20% pulmonary hypertension. This is not uncommon in the Northern Territory. The majority of these cases were diagnosed before admission for birth, however a small number were only diagnosed perinatally. The majority of these cases were able to be managed through normal vaginal delivery or elective lower segment caesarean section without fatal complications. A small number of attempted vaginal deliveries resulted in emergency.

We observe the changing physiology within pregnancy trimesters and stages of delivery and the impact this has on valvular gradients and pulmonary hypertension, including the incredible and unexpected physiological reserve many of these females display. We also discuss the various methodology of diagnosis, the medical and social management of such females, including the anaesthetic approach to vaginal delivery or lower segment caesarean section.

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ISHR Student Investigator Prize Finalists (033–036)

033

Investigating the Safety of Enhanced Cardiac Phosphoinositide 3-Kinase [PI3K (p110alpha)] as a Prospective Therapeutic Gene

S. Bass-Stringer [1,2,*], L. Bottrel [1,2], C. Harmawan [1], S. Yildiz [1], D. Donner [1], H. Kiriazis [1], K. Weeks [1], C. Thomas [2], B. Bernardo [1], J. McMullen [1,2]

[1] *Baker Heart And Diabetes Institute, Melbourne, Australia*
[2] *La Trobe University, Bundoora, Australia*

Introduction: PI3K (p110α) is a master regulator of exercise-induced heart growth. Heart-specific transgenic mice expressing constitutively active PI3K (caPI3K) on a single allele (heterozygote, het) display physiological hypertrophy. CaPI3K het mice are also protected against heart failure. The aim of this study was to investigate whether further increasing the dose of PI3K has an impact on cardiac remodelling and function. This is a crucial step to further establish the safety of cardiac PI3K as a therapeutic agent for subsequent gene therapy trials.

Methods: Adult non-transgenic (Ntg: female $n = 9$, male $n = 13$), caPI3K het (female $n = 21$, male $n = 19$) and caPI3K homozygote (homo: female $n = 21$, male $n = 13$) mice were phenotyped at 20–24 weeks of age using echocardiography and electrocardiography to assess cardiac function and electrical activity. Morphological, molecular and histological analyses were performed on heart tissue.

Results: Heart weight/tibia length ratio was increased in male and female caPI3K het vs. Ntg (~13% and 22%, $P < 0.001$), and increased further in caPI3K homo mice (~19% and 28%, $P < 0.001$). Systolic function (fractional shortening) was maintained or enhanced in caPI3K het and homo mice without evidence of cardiac fibrosis, arrhythmia, or changes in a cardiac stress marker (atrial natriuretic peptide). There was a comparable increase in phosphorylated Akt/total Akt (~4.4-fold) in hearts of caPI3K het and homo mice in both sexes vs. Ntg ($P < 0.05$).

Conclusion: Increased PI3K expression was associated with a dose-dependent increase in physiological cardiac hypertrophy in both sexes. No evidence of pathology was observed, providing strong rationale for pursuing caPI3K as a gene therapy target.

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034

Microelectrode Array Screening of Different Cardiomyocyte Cultures Reveals Inherent Disparities in Cardiac Cell Electrophysiology

H. Waddell [1,*], S. Wells [1,2], C. Sim [3], E. Porrello [1,3], L. Delbridge [1], J. Bell [1]

[1] Department of Physiology, University of Melbourne, Parkville, Australia
[2] Institute of Cardiovascular Sciences, University of Birmingham, Birmingham, United Kingdom
[3] Murdoch Children's Research Institute, Melbourne, Australia

Numerous treatment strategies are available for atrial and ventricular arrhythmias, though the risk of side effects and incomplete effectiveness limit their clinical use. Cardiomyocyte culture models provide a high-throughput platform for screening novel compounds for anti-arrhythmic properties, but characterisation of their basic electrophysiological properties is lacking.

This study aimed to directly compare the electrophysiological properties of three commonly used cardiac cultures – neonatal rat ventricular myocytes (NRVM), immortalised atrial HL-1 cells and human iPSC derived cardiomyocytes (hiPSC-CM). Cells were cultured on multi-electrode arrays (MEA) for 48–120 hrs. Extracellular field potentials (FP) were recorded and conduction velocity (CV) mapped in the presence or absence of $1\,\mu M$ isoproterenol to assess β-adrenergic responsiveness.

Spontaneous beating rate was significantly faster in hiPSC-CMs (NRVM vs HL-1 vs hiPSC-CM, bpm: 81.5 ± 6.9 vs 49.7 ± 5.6 vs 162.5 ± 38.0; $p < 0.05$), and FP morphology differed between all cell types. FP amplitude was greatest in NRVMs (mV: 2.95 ± 0.58 vs 0.26 ± 0.02 vs 0.40 ± 0.09; $p < 0.05$) and FP duration significantly shorter in HL-1 cells (ms: 40.2 ± 1.4 vs 184.0 ± 10.5 vs 146.9 ± 23.2; $p < 0.0001$). HL-1 cells also exhibited slower conduction velocities (NRVM vs HL-1, cm/s: 24.25 ± 1.91 vs 0.83 ± 0.03; $p < 0.0001$) and did not respond to isoproterenol, in contrast to NRVM and hiPSC-CM.

This is the first study to quantify the inherent disparities in cardiac cell culture electrophysiology and the necessity to factor in these cellular properties when selecting culture models. These findings are an important step towards the standardisation of cultured cardiomyocyte MEA that will be essential to its application as a high-throughput platform for anti-arrhythmic drug development.

035

Misregulation of Mitochondrial Protein Synthesis Leads to Cardiomyopathy

L. Hughes [1,*], D. Rudler [1], K. Perks [1], T. Richman [1], I. Kusnetsova [1], J. Ermer [1], A. Shearwood [1], H. Viola [2,3], L. Hool [2,3], S. Siira [1], O. Rackham [1,4], A. Filipovska [1,4]

[1] Harry Perkins Institue of Medical Research, Nedlands, Australia
[2] School of Human Sciences, The University of Western Australia, Nedlands, Australia
[3] Victor Chang Cardiac Research Institute, Darlinghurst, Australia
[4] School of Molecular Sciences, The University of Western Australia, Nedlands, Australia

Mitochondria produce more than 90% of the energy required by our bodies and thereby have a fundamental role in cell and energy metabolism. Mitochondria are composed of proteins encoded by both the nuclear and mitochondrial genomes and the coordinated expression of both genomes is essential for energy production. Impaired energy production leads to mitochondrial dysfunction that causes or contributes significantly to a variety of diseases including metabolic disorders and cardiovascular diseases. How uncoordinated gene expression causes mitochondrial dysfunction and compromised energy production in heart and metabolic diseases is poorly understood, making it difficult to develop effective treatments. We have created a new model of cardiovascular disease caused by loss of an essential nuclear encoded RNA-binding protein, involved in the regulation of mitochondrial protein synthesis. Loss of this RNA-binding protein is embryonic lethal, so to characterise its molecular role we developed and investigated a homozygous heart- and skeletal-muscle-specific knockout (KO) mouse model. At 25 weeks KO mice weighed approximately 25% less than wild-type (wt) counterparts, and exhibited a significantly increased heart weight to body weight ratio ($0.64\% \pm 0.03$, $n = 4$) versus wt mice ($0.44\% \pm 0.02$, $n = 5$, $p < 0.05$). Echocardiography revealed that KO mice developed dilated cardiomyopathy by 25 weeks, with a significant decrease in fractional shortening, posterior wall and intraventricular septum thickness versus wt mice ($n = 4$, $p < 0.05$). Experiments to characterise its molecular function indicate that this protein is essential for coordinated expression of mitochondrial genes and proteins, assembly and function of the electron transport chain and ultimately heart function.

036

Weight Fluctuation Induces Formation of Pro-Arrhythmic Substrate by Fibro-Fatty Depositions and Residual Electro-Structural Remodelling: Evidence from an Ovine Model

T. Agbaedeng [1,2,*], D. Twomey [1,2,3],
S. Thanigaimani [1,2,3], D. Linz [1,2,3],
D. Lau [1,2,3], R. Mahajan [1,2,3,4], P. Sanders [1,2,3]

[1] *The University of Adelaide, Adelaide, Australia*
[2] *South Australian Health and Medical Research Institute, Adelaide, Australia*
[3] *Royal Adelaide Hospital, Adelaide, Australia*
[4] *Lyell McEwin Hospital, Adelaide, Australia*

Background: Obesity-mediated epicardial adipose tissue (EAT) expansion drives fatty infiltration, which forms the unique substrate for atrial fibrillation (AF). The LEGACY study showed the benefits of weight loss but an attenuated response with weight fluctuation. How fluxes in weight impact the atrial substrate remains unknown.

Objective: To investigate EAT and the atrial substrate due to weight fluctuation.

Methods: We studied 24 sheep in 3 equal groups over 80 weeks: 1. Obesity was induced by high calorie diet fed ad libitum; 2. Weight fluctuation by 20-week cycle of weight gain/loss; and 3. Lean controls maintained at baseline weight. All sheep underwent: daily weight measurement; haemodynamic and imaging assessments (CMRI and DEXA); electrophysiological studies; and histological and structural analysis.

Results: The Table shows the group differences. Compared to reference controls, obesity demonstrated: Increased atrial volume and pressure, abnormal atrial electrical properties, expanded EAT and ensuing fibro-fatty infiltrations, and myolysis of myocytes. Despite comparable weight and EAT with controls, weight fluctuation resulted in extensive and severe fibro-fatty infiltrations, and twofold greater myolysis that persisted. More importantly, EAT and fibro-fatty infiltrates strongly correlated with increased atrial volume and pressure; with only fibro-fatty infiltrates correlating with fractionated electrograms ($r = 0.71$, $p < 0.001$) and conduction slowing ($r = -0.59$, $p = 0.006$). Similarly, atrial myolysis exhibited significant correlations with atrial enlargement and haemodynamics, and electrical substrates ($p < 0.05$ for all).

Conclusions: Obesity induces fibro-fatty replacement of atrial myocytes and deterioration of contractile units, which may drive impaired electrical remodelling. Despite final weight loss, weight fluctuation demonstrates residual electro-structural, fibro-fatty and contractile substrates.

Paediatric and Congenital Prize Finalists (037–040)

037

Body Composition Abnormalities in Adults with a Fontan Circulation

D. Tran [1,2,3,*], P. D'Ambrosio [2,3], C. Verrall [4],
C. Attard [5], J. Briody [6], M. D'Souza [2],
M. Fiatarone Singh [1,2], J. Ayer [2,4],
Y. d'Udekem [7,8], S. Twigg [2,9], G. Davis [1],
D. Celermajer [2,3], R. Cordina [2,3]

[1] *Faculty of Health Sciences, The University of Sydney, Lidcombe, Australia*
[2] *Sydney Medical School, The University of Sydney, Camperdown, Australia*
[3] *Department of Cardiology, Royal Prince Alfred Hospital, Camperdown, Australia*
[4] *Heart Centre for Children, The Children's Hospital at Westmead, Westmead, Australia*
[5] *Haematology Research Group, Murdoch Children's Research Institute, Parkville, Australia*
[6] *Department of Nuclear Medicine, The Children's Hospital at Westmead, Westmead, Australia*
[7] *Department of Paediatrics, Faculty of Medicine, The University of Melbourne, Parkville, Australia*
[8] *Department of Cardiac Surgery, Royal Children's Hospital Melbourne, Parkville, Australia*
[9] *Department of Endocrinology, Royal Prince Alfred Hospital, Camperdown, Australia*

Background and methods: The Fontan circulation exists with no subpulmonary ventricular pump. We aimed to characterise body composition in this setting and to explore possible pathophysiological associations. Participants were recruited for dual x-ray absorptiometry (DXA), cardiopulmonary exercise testing, echocardiography and biochemical assessment.

Results: Twenty-eight people with a Fontan circulation (26 ± 7 years) were recruited. All were NYHA Class I/II with 46% males. Skeletal muscle mass (relative appendicular lean mass Z-score) was reduced (-1.49 ± 1.10, $p \leq 0.001$); 68% had muscle mass deficits (Z-score <-1), 39% were in sarcopenic range (Z-score <-2) and only 32% had normal muscle mass (Z-score ≥ -1). Skeletal muscle mass correlated with % predicted oxygen pulse (stroke volume surrogate, $r = 0.50$, $p = 0.007$), % predicted maximum handgrip strength ($r = 0.53$, $p = 0.004$), systolic function ($r = 0.42$, $p = 0.024$) and was inversely related with haemoglobin ($r = -0.39$, $p = 0.038$), likely reflecting reduced oxygen saturations, which result in compensatory erythrocytosis. Appendicular lean mass was independently associated with peak VO_2 ($\hat{I}^2 = 73$ mL/min, $p \leq 0.001$). Overall, by DXA, only 50% had normal range adiposity, 14% had moderate adiposity, 32% had high adiposity, and 4% had low adiposity. In contrast, 32% had above normal range BMI. The level of agreement between BMI and DXA for adiposity categorisation was only fair ($k_w = 0.53$).

Conclusion: Young adults with a Fontan circulation have a body composition profile characterised by skeletal muscle

deficiency and are predisposed to increased adiposity, which is underestimated by BMI. Superior skeletal muscle mass, which is independently related with peak exercise capacity, is associated with lower haemoglobin levels and greater systolic function.

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038

Bone Density Abnormalities in Fontan Adults; Prevalence and Associations

P. D'Ambrosio [1,2,*], D. Tran [1,2], C. Verrall [3], C. Attard [8], M. Fiatarone Singh [4,10], J. Ayer [11,12], Y. d'Udekem [7,8,9], S. Twigg [2,5], D. Celermajer [1,2,6], R. Cordina [1,2]

[1] Department of Cardiology, Royal Prince Alfred Hospital, Sydney, Australia
[2] Faculty of Medicine and Health Sciences, University of Sydney, Sydney, Australia
[3] The Sydney Children's Hospital Network, Sydney, Australia
[4] Physical Activity, Lifestyle, Ageing and Wellbeing Faculty Research Group, Faculty of Health Sciences and Sydney Medical School, The University of Sydney, Sydney, Australia
[5] Department of Endocrinology, Royal Prince Alfred Hospital, Sydney, Australia
[6] Heart Research Institute, Sydney, Australia
[7] Department of Cardiothoracic Surgery, Royal Children's Hospital, Melbourne, Australia
[8] Murdoch Children's Research Institute, Royal Children's Hospital, Melbourne, Australia
[9] Department of Paediatrics, University of Melbourne, Melbourne, Australia
[10] Hebrew Senior Life and Jean Mayer USDA Human Nutrition Research Centre on Ageing, Tufts University, Boston, United States of America
[11] Paediatric & Child Health, Children's Hospital Westmead, Sydney, Australia
[12] Charles Perkins Centre, University of Sydney, Sydney, Australia

Objective: To characterise bone mineral density status and associated pathophysiological features in adults living with a Fontan circulation.

Patients and Design: Participants underwent bone mineral density and body composition measurement using dual-energy X-ray absorptiometry. Cardiopulmonary exercise testing, biochemical analysis and transthoracic echocardiography were also performed.

Results: In our cohort ($n = 28$, aged 26 ± 6 years, 54% female, NYHA I–II), 24% of patients were osteopoenic, 5% were osteoporotic and 14% had Z-scores < -2.0, which is below the expected range for age (hip t score: -0.6 ± 1.1, $p = 0.02$; spine t score: -0.6 ± 0.9, $p = 0.01$; hip z score: -0.6 ± 1.1, $p = 0.01$; spine z score: -0.7 ± 1.1, $p < 0.01$). Compared to laboratory reference values, parathyroid hormone (PTH) was significantly increased (6.1 ± 3.5 vs. 4 pmol/L, $p = 0.01$) and 27% of patients had 25-OH vitamin D levels below the normal range (<50 nmol/L). Two (7%) patients were taking vitamin D supplementation. Vitamin D negatively correlated with PTH ($r = -0.53$, $p = 0.01$) suggesting secondary hyperparathyroidism. Hip t scores negatively correlated with PTH ($r = -0.44$, $p = 0.07$) and NT-proBNP levels ($r = -0.42$, $p = 0.08$) and positively correlated with oxygen saturations ($r = 0.45$, $p = 0.05$). Atrioventricular valve systolic to diastolic ratio, an echocardiographic measure of diastolic dysfunction, inversely correlated with hip t and z scores ($p < 0.01$).

Conclusions: Adults living with Fontan circulation are predisposed to abnormal bone mineral density which is associated with secondary hyperparathyroidism, low resting saturations, diastolic cardiac dysfunction and neurohormonal activation.

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039

Coronary Artery Fistulas in Neonates, Infants, and Children: Symptoms and Signs, Diagnosis and Management, Long-term Outcome in our Center

A. Mustafa

Qch, Rochedale, Australia

Introduction: Congenital coronary artery fistulas (CAF) are rare. Colour Doppler echocardiography has increased the detection of CAF. During infancy or childhood, most are asymptomatic. The need to treat is controversial.

Aim: To establish mid-term outcomes of CAF in the paediatric population.

Methods: Retrospective chart review of all patients presenting to a single centre from January 2008–August 2018. Patients with CAF were identified based on echocardiographic, CT, MRI or catheter assessment. Those with additional complex cardiac disease were excluded. CAF were then classified as significant or insignificant based on the symptomatology, presence of continuous murmur and/or the size of the fistula on colour Doppler.

Results: 64 patients were diagnosed with CAF. Median age at diagnosis was 48 months (6–108 months); median weight 12.6 Kg (4.2–26.5 kg). 62/64 were asymptomatic and 59/64 were clinically unapparent. Median follow-up was 36 months (13–60 months). Follow-up was available on 53/64 patients. At latest follow-up 25/53 (47%) were no longer echocardiographically evident, and a further 23/53 (43%) were deemed to be insignificant. 4/64 (6%) required intervention (3/4 surgically, 1/4 catheterisation). 4/4 (100%) requiring intervention were apparent clinically at presentation. There was no bacterial endocarditis or other complications. 1/64 with a continuous murmur did not require intervention.

Conclusion: In the current era most CAF are incidental findings. Our study would suggest CAF which are clinically unapparent, asymptomatic and appear insignificant on colour Doppler are very unlikely to require intervention or suffer complications. Similarly, CAF that require intervention are identifiable at the time of presentation.

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040

Foetal Outcomes after HLHS Diagnosis: A 10 year Queensland Experience

S. Veerappan [1,*], A. Lee-Tannock [2],
C. Ward [1], A. Gooi [1]

[1] Queensland Children's Hospital, South Brisbane, Australia
[2] Mater Health Services, South Brisbane, Australia

Introduction: With the advances in foetal echocardiography over the last 20 years, the majority of hypoplastic left heart syndrome (HLHS) is now diagnosed antenatally. In this retrospective study, we looked at outcomes after antenatal diagnosis of HLHS in our centre.

Methods: We reviewed the reports of all the foetal echocardiograms done between 2008 and 2017 and selected all the patients with a diagnosis of HLHS. Information on the mother and pregnancy were obtained from the obstetric notes.

Results: There was a total of 160 foetuses with a diagnosis of HLHS in our study period. Foetal echocardiograms were performed at an average gestational age of 21 + 5 weeks (+/−4+1 week). There was one intrauterine death before a parental decision was made. Parents elected to terminate in 85 cases (53.1%), chose compassionate/palliative care in 26 pregnancies (16.3%) and elected for surgery in 48 cases (30%). There was no significant difference in outcomes between the two foetal cardiologists ($p = 0.45$). Prior to 2015, when patients had to travel interstate for the Norwood palliative surgery, out of 110 pregnancies with HLHS, only 27 parents (24.5%) elected for surgery. From 2015, this percentage significantly increased to 42% (21 out of 50 cases) which was statistically significant ($p = 0.02$)

Conclusions: Our study demonstrates the outcomes after foetal diagnosis of HLHS with the availability of local Norwood surgery significantly impacting on parents' decision to proceed with surgical intervention.

Preventative and Clinical Cardiology Prize Finalists (041–044)

041

Audit of a Cardiac Screening Policy for Elite Australian Cricketers

J. Orchard [1,2,*], J. Orchard [2], A. La Gerche [3],
A. Kountouris [4], H. Raju [5], M. Young [6],
C. Semsarian [7]

[1] HRI/Charles Perkins Centre, University of Sydney, Australia
[2] Faculty of Medicine and Health, University of Sydney, Australia
[3] Baker Heart and Diabetes Institute, Melbourne, Australia
[4] Cricket Australia, Melbourne, Australia
[5] Macquarie University, Sydney, Australia
[6] Qsportsmedicine, Brisbane, Australia
[7] Royal Prince Alfred Hospital, Centenary Institute, University of Sydney, Australia

Background: Cricket Australia implemented a policy recommending players undertake cardiac screening. This is consistent with other sports, and aims to prevent sudden cardiac arrest/death (SCA/D). Screening involved a history and physical, and resting 12-lead electrocardiogram (ECG), with follow-up tests conducted if indicated.

Aims: To assess policy compliance, including the number/completeness of follow-up tests, and to document/analyse ECG findings.

Methods: Audit (February 1, 2019) examined screening reports for the previous 5 years for players in all Australian Cricket state squads, male and female, including junior players aged ≥16. Data were extracted from a database with complete records for all players. The audit analysed which players had been screened, signed waivers opting out, required follow-up tests, and whether follow-up was complete. ECGs were reviewed according to the International criteria. Where a player required follow-up, their file was checked.

Results: 648/670 (97%) players had been screened at the time of audit, with 1% opting out. In terms of follow-up: 5% required echocardiogram, 2% required ECG stress test, 1% required other interventions, no players required cardiac MRI. No players were excluded from sport, no SCA/D occurred during the period. Compliance was high amongst all squads (>95%). ECG analysis suggested cricket is a sport of moderate cardiac demands, with benign athlete heart changes common but abnormal ECGs uncommon.

Conclusions: Initial audit of a cardiac screening program in elite Australian cricketers found excellent compliance with 97% of players screened. A small proportion required follow-up testing and no player was excluded from sport due to a cardiac problem.

042

Exercise Capacity and All-Cause Mortality in Remote Indigenous and Non-Indigenous Populations

D. Chang[1,*], N. Kangaharan[2], J. Forde[2], D. Goh[2], H. Elangovan[2], N. Manek[2], C. Arauz[2], S. Brady[3], P. Sanders[4], C. Wong[4]

[1] *University of Queensland-Ochsner, New Orleans, United States*
[2] *Department of Cardiology, Alice Springs Hospital, Alice Springs, Australia*
[3] *Department of Medicine, Alice Springs Hospital, Alice Spings, Australia*
[4] *Center for Heart Rhythm Disorders (CHRD), South Australian Health and Medical Research Institute (SAHMRI), University of Adelaide and Royal Adelaide Hospital, Adelaide, Australia*

Background: Exercise capacity is a powerful predictor of all-cause mortality. However, it is unclear whether this association is similar in remote Indigenous populations. Central Australia is the most populous Indigenous region faced with a disproportionate burden of morbidity and mortality. Given their geographical isolation from tertiary centers, exercise testing could provide useful risk-stratification locally.

Purpose: To characterise the association of exercise capacity with all-cause mortality in Indigenous and non-Indigenous individuals residing in Central Australia.

Methods: Demographic, clinical and medication data were prospectively collected from patients undergoing exercise stress tests between 2007–2017. Patients were followed up for all-cause mortality.

Results: A total of 3,414 patients (34% Indigenous, mean age 49 ± 13) were included. At 4.8 ± 2.9 years of follow-up, 86 (2.5%) deaths had occurred. Each 1-MET increase in exercise capacity conferred a 12% lower risk for mortality among Indigenous individuals (HR 0.88, 95% CI 0.80–0.97) and 16% lower risk for mortality among non-Indigenous individuals (HR 0.84, 95% CI 0.75–0.94) after adjusting for age, comorbidities, and medications. Mortality risk reduction for each 1-MET increase in exercise capacity was similar ($p = 0.46$) for both Indigenous and non-Indigenous individuals.

Conclusions: Exercise capacity is a significant predictor of all-cause mortality in remote Indigenous and non-Indigenous individuals residing in remote Australia, with similar impact according to ethnicity. These findings have important clinical implications towards exercise capacity for risk-stratification and the preventative importance of physical activity.

043

More Intensive LDL-C Lowering Reduces Major Vascular Events Beyond Current Recommendations: Systematic Review and Meta-Analysis

N. Wang[1,*], J. Fulcher[1], N. Abeysuriya[2], S. Kumar[3], I. Wilcox[1], A. Rodgers[4], S. Lal[1]

[1] *Royal Prince Alfred Hospital, Sydney, Australia*
[2] *University of Queensland, Australia*
[3] *Royal North Shore Hospital, St Leonards, Australia*
[4] *The George Institute, Sydney, Australia*

Aims: To determine the relationship between more intensive low-density lipoprotein (LDL-C) lowering therapy and relative risk of major vascular events (MVEs) across different LDL-C levels.

Methods: Randomised trials of statins, ezetimibe and proprotein convertase subtilisin/kexin type 9 (PCSK9) inhibitors that reported rates of MVEs were included. Random-effects and network meta-analyses evaluated associations between baseline LDL-C, achieved LDL-C, degree of LDL-C lowering and 10-year risk of cardiovascular (CVD) death with the relative risk (RR) of MVEs.

Results: Fifty studies, totalling 316,605 patients with mean follow-up 3.6 ± 1.6 years were included. Although more intensive LDL-C lowering was associated with greater reductions in MVEs in patients with higher baseline LDL-C ($p < 0.001$), there was benefit in further lowering LDL-C amongst subgroups of patients with all baseline LDL-C <2.07 mmol/l (RR, 0.89; 95% CI, 0.82–0.96). In a network meta-analysis, patients with achieved LDL-C <1.50 mmol/l were most likely free from MVEs (surface under the cumulative ranking curve, 0.98), followed by 1.50–1.79, 1.80–2.59, 2.60–3.39, 3.40–4.09 and $\geq$4.10 mmol/l respectively. In meta-regression of primary prevention trials, LDL-C lowering therapy provided greater RR reductions in MVEs in populations with lower 10-year risk of CVD death ($p = 0.030$). Patients aged >75 years who received intensive LDL-C lowering therapy had significantly less MVEs. There was significantly more adverse drug reactions in the intensive LDL-C lowering arm (RR, 1.18; 95% CI, 1.10–1.27), but no significant difference in serious adverse effects.

Conclusions: This meta-analysis provides new evidence that further lowering LDL-C is associated with greater reductions in MVEs beyond current recommendations.

044

The Single Troponin Accelerated Triage (STAT) Chest Pain Study: Results from Phase 1

C. Winnall [1,*], S. MacDonald [2,3],
D. Fatovich [2,3], R. Alcock [1], J. Spiro [1,3],
C. Schultz [1,3], G. Hillis [1,3]

[1] *Department of Cardiology, Royal Perth Hospital, Perth, Australia*
[2] *Department of Emergency Medicine, Royal Perth Hospital, Perth, Australia*
[3] *University of Western Australia, Nedlands, Australia*

Background: The majority of patients presenting to an Emergency Department (ED) with chest pain do not have acute myocardial infarction (MI). In particular, patients who have very low levels of high-sensitivity cardiac troponin (hsTn) at presentation are likely at extremely low risk. The STAT Chest Pain Study is testing the hypothesis that patients who present with very low levels of hsTnI (<5 ng/L, Abbott Architect assay) >2 hours after symptom onset can be safely and quickly discharged after a single troponin measurement. Here we present data from phase 1 of the study.

Methods: This is a prospective cohort study recruiting all patients aged >18 yrs presenting with symptoms suggestive of possible MI to Royal Perth Hospital ED, using opt-out consent. In phase 1, patients were managed according to the current CSANZ/NHF recommended chest pain pathway.

Results: 1,251 consecutive patients were enrolled; of these 37% (468) were discharged directly from the ED with the remainder being admitted for further assessment. 73% (911) of patients presented >2 hrs from the onset of their symptoms, and of these 701 had an initial hsTnI <5 ng/L, representing 56% of all patients. None of these patients had an index MI or an MI in the following 30 days.

Conclusions: These data suggest that MI can be confidently excluded in >50% of patients presenting to ED with chest pain after a single hsTn measurement, and the vast majority could be safely discharged without further testing. This is being prospectively tested in phase 2 of the study.

Hypertension (045–052)

045

Blood Pressure Variability and Cerebral Small Vessel Disease: a Systematic Review, Meta-Analysis and Meta-Regression

P. Tully

The University of Adelaide, Adelaide, Australia

Background: Recent empirical work demonstrates an association between blood pressure variability (BPV) with stroke and cardiovascular events, however, the association remains controversial. The objective of this study was to systematically review the literature and quantify the bidirectional association between intra-individual BPV and cerebral small vessel disease (CSVD).

Methods: A systematic review of electronic databases was performed on MEDLINE, EMBASE and SCOPUS from inception until September 2018. Eligibility criteria: Population, adult humans (over 18 years but with no upper age limit) without sub-acute stroke <4 weeks from primary care, community cohort, electronic database registry, or randomised controlled trial; Exposure, BPV quantified by any metric over any duration; Comparison, low versus high or mean BPV; Outcomes, 1) prevalent or incident CSVD or progression of CSVD, and 2) standardised mean difference in BPV.

Findings: Twenty-six articles were included describing 25 studies (11,481 unique brain scans, mean age 73.1 years, 48.3% female). Systolic BPV was associated with CSVD (12 studies, OR = 1.29; 95% CI 1.18 to 1.41) and there was marginal evidence of heterogeneity between BPV and mean systolic pressure effect sizes ($p = 0.05$ for comparison, $I^2 = 74\%$). Evidence was sparse for diastolic BPV and risk of CSVD (6 studies, OR = 1.30; 95% CI 1.14 to 1.48). Small but significant differences were evident between CSVD populations systolic BPV (15 studies, Hedge's $g = 0.28$; 95% CI 0.18 to 0.38) and diastolic BPV (Hedge's $g = 0.13$; 95% CI 0.08 to 0.19) without heterogeneity between BPV and mean pressure effect sizes.

Interpretation: The association between BPV and CSVD has implications for blood pressure monitoring and management in people with CSVD.

046

Development and Testing of an Evidence-based Education Package to Improve Home Blood Pressure Monitoring Accuracy, Knowledge, Technique and Patient Satisfaction

C. Yeoh [1,*], R. Tirimacco [2], P. Tideman [2],
R. Clark [1]

[1] *College of Nursing And Health Sciences, Flinders University, Bedford Park, Australia*
[2] *Integrated Cardiovascular Clinical Network Country Health SA, Bedford Park, Australia*

Background: Home blood pressure monitoring (HBPM) is becoming ubiquitous to current hypertension diagnosis and management, patients training using evidence-based guideline can help improve the accuracy of their measurements. The aim of this study was to determine the effectiveness of an evidence based, patient-centered education package in improving their HBPM knowledge and technique.

Methods: Eligibility criteria included patients who were currently (or recommended to) performing HBPM, medically stable and not undergoing medication review. The measurement instruments were adapted from published instruments, updated with current recommendations from the Australian Expert Consensus Statement for HBPM. The results from the pre- and post-surveys were then compared to determine the effectiveness of the intervention.

Results: The study recruited 26 participants (18 patients, 8 nurses) from multiple locations across the south-east

region of South Australia. Nurses performed better than the patient group in both HBPM and hypertension knowledge in pre-intervention (nurses: mean = 11.63, SD ± 2.72; patients: mean = 9.83, SD ± 3.35) and post-intervention (nurses: mean = 16.13, SD ± 0.64; patients: mean = 15.89, SD ± 1.02) questionnaires. Overall HBPM knowledge improved by a mean of 5.58, SD ± 3.29, 95% CI 4.25–6.91, $p \leq 0.001$), similarly hypertension knowledge also improved by a mean of 1.42, SD ± 1.65, 95% CI 0.76–2.09, $p \leq 0.001$. Participants were very receptive to the education package, the overall level of satisfaction to the contents and delivery method was 85%.

Conclusions: The intervention provided a significant statistical improvement on participants' HBPM and hypertension knowledge. Further longitudinal studies and RCT are recommended for further improvement of the education package.

047

Factors Associated with Symptomatic Hyponatraemia from Hydrochlorothiazide in Asian Hypertensive Patients

S. Silaruks*, P. Napinkul, K. Sawanyawisuth

Department of Medicine, Faculty of Medicine, Khon Kaen University, Khon Kaen, Thailand

Background: Hydrochlorothiazide is a cheap and effective antihypertensive agent. However, it may cause serious symptomatic hyponatraemia. Reported risk factors for hyponatraemia from hydrochlorothiazide include obesity or advanced age. Most of these studies have been conducted in Western countries.

Objective: To evaluate risk factors for hyponatraemia from hydrochlorothiazide in Asian hypertensive patients.

Methods: The study period was between 2005 and 2014 conducted at the hypertension clinic, tertiary care center. Eligible patients were divided into two groups: those with and those without hyponatraemia. Patients with hyponatraemia were identified using the ICD-10 code E871. Patients in the non-hyponatraemia group were those who had not had any reported hyponatraemia up until their final visit in December 2014. The ratio of hyponatraemia to non-hyponatraemia patients was 1:2. Clinical data of all patients were retrospectively reviewed. Factors that differed significantly between the two groups were analysed using descriptive statistics and logistic regression analysis.

Results: There were 68 patients admitted due to symptomatic hyponatraemia from hydrochlorothiazide. Four independent factors in the model predictive of the occurrence of symptomatic hyponatraemia were demonstrated. Male gender, high body mass index, and high serum albumin were negatively related with occurrence (adjusted ORs of 0.099, 0.683, and 0.122, respectively). High plasma glucose levels were positively related with occurrence, (adjusted OR of 1.030 (95% CI of 1.009, 1.051).

Conclusion: Factors related with hydrochlorothiazide induced symptomatic hyponatraemia in Asian hypertensive patients were gender, body mass index, serum albumin level, and plasma glucose level.

048

General Adult Transfer Functions Underestimate Central Aortic Systolic Pressure in Children and Adolescents when Compared to Age-Appropriate Transfer Functions

T. Cai [1,2,3,*], A. Meroni [1,2], A. Qasem [4], M. Butlin [4], J. Ayer [5], D. Celermajer [1,3], A. Avolio [4], M. Skilton [1,2]

[1] *University of Sydney, Camperdown, Australia*
[2] *Boden Institute of Obesity, Nutrition, Exercise and Eating Disorders, Camperdown, Australia*
[3] *Royal Prince Alfred Hospital, Camperdown, Australia*
[4] *Macquarie University, Macquarie, Australia*
[5] *Children's Hospital at Westmead, Westmead, Australia*

Background: Central aortic pressure can be estimated non-invasively in adults using general transfer functions. Similar techniques have been applied to, but not formally validated in paediatric populations. We recently developed and validated two age-appropriate paediatric transfer functions, and sought to determine their accuracy across childhood and adolescence.

Methods: We recruited 97 healthy children between 2 and 20 years of age in five pre-specified age groups. Central waveforms were estimated by applying two previously developed paediatric transfer functions developed in 8 year and 14 year-old children (8TF, 14TF respectively), and a proprietary adult transfer function (aTF) (Sphygmocor CvMS, AtCor) to radial waveforms measured by tonometry. Accuracy was tested against central waveforms derived from carotid tonometry.

Results: Central systolic blood pressure (cSBP) increases with age (1.1 mmHg per year; CI 95% 0.7–1.6). 8TF estimates higher cSBP than 14TF, which estimates higher cSBP than aTF across all ages. The opposite relationship was demonstrated for central augmentation index predicted by each function. 8TF most accurately estimated cSBP in childhood (age groups: 2–6.5 years, −0.8 mmHg [6.6]; 6.6–9.5 years, −0.1 mmHg [6.5]; 9.6–12.5 years, −0.9 mmHg [7.8]) and in late adolescence (15.6–20 years, 1.6 mmHg [7.3]), while 14TF most accurately estimated cSBP in early adolescence (12.6–15.5 years, −2.2 mmHg [7.1]).

Conclusions: In children and adolescents, aTF underestimates cSBP compared to paediatric transfer functions, possibly explained by a tendency for transfer functions to 'overfit' waveforms based on the age of the people in which they were developed. These results support the use of age-appropriate paediatric transfer functions.

049

Inaccurate Cuff-Blood Pressure Misses Potentially Preventable Cardiovascular Events and Increases Health Costs: a Markov Modelling Study from Real Patient Data

R. Fonseca[1], A. Palmer[1], D. Picone[1], M. Schultz[1], A. Black[2,*], N. Dwyer[2], P. Roberts-Thomson[2], P. Otahal[1], A. Cremer[3], G. Pucci[4], H. Cheng[5], J. Wang[6], R. Schmieder[7], S. Omboni[8], T. Pereira[9], T. Weber[10], W. Bros[11], E. Laugesen[12], B. Westerhof[13], J. Sharman[1]

[1] Menzies Institute For Medical Research, Hobart, Australia
[2] Royal Hobart Hospital, Hobart, Australia
[3] Department of Cardiology/Hypertension, University Hospital of Bordeaux, Bordeaux, France
[4] Unit of Internal Medicine at Terni University Hospital, Department of Medicine, University of Perugia, Perugia, Italy
[5] Department of Medicine, National Yang-Ming University, Department of Medical Education, Taipei Veterans General Hospital, Taipei, Taiwan
[6] Centre for Epidemiological Studies and Clinical Trials, Shanghai Key Laboratory of Hypertension, The Shanghai Institute of Hypertension, Department of Hypertension, Ruijin Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai, China
[7] Department of Nephrology and Hypertension, University Hospital Erlangen, Friedrich-Alexander University Erlangen-Nürnberg, Erlangen, Germany
[8] Clinical Research Unit, Italian Institute of Telemedicine, Varese, Italy
[9] Polytechnic Institute of Coimbra, ESTES, Department of Cardiopneumology, General Humberto Delgado Street 102, Lousã, Portugal
[10] Cardiology Department, Klinikum Wels-Grieskirchen, Wels, Austria
[11] St Antonius Hospital, Department of Internal Medicine, Nieuwegein, The Netherlands
[12] Department of Endocrinology and Internal Medicine, Aarhus University Hospital, Aarhus, Denmark
[13] Department of Pulmonary Diseases, VU University Medical Center, Amsterdam, The Netherlands

Background: Hypertension management is directed by cuff blood pressure (cuff-BP), but significant inaccuracy can occur. Cuff-BP inaccuracy may influence future cardiovascular (CV) events and associated health costs, but this is unknown and was the aim of this study.

Methods: Microsimulations based on Markov modelling were used to determine the differences in the number of CV events (CV death, stroke, acute myocardial infarction, atrial fibrillation, and heart failure) and total health costs of CV events based on cuff-BP compared with accurate-BP from intra-arterial aortic BP. Modelling was from data recorded among 1,683 participants during cardiac catheterisation from 30 separate studies as part of the INSPECT consortium.
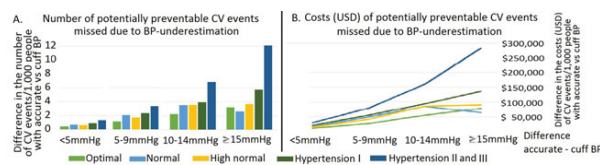

Fig. 1.

Results: Prevalence of cuff-BP underestimation and overestimation was 54% and 46%, respectively, and both of these inaccuracies increased as the level of BP increased (from optimal BP to hypertension grades I–III). Among people with hypertension grades II and III, the ratio of cuff underestimation vs overestimation was 17:1. The number of CV events missed (Fig. 1 A) and associated health costs (Fig. 1 B) both increased stepwise across the levels of BP control as cuff-BP inaccuracy (underestimation) increased.

Conclusion: Many potentially preventable CV events are missed due to inaccurate (underestimated) cuff-BP, and this is associated with major increases in health costs. These adverse outcomes could be remedied with improvements in the accuracy of cuff-BP.

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050

Non-Invasive Assessment of Central Blood Pressure: Clinical Relevance of Current Methodologies

K. Khokhar[1,*], D. Lau[1], M. Stiles[2], R. Mahajan[1], A. Elliott[1], D. Linz[1], D. Munawar[1], K. Kadhim[1], M. Emami[1], V. Mailk[1], C. O'Shea[1], P. Sanders[1]

[1] CHRD, Royal Adelaide Hospital, University of Adelaide and South Australian Health and Medical Research Institute, Adelaide, Australia
[2] Waikato Clinical School, Department of Health and Sciences, Auckland University, New Zealand, Hamilton, New Zealand

Background and Introduction: Central high blood pressure is increasingly recognised for its independent value to predict cardiovascular outcomes. However, non-invasive evaluation of central haemodynamics is rarely performed in routine clinical practice.

Objective: To review the currently available techniques for non-invasive assessment of central blood pressure indices in order to expand their use in routine cardiovascular screening.

Method: A clinical appraisal of currently available techniques used to estimate central blood pressure indices was performed.

Results: Majority of the available devices conform central pressure waveform. The recorded peripheral pressure waveform was further calibrated by brachial blood pressure indices before subjecting it to a mathematical algorithm to derive

CBP and its indices. The imprecisions in peripheral wave calibration can lead to a variable band error of 5 ± 8 mmHg in central blood pressure estimates. In comparison to increased central pulsatile load assessment, aortic stiffness, as a surrogate for persistently high central blood pressure, is more strongly associated with adverse cardiovascular outcomes including AF. In general, carotid –femoral pulse wave velocity is used to estimate aortic stiffness and is widely accepted for its reliability and reproducibility.

Conclusion: Improved calibration standards for devices to estimate central blood pressure non-invasively are required to enhance their clinical utility. Aortic stiffness assessment is clinically more applicable because of its reliability and it better represents premature conduit vascular remodelling consequent to the increased central pulsatile load.

Characteristics of Devices in Clinical Use to Estimate CBP and Its Indices

Device	Technique & peripheral site of recording of pulse wave	Calibration method of peripheral pressure	Mathematical principle to derive central pressure	Technique used for Invasive validation	Estimated CBP indices
SphygmoCor	Applanation tonometry of radial artery	Brachial SBP/DBP/MAP	(Generalized Transfer Function) GTF	(Micro-tipped) MT or (Fluid Filled) FF	CPW, CSBP,CDBP, CPP, CAIx, CAP
SphygmoCor XCEL	Brachial Oscillometry	Brachial SBP/DBP	GTF	MT	CSBP, CDBP, CPP, CAIx
Omron HEM-9000AI	Applanation tonometry of radial artery	Brachial SBP/DBP	(Wave Analysis) WA (SBP2)	MT or FF	CSBP, CDBP, CPP, CAIx
Arteriograph	Brachial Oscillometry (35mmHg > SBP)	Brachial SBP/DBP	WA (SBP2)	FF	CSBP, CDBP, CPP, CAIx
Mobil-O-Graph	Brachial Oscillometry	Brachial SBP/DBP	GTF	MT	CSBP, CDBP, CPP, CAIx
Vicorder	Brachial Oscillometry	Brachial SBP/DBP	GTF	FF	CSBP, CDBP, CPP, CAIx
PulseCor R6.5 and R7	Brachial Oscillometry	Brachial MBP/DBP	Physics Model	FF	CSBP, CDBP, CPP
BPro	Applanation tonometry of radial artery	Brachial SBP/DBP	NPMA	FF	CSBP, CDBP, CPP
PulsePen & Complior Analyse	Applanation tonometry of carotid artery	Carotid Artery waveform	Direct Method	FF	CSBP, CDBP

051

Obesity is Not an Independent Risk Factor of Obstructive Sleep Apnoea in Asian Hypertensive Patients

S. Silaruks *, K. Sawanyawisuth, P. Mahawarakorn, S. Khamsai, P. Limpawattana, J. Chindaprasirt, V. Senthong

Department of Medicine, Faculty of Medicine, Khon Kaen University, Khon Kaen, Thailand

Background: Obstructive sleep apnoea (OSA) has been known to be a secondary cause of hypertension by the JNC 7 since 2003. The prevalence of OSA in hypertension is ranged from 30–80% in Western countries. There is limited data on prevalence and risk factors of OSA in Asian hypertensive patients.

Methods: We enrolled all hypertensive patients treated at the hypertension clinic, tertiary care center. The definition of OSA as a cause of hypertension is defined by presence of apnoea-hypopnoea index more than 5 events/hour by polysomnography and no other identifiable causes of hypertension. Prevalence of OSA in hypertensive patients was calculated. Risk factors for OSA in hypertensive patients were also studied by using multivariate logistic regression analysis.

Results: There were 726 hypertensive patients treated at the clinic. Of those, 324 patients (44.63%) were diagnosed as OSA. Approximately one-third of patients with and without OSA were randomly studied; 106 OSA patients and 147 non-OSA patients. There were 4 independent factors associated with OSA-induced hypertension: age, gender, history of snoring, and history of morning headache. The adjusted odds ratio (95% confidence interval) of all factors were 0.97 (0.95, 0.99), 1.95 (1.03, 3.69), 7.95 (4.02, 15.73), and 3.58 (1.51, 8.48), respectively. Neither body mass index nor abdominal circumference was statistically related with OSA.

Conclusions: The prevalence of OSA in our hypertensive clinic was 44.63%. The independent predictors for OSA in hypertension were age, gender, history of snoring, and history of morning headache.

052

Zinc Modulates Endothelin-1 and Nitric Oxide Signalling in Vascular Endothelial and Smooth Muscle Cells

A. Abdo [1,2,*], A. Jaghoori [3], H. Tran [2], R. Jakobczak [1,3], J. Beltrame [1,2,3], P. Zalewski [1,2]

[1] Department of Medicine, Basil Hetzel Institute, Adelaide, Australia
[2] Faculty of Health and Medical Sciences, University of Adelaide, Adelaide, Australia
[3] Department of Medicine, The Queen Elizabeth Hospital, Adelaide, Australia

Zn homeostasis is an important regulator of vascular function, from the inflammatory response to vasodilation. Smoking significantly decreases endothelial Zn levels and causes loss of ZIP2 (Zn cystosolic influx transporter) expression in mice. Endothelin-1 (ET1), an endothelium-derived vasoconstricting factor, is systemically elevated in smokers, who also have lowered Zn, impaired NO production and can present increased risk of coronary vasospasm. Furthermore, circulating ET1 levels are elevated in patients with coronary slow flow; a microvascular disorder with higher prevalence in smokers. Our preliminary data have shown Zn chelation caused vasoconstriction of human subcutaneous microvessels and ET1-dependent vasoconstriction was significantly ablated by physiological Zn levels in a concentration dependent manner. On this basis, we extended this study to see which Zn transporters (ZnT1-10 and ZIP1-14) respond to changing Zn homeostasis in endothelial (EC) and smooth muscle cells (SMC), and the effect of Zn on ET1 and NO signalling. In both EC and SMC, ZIP2 and ZIP12 gene expression were upregulated under Zn depleted conditions (20 uM TPEN; $n = 4$). Preliminary data show that both basal NO production and intracellular ET1 levels were increased in EC with increasing intracellular Zn concentrations. However, intracellular ET1 protein was markedly reduced under Zn depleted conditions in EC, while it was increased in SMC (fluorescence confocal microscopy). Hypozincaemia may therefore trigger ET1 release, which may reflect a coupled role for Zn and NO in opposing ET1 release. This will be confirmed by measuring ET1 in the extracellular supernatant.

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Cardiomyopathy/Heart Failure (053–148)

053

A Novel Therapy to Restore Metabolic Activity and Prevent Hypertrophic Cardiomyopathy

H. Viola [1,*], A. Shah [1], L. Hool [1,2]

[1] The University of Western Australia, Crawley, Australia
[2] Victor Chang Cardiac Research Institute, Sydney, Australia

Hypertrophic cardiomyopathy (HCM) is associated with altered metabolic activity and hypercontractility. Alterations in L-type Ca^{2+} channel (LTCC) activity can regulate mitochondrial function. The sarcomeric network plays a structural-functional role in this response. Cardiomyocytes from a murine model of HCM due to a mutation in sarcomeric cardiac troponin I (*cTnI-G203S*) exhibit a *faster* LTCC inactivation rate, impaired communication between LTCC and mitochondria, and a "hypermetabolic" mitochondrial state. Conversely, a peptide targeting LTCC alpha-interaction domain, that prevents conformational movement of LTCC β_2 subunit (AID-TAT), *slows* LTCC inactivation rate and *decreases* metabolic function in *wt* cardiomyocytes. We assessed the efficacy of *in vivo* exposure of *cTnI-G203S* mice to AID-TAT on metabolic function and HCM development. First, cardiac uptake of *sulfo*-cyanine7 labelled AID-TAT (AID-TAT-Cy7) was assessed in adult BALB/c nude mice (10 μM via intraperitoneal [IP] injection; Maestro 2.6 *in vivo* Imaging System). Significant cardiac uptake occurred within 1 hr versus a scrambled control AID(S)-TAT-Cy7 (3.8 ± 0.02-fold increase, $n = 7$, $p < 0.05$). Next, we assessed the efficacy of *in vivo* treatment of *cTnI-G203S* mice with AID-TAT (10 μM 3×/wk/5wk, IP) on (i) sarcomeric organisation (immunohistochemistry), (ii) mitochondrial membrane potential (Ψ_m, JC-1 fluorescence) and mitochondrial oxygen consumption (flavoprotein oxidation, autofluorescence), and (iii) cardiac function (echocardiography). AID-TAT restored sarcomeric organisation, normalised Ψ_m (AID-TAT: $20.1 \pm 2.2\%$ increase, $n = 18$ vs AID(S)-TAT: $30.3 \pm 1.8\%$ increase, $n = 18$; $p < 0.05$) and flavoprotein oxidation (AID-TAT: $17.8 \pm 2.1\%$ increase, $n = 29$ vs AID(S)-TAT: $42.3 \pm 5.0\%$ increase, $n = 26$; $p < 0.05$), and prevented development of HCM (echocardiography). We conclude that treatment of *cTnI-G203S* mice with AID-TAT restores structural-functional communication between cardiac LTCC and mitochondria, and prevents HCM development.

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A Retrospective Cohort Study of Heart Failure in the Australian Primary Care Setting – Clinical Characteristics of HF Patients (SHAPE Study)

A. Sindone[1], R. Audehm[2],
D. Haikerwal[3,4,5], K. Lim[6], P. Piazza[7],
R. Parsons[8], A. Neville[8], D. Liew[9,*]

[1] Concord Hospital, Sydney, Australia
[2] Carlton Family Medical, Melbourne, Australia
[3] Heart West, Melbourne, Australia
[4] Western Health, Melbourne, Australia
[5] Alfred Hospital, Melbourne, Australia
[6] Novartis Pharmaceuticals Australia Pty Ltd, Sydney, Australia
[7] Five Dock Family Medical Practice, Sydney, Australia
[8] Austrials, Sherwood, Australia
[9] Monash University, Melbourne, Australia

This real world evidence study seeks to profile patients with heart failure (HF) being cared for in Australian general practice. Patients were identified through an analysis of de-identified data of adult patients seen between 1 July 2013 and 30 June 2018 at a large network of general practices across Australia. The present analysis describes the clinical characteristics of patients classified as having (1) definite and (2) probable HF.

Of a total 1.93 million adults patients seen in the study period, 21,878 patients satisfied predetermined criteria for (1) and (2). Notably 45.4% did not have a formal diagnosis of HF documented in the notes or diagnosis section of their records. In terms of comorbidities, 30.6% had a history of hypertension recorded in the diagnosis field, 8.4% diabetes, 8.2% coronary artery disease, 1.3% peripheral arterial disease and 1.5% atrial fibrillation/flutter.

Of the cohort, 35.7% had been prescribed HF-specific medications with 34.4% being a HF specific beta-blocker. In terms of other medications, 38.7% had also been prescribed an ACE inhibitor, 30.0% an ARB, 54.3% a loop diuretic and 15.3% spironolactone. NSAIDs, corticosteroids and tricyclic antidepressants (all of which should be avoided in HF) had been prescribed to 56.5%, 39.5% and 13.9% respectively.

Left ventricular ejection fraction (EF) results were available for 982 patients. Of these, 38% had EF $\geq$50%, 17% had EF between 41–49% and 45% had EF $\leq$40%. eGFR was available in 9550 patients. Of these, eGFR was <60 ml/min/1.73^2 in 27.6% and <30 ml/min/1.73^2 in 6%.

Analyses of aetiology and medication dose levels are planned.

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A Retrospective Cohort Study of Heart Failure in the Australian Primary Care Setting – Method and Demographic Results (SHAPE study)

A. Sindone[1,*], R. Audehm[2],
D. Haikerwal[3,4,5], K. Lim[6], P. Piazza[7],
R. Parsons[8], A. Neville[8], D. Liew[9]

[1] Concord Hospital, Sydney, Australia
[2] Carlton Family Medical, Melbourne, Australia
[3] Heart West, Melbourne, Australia
[4] Western Health, Melbourne, Australia
[5] Alfred Hospital, Melbourne, Australia
[6] Novartis Pharmaceuticals Australia Pty Ltd, Sydney, Australia
[7] Five Dock Family Medical Practice, Sydney, Australia
[8] Austrials, Sydney, Australia
[9] Monash University, Melbourne, Australia

This study sought to describe the 'real world' state of heart failure (HF) and its management in Australian primary care. Analyses were undertaken of secondary de-identified data of adult patients seen between 1 July 2013 and 30 June 2018 from a large network of general practices across Australia. We examined structured data from medical records (e.g. diagnoses, medications) as well as free text entries in the consultation notes for pre-specified, HF-relevant terms to identify and describe the HF population.

Data were examined for the presence of a diagnosis of HF, use of HF-specific medications, HF-diagnostic investigation (e.g. BNP/NT-proBNP, echocardiography) results and typical signs/symptoms of HF. The population was then stratified into three groups based on a hierarchy of diagnostic criteria: (1) definite HF, (2) probable HF and (3) possible HF.

The practices provided care to 1.93 million individual adult patients. From this population, 16,990 (0.88%) were in group (1), 4888 (0.25%) in (2) and 36,446 (1.89%) in (3). Of the 1.13% of the population with either definite or probable HF, the median age was 72 years (IQR 59–83); 50.6% were female and 1.65% were classified as Aboriginal/Torres Strait Islander.

A recorded HF diagnosis (11,937) and HF-specific medications (4773) were the most common methods to classify "definite HF" patients. Typical signs and symptoms of HF in combination with diuretic use was the most common method to classify "probable HF" patients (4756).

This novel approach is the largest Australian real-world evidence study of HF, quantifying the characteristics of this population.

A Systematic Review and Meta-Analysis of the Prevalence of Left Ventricular Non-Compaction in Adults

S. Ross [1,2,*], C. Semsarian [1,2,3,4], K. Jones [2], B. Blanch [2], R. Puranik [1,3], K. McGeechan [4,5], A. Barratt [4,5]

[1] Sydney Medical School, Faculty of Medicine and Health, The University of Sydney, Sydney, Australia
[2] Agnes Ginges Centre for Molecular Cardiology, Centenary Institute, Sydney, Australia
[3] Department of Cardiology, Royal Prince Alfred Hospital, Sydney, Australia
[4] Wiser Healthcare, Sydney, Australia
[5] Sydney School of Public Health, Faculty of Medicine and Health, The University of Sydney, Sydney, Australia

Aim: To assess the reported prevalence of left ventricular non-compaction (LVNC) in different adult cohorts, taking in to consideration the role of diagnostic criteria and imaging modalities used.

Methods and Results: Systematic review and meta-analysis of studies reporting LVNC prevalence in adults. Studies were sourced from Pre-Medline, Medline and Embase, and assessed for eligibility according to a standardised proforma. Eligible studies provided a prevalence of LVNC in adult populations ($\geq$12 years). Studies were assessed, and data extracted by two independent reviewers. Fifty-nine eligible studies documenting LVNC in 67 unique cohorts were included. The pooled prevalence estimates for LVNC were consistently higher amongst cohorts diagnosed on cardiac magnetic resonance (CMR) imaging (14.79%, $n = 26$) compared with echocardiogram (1.28%, $n = 36$). The prevalence of LVNC varied between disease and population representative cohorts. Athletic cohorts demonstrated high pooled prevalence estimates on echocardiogram (3.16%, $n = 5$) and CMR imaging (27.29%, $n = 2$).

Conclusions: LVNC in adult populations is a poorly defined entity which likely encompasses both physiological adaptation and pathological disease. There is a higher prevalence with the introduction of newer imaging technologies, specifically cardiac magnetic resonance imaging, which identify LVNC changes more readily. The clinical significance of these findings remains unclear, however there is significant potential for overdiagnosis, overtreatment and unnecessary follow-up.

A Systematic Review of Frailty Scores Used in Heart Failure Patients

N. Chokshi [1,*], B. Karmakar [1], F. Pathan [1,2,3]

[1] Department of Cardiology, Nepean Blue Mountains Local Health District, Sydney, Australia
[2] The University of Sydney, Sydney, Australia
[3] The Charles Perkins Centre, Sydney, Australia

Background: Frailty is a common geriatric syndrome and is prevalent across many conditions including chronic heart failure (CHF). The presence of frailty in patients with CHF is strongly associated with increased vulnerability to adverse events, including falls, hospitalisation and mortality.

Aim: To systematically review the existing evidence and determine which frailty assessment tools and criteria are most valuable in measuring frailty status in patients with heart failure.

Methods: A literature search using databases PubMed and Scopus was performed in accordance with PRISMA guidelines. Key search terms included: "Frailty", "fragility", "Fried", "Barthel", "Gait speed", "SPPB" or "frailty phenotype" AND "Heart failure" or "Cardiac failure/CHF". Only articles that assessed frailty using systematically defined criteria were accepted for review.

Results: From initial 2,328 articles, 1,628 remained after duplicates were deleted. Of those, 1,372 were excluded by screening titles, and a further 180 articles excluded after screening abstracts. Full-text reviews were performed on the remaining 76 articles. Several frailty tools were identified, most assessed similar features, including aspects of muscle wastage, subsequent physical weakness and inactivity, cognitive impairment and exhaustion. The most commonly evaluated frailty tools included the Fried's Frailty Criteria ($n = 50$), Barthel Index ($n = 22$), and SPPB ($n = 12$), with Fried's criteria providing significant prognostic data.

Conclusion: There is currently no gold standard frailty measurement tool, however achieving a standardised form of assessment can increase the capacity to prevent, identify and manage frailty in the heart failure population.

Accuracy of Side Effect Reporting in Australian Prescribing Information

M. Ray [*], J. Moore

Royal North Shore Hospital, St Leonards, Australia

The beneficial effects observed in patients taking inert substances placebo effects are well known. Less recognised are the adverse effects from these inert substances - the nocebo effect. Patients, perceptions strongly influence nocebo effects; thus to distinguish true adverse effects from nocebo effects requires blinding [1]. Although beta-blockers have proven efficacy in heart failure, use may be limited by concerns about side effect. Side effect information in Australian prescribing

information may overestimate the true rate of side effects and limit usage of these life-preserving heart failure medications.

We compared the adverse effects listed in a systematic review of randomised control trials of beta-blockers with the adverse effects listed in reference texts: The Australian Medicines Handbook Online and MIMS Online [2–4].

25 of 33 adverse effects listed in the systematic review were listed in AMH or MIMS. Of all listed adverse effects the rates were comparable for 10/25. Adverse effects were overestimated in 15/25 cases. Twelve adverse effects listed as common in reference texts were actually less common in the active treatment arm of randomised control trials.

This study demonstrates that Australian reference texts overestimate the true rate of adverse effects attributable to beta-blockers and misinform patients and clinicians. As recognised by Barron et al. [2] overestimating these adverse effects may lead to clinicians and patients ceasing beneficial medications. Reviewing how information on adverse effects is published in Australian prescribing references may improve treatment of many conditions and reduce discontinuation of proven therapies.

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059

Adherence to Guideline Directed Medical Therapy of Patients Admitted to Hospital with Acute Heart Failure

A. Driscoll [1,2,*], D. Dinh [3], J. Wong [4], G. Toogood [5], I. Hopper [3,6], H. Zimmet [3,7], A. Brennan [3], J. Lefkovits [3], H. Carruthers [3], J. Mariani [6,8], H. Connor [9], C. Reid [3,10]

[1] Deakin University, Burwood, Australia
[2] Austin Health, Heidelberg, Australia
[3] Monash University, Prahran, Australia
[4] Melbourne Health, Parkville, Australia
[5] Peninsula Health, Frankston, Australia
[6] Alfred Health, Prahran, Australia
[7] Epworth Healthcare, Richmond, Australia
[8] Bairnsdale Regional Health Service, Bairnsdale, Australia
[9] Central Gippsland Health Service, Gippsland, Australia
[10] Curtin University, Perth, Australia

Background: National guidelines for the management of heart failure (HF) inform clinical practice. However, translation into clinical practice is suboptimal, denying patients the full benefit of evidence-based therapy. This study evaluated the translation of clinical guidelines in the management of patients admitted to hospital with acute HF.

Methods: Sixteen Victorian hospitals participated in a prospective state-wide HF study of patients admitted to hospital with acute HF over one month and followed up for 30 days post-discharge. The project was conducted annually over three consecutive years from 2015–2017.

Results: Of the 1222 patients, 56.5% were male with an average age of 77 years (SD 13.17 years) and 73.6% had HFrEF. Hypertension and chronic renal disease were the most common comorbidities (75.5% and 63.6% respectively). In patients with HFrEF, 73.1% were prescribed, at discharge, an ACEI/ARB, 74.8% a beta-blocker and 46.6% an aldosterone antagonist. On average, these patients were prescribed 10.46 ± 4.03 medications. At 30 days, 53.6% of all patients had been seen in outpatients with median time to appointment of 21 (IQR 12–30) days. A third of all patients had been referred to a HF home visiting program. Of these patients, 49% were seen within 30 days post-discharge with median time to first visit of 13 (IQR 6.25–27) days. Thirty-day readmission rates were 24.4% and mortality was 4.8%.

Conclusion: Rates of guideline directed medical therapy remain suboptimal in HFrEF patients. Post-discharge follow-up was also inadequate. Strategies to improve rapid review post-discharge and translation of evidence into clinical practice are urgently needed.

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060

AF-Mediated Heart Failure: A Retrospective Observational Study

A. Rao [1,*], S. Hales [1], B. Patani [1], D. Mou [1,2], L. Kanagaratnam [1,3,6], E. Barin [1,2,3], A. Sindone [1,3,4,6], G. Gan [1,5,7]

[1] Department of Cardiology, Ryde Hospital, Eastwood, Australia
[2] Department of Cardiology, Macquarie University Hospital, Macquarie Park, Australia
[3] Department of Cardiology, Royal North Shore Hospital, St Leonards, Australia
[4] Department of Cardiology, Concord General and Repatriation Hospital, Concord, Australia
[5] Department of Cardiology, Blacktown Hospital, Blacktown, Australia
[6] University of Sydney, Camperdown, Australia
[7] University of New South Wales, Kensington, Australia

Background and Aim: Heart failure is one of the leading causes for hospitalisation and imposes a significant economic burden on the health system. Atrial fibrillation affects one in three patients with heart failure (REF), and is a common cause of heart failure admission. The aim of our study is to evaluate the impact of AF-related heart failure (HF) admissions relative to admissions for HF without AF.

Method: Patients admitted to Ryde Hospital with a primary diagnosis of decompensated HF in the time period

of Jan-2018 to Dec-2018 were evaluated. We grouped patients based on the primary cause of decompensation (AF vs Non AF). We compared admission indices including length of stay and complications during admission.

Results: 164 patients were included (Group 1: AF-related decompensation, $n = 56$; Group 2: Non-AF-related decompensation $n = 108$). The mean age was (84.59 ± 8.2SD, 45.7% females). 48% of patients had history of ischaemic heart disease, 14.9% had COPD, and 28.4% had diabetes mellitus. On between-group analysis, patients with AF mediated decompensations had a significantly longer length of stay (7.04 ± 5.20 SD vs 5.16 ± 3.94 SD, $p = 0.01$), compared to non-AF mediated decompensations. Troponin and haemoglobin levels were not significantly different between groups. However, a higher proportion of patients in the AF group had history of anaemia (58% vs 66%, $p = 0.40$), and raised troponin levels (31% vs 41%, $p = 0.40$).

Conclusion: Our finding suggest AF mediated decompensated HF is associated with longer lengths of stay and trend towards higher complications.

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061

Ambulatory Inotropes as a Bridge to Heart Transplantation: A Safe Alternative to Mechanical Support?

M. Stubbs *, P. Ruygrok

Auckland District Health Board, Auckland, New Zealand

Background: Patients with advanced systolic heart failure are susceptible to acute deterioration refractory to standard medical therapies. This case series explores our local experience with ambulatory parenteral inotropic therapy as a means to support susceptible patients on the heart transplant waiting list.

Methods and results: We reviewed medical records of all patients treated with ambulatory inotropes through the national transplant centre. Fifteen patients were treated between 2001 and 2018. Mean age was 43.6 years, ranging from 11 to 63 years. Inotropes used consisted of dobutamine (dose range 3–10 mcg/kg/min, mean 4.4 mcg/kg/min) and milrinone (dose range 0.3–0.5 mcg/kg/min, mean 0.46 mcg/kg/min). Levosimendin was used intermittently in 8 of 15 patients. All patients had inotropes administered via peripherally inserted central catheter (PICC). Median duration of therapy was 139 days (range 20–717 days). Fourteen of 15 patients were transplanted successfully (one withdrew from the waitlist by personal choice). Dominant aetiology of heart failure was dilated cardiomyopathy (seven of 15). There was an improvement in functional status in nine of 13 patients (data incomplete in two of 15). During the 2707 patient days on inotropes, there were no deaths, and no patients were withdrawn from inotropes due to adverse effects. Two patients had ventricular arrhythmia requiring ICD therapy, and there were five minor complications in three patients.

Conclusion: When managed by a specialist team ambulatory inotropic therapy for advanced heart failure resistant to standard medical therapy appears to be a reasonably safe and effective alternative therapy to bridge actively listed patients to heart transplantation.

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063

Anti-Angiogenic Vascular Endothelial Growth Factor-A Isoform: VEGF-A165b is Present in Human Right Atrial Appendage, but is not Altered in Diabetes

A. Croft [1,2,*], T. Senanayake [3], L. Butel-Simões [3], N. Mabotuwana [1,2], A. Boyle [1,2,3], A. Sverdlov [1,2,3], D. Ngo [1,2]

[1] *University of Newcastle, New Lambton Heights, Australia*
[2] *Hunter Medical Research Insititute, New Lambton Heights, Australia*
[3] *John Hunter Hospital, New Lambton Heights, Australia*

Introduction: The alternative splice variant of vascular endothelial growth factor (VEGF-A): VEGF-A165b is anti-angiogenic and has been described to regulate angiogenesis in cancer, retinopathy, and obesity. In this study, we describe for the first time, presence of VEGF-A165b in human cardiac tissue, and sought to determine whether VEGF-A165b is altered in patients with diabetes.

Methods and Results: A total of 33 right atrial appendage biopsies were collected from consenting patients during cardiac or vascular surgery at the John Hunter Hospital. Patient demographics and co-morbidities were recorded on the day of surgery and confirmed via access to medical records. A majority of patients (82%) were male; 32% of patients had previous MI, $n = 10$ (30%) patients had diabetes. Detection of VEGF-A165b levels were determined using the ELISA kit (R&D systems). Patients with diabetes tended to have lower VEGF-A165b expression ($p = 0.1$). There was no difference in VEGF-A165b expressions in patients with previous myocardial infarction or diastolic impairment. On multivariate analysis, presence of diabetes is not associated with changes in VEGF-A165b expression, independent of age, BMI, gender, and cardiovascular co-morbidities.

Conclusions: VEGF-A165b is present in human cardiac tissue. In patients who underwent CABG surgery, there was no difference in VEGFA-165b expression between patients with vs without diabetes. Larger study population is required to dissect the regulatory mechanisms of cardiac VEGF-A165b in metabolically-induced cardiovascular pathologies.

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064

Association Between Heart Rate Variability and Echocardiographic Parameters in Heart Failure with Reduced and Preserved Ejection Fraction

A. Jian [1,*], C. Todd [2], D. Kaye [2], S. Nanayakkara [2]

[1] *University of Melbourne, Melbourne, Australia*
[2] *The Alfred Hospital, Department of Cardiovascular Medicine, Melbourne, Australia*

Background: Heart rate variability (HRV) has been associated with adverse outcomes in patients with heart failure with reduced ejection fraction (HFrEF). Despite similar sympathetic derangements in HFpEF, little data on HRV in HFpEF exist. We sought to determine whether patients with HFPEF displayed similar derangements in HRV to HFREF patients, and then to analyse the structural associations with these parameters.

Methods: We conducted a retrospective Holter analysis of 82 patients (33 HFpEF, 22 HFrEF, 27 control) with echocardiographic data. Time domain and frequency domain HRV measures included standard deviation of all NN interval (SDNN), standard deviation of the average NN intervals (SDANN), low frequency (LF) and high frequency (HF).

Result(s): HRV time domain measures were similarly decreased in both HFpEF and HFrEF compared with controls (SDNN 104 [87–128] vs 119 [91–185] vs 149 ms [121–170], $p = 0.005$; SDANN 89 [71–108] vs 106 [66–157] vs 124 ms [105–154], $p = 0.004$; triangular index 27 [24–33] vs 30 [23–40] vs 39 [32–48], $p = 0.002$). Across SDNN tertiles segregated based on <100 ms, 100–150 ms and >150 ms, E/e' was increased in the lowest tertile compared to the highest (13.2 ± 5.3 vs. 8.7 ± 4.4, $p = 0.006$). Univariate regression analysis demonstrated that decreased SDNN ($p = 0.008$), SDANN ($p = 0.006$) and triangular index ($p = 0.028$) were predictors of high E/e'. In the HFPEF group, only decreased SDANN ($p = 0.049$) was associated with high left atrial volume index (LAVI).

Conclusion: HRV was markedly impaired in both HFPEF and HFREF compared to healthy controls. In particular, decreased time domain HRV measures may be associated with worsened diastolic dysfunction.

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Baseline Characteristics, Management and Outcomes of Patients With Heart Failure and Preserved Ejection Fraction in a Nurse Facilitated Care Model

L. Kearney*, K. Lu, J. McGillion, R. Hamilton, M. Duong, S. Kim, D. Eccleston, S. Delacroix

Genesiscare, Leabrook, Australia

Introduction: Current clinical guidelines recommend that patients with heart failure (HF) receive multidisciplinary care at nurse-led HF clinics both for optimisation of medical therapies and to reduce preventable readmissions.

Methods: We present the biological and clinical characteristics of patients with HF and preserved ejection fraction (HFPEF) and the clinical outcomes achieved (all-cause mortality [ACM] or HF hospitalisation) within the GenesisCare Heart Failure Management Clinics (GC-HFMC). GC-HFMCs are a HF specialist led, nurse-facilitated model providing comprehensive pharmacological and non-pharmacological management, HF education and a HF nurse support service.

Results: The cohort ($n = 297$) was predominantly female (62%) with mean age 79 ± 10 years, median LVEF of 60% (IQR 55,65) and NYHA class II (56%) and III (34%). Community referrals accounted for 80% of patients, with 20% referred post hospitalisation. There was a high incidence of comorbidities, such as hypertension (83%), dyslipidaemia (65%), arrhythmia (64%), diabetes (34%), chronic renal failure (45%), airway disease (33%) and anaemia (31%). The STOP-Bang score indicated 76% of patients were high risk for obstructive sleep apnoea (OSA) but only 15% had a known OSA diagnosis. Medications included BB (57%), ACEI/ARB (59%) and diuretics (81%). Patient satisfaction with care was high (net promoter score >80%). At one year, the combined end point of ACM or HF hospitalisation occurred in 11.1%, and ACM occurred in 6.4%.

Conclusions: The findings demonstrate the impact of nurse facilitated GC-HFMCs in providing quality care and delivering low hospitalisation and mortality rates.

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"Better Out Than in": Outcomes for an Early Review Clinic for Heart Failure Patients

A. Rao [1,*], S. Hales [1], T. Montague [1], A. Sindone [1,2,3,4]

[1] *Department of Cardiology, Ryde Hospital, Eastwood, Australia*
[2] *Department of Cardiology, Royal North Shore Hospital, St Leonards, Australia*
[3] *Department of Cardiology, Concord General and Repatriation Hospital, Concord, Australia*
[4] *University of Sydney, Camperdown, Australia*

Background and Aim: Congestive Heart Failure accounted for 16,757 hospital admissions between 2016–2017 in NSW [1]. During this period, length of stay varied between 1–69 days and following discharge, 18.3% of patients were readmitted in 30 days with a principal diagnosis of heart failure [1]. We aimed to pilot a model for an early review clinic at Ryde Hospital for Heart Failure patients, to assess its effect on length of stay and readmission rate.

Method: Inpatients were recruited from Ryde Hospital, who had been admitted with a principal/secondary diagnosis of heart failure, and had been treated by/or consulted by the cardiology team for heart failure optimisation. Patients were seen within 10 days of discharge, and had blood tests prior to review. Only one appointment was made and the patients were discharged to their regular cardiologist, or advised to present to ED for review.

Results: Length of stay for heart failure admissions at Ryde Hospital remained similar pre-and post-clinic (approximately 6.4 days). However, unplanned readmission for heart failure in 30 days had decreased from 8.2% to 5.95% post-clinic. 80% of patients underwent a medication change at the review and patient reported feedback was also very positive.

Conclusion: The early review clinic may have contributed to reduced representations for heart failure, compared with the state average and Ryde's past performance. Furthermore, patient-reported outcomes strongly support the clinic. Such a clinic could improve overall patient outcomes and reduce the cost of care.

Reference: 1. Multiple contributors. "ACI - CHF Clinical Documentation Audit Statewide Report". Audit and Improvement Team, Clinical Information and Decision Support, System Transformation Evaluation and Patient Experience. Agency for Clinical Innovation. 2019.

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067

Cardiac B55α: a Novel Regulator of β-Adrenergic Signalling and Hypertrophic Gene Expression

N. Sergienko*, D. Donner, J. McMullen, K. Weeks

Baker Heart And Diabetes Institute, Melbourne, Australia

Introduction: Cardiac hypertrophy is an independent risk factor for heart failure. A key contributor to this maladaptation is activation of β-adrenergic signalling in cardiomyocytes. B55α, a regulatory subunit of protein phosphatase 2A, modulates hypertrophic signalling downstream of β-adrenergic receptors *in vitro.* To investigate the function of cardiac B55α *in vivo*, we generated mice with heterozygous (HET) or homozygous (HOM) deletion of the gene encoding B55α.

Methods: Cardiac function, morphology, histology and molecular analyses were performed in (i) a basal cohort ($n = 6$–14/genotype, ~10–12 weeks of age, both sexes) and (ii) a cohort subjected to 13 days of isoproterenol treatment administered via osmotic mini-pump (30 mg/kg/day, $n = 5$–6/group, male mice).

Results: HOM mice were embryonically lethal. HET mice displayed a ~50% reduction in cardiac B55α expression ($p = 0.007$) and showed no signs of pathology (normal systolic function, no fibrosis or induction of the cardiac stress markers *Nppa* and *Nppb*). Isoproterenol did not significantly increase heart weight/tibia length ratio of WT or HET mice, however HET mice displayed more pronounced changes in gene transcription. Specifically, expression of myosin heavy chain isoforms α and β switched in favour of the β-isoform in HET ($p = 0.004$) but not WT ($p = 0.69$) mice. This dysregulation is frequently observed in settings of cardiac hypertrophy and failure.

Conclusion: Reduced B55α expression did not cause adverse remodelling in the murine heart in the absence of pathological stimuli. However, reduced B55α exacerbated hypertrophic gene transcription in response to sustained β-adrenergic receptor stimulation, identifying B55α as a potential negative regulator of hypertrophic gene expression *in vivo.*

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Cardiac Biopsies Without Mass Spectrometry is Inaccurate in Differentiating Between Transthyretin (ATTR) and Light Chain (AL) Cardiac Amyloidosis

B. Choi[1,2,*], J. Hare[1,2,3], D. Kaye[1,2,3]

[1] *Alfred Health, Melbourne, Australia*
[2] *Monash University, Clayton, Australia*
[3] *Baker Heart and Diabetes Institute, Melbourne, Australia*

Background: Incidence of cardiac amyloidosis (CA) is increasing with advancements in imaging technologies, particularly with cardiac magnetic resonance imaging (CMR) and nuclear bone scan. Historically, cardiac biopsy is the gold standard for diagnosing CA and indicated when there is suspicion on clinical features and imaging. However, mass spectrometry is required for differentiating between ATTR and AL. Mass spectrometry is commonly not performed due to cost and limited availability. We describe the limitations of cardiac biopsies without mass spectrometry in subtyping.

Methods: All patients diagnosed with CA at Alfred Health between 2007 and 2018 were identified. Clinicopathological data and investigative results were retrospectively collected.

Results: 70 patients with CA were identified with a mean age of 66 years. 73% were male. ATTR and AL were diagnosed in 36% and 64% of patients, respectively. Cardiac biopsies were performed in 40 patients of which only 30% of these underwent mass spectrometry for further analysis to differentiate between ATTR and AL. Due to a lack of further confirmation with mass spectrometry, 21% of AL patients were misdiagnosed as ATTR on cardiac biopsies. 20% of patients with ATTR had monoclonal gammopathy with undetermined significance (MGUS).

Conclusion: Differentiating the subtype of CA on cardiac biopsies is inaccurate without mass spectrometry, which may lead to misdiagnoses, inappropriate management and poorer outcomes. With the combined poor availability of mass spectrometry and high percentage of ATTR patients with MGUS, investigations such as nuclear bone scan may provide an accurate and readily accessible alternative for differentiating between ATTR and AL.

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Cardiac Magnetic Resonance Imaging and Position Emission Tomography in the Evaluation of Patients with Suspected Cardiac Sarcoidosis: A Single Centre Experience

J. Phan [1,2,*], N. Kerr [1,3], B. Walker [1,2], R. Subbiah [1,2,3]

[1] *St Vincent's Hospital Sydney, Darlinghurst, Australia*
[2] *University of New South Wales, Sydney, Australia*
[3] *Victor Chang Cardiac Research Institute, Sydney, Australia*

Background: Current diagnostic criteria for cardiac sarcoidosis (CS) require histological confirmation from either cardiac or extracardiac specimens. Cardiac magnetic resonance imaging (CMR) and F18-fluorodeoxyglucose positron emission tomography (FDG-PET) are increasingly used to facilitate a non-invasive diagnosis of CS. We sought to compare CMR and cardiac PET findings in patients with suspected CS.

Methods: We performed a retrospective review of patients undergoing CMR and cardiac PET for suspected CS between 2011 and 2017. Standard CMR parameters were recorded, including the presence of myocardial oedema based on T2-weighted sequences and late gadolinium enhancement (LGE). Perfusion defects and FDG uptake were recorded in all patients undergoing cardiac PET. Patients were categorised as probable cardiac sarcoidosis according to the Heart Rhythm Society (HRS) guideline.

Results: 52 patients were included in the study. 7 patients (13%) met the HRS criteria for probable cardiac sarcoidosis. 36 patients (69%) had LGE on CMR. 11 patients (21%) had myocardial oedema on CMR, all of whom also had LGE. 14 patients had positive findings on FDG-PET. 4/11 patients (36%) with myocardial oedema on CMR had positive findings on FDG-PET. 24/36 patients (67%) with LGE on CMR had normal PET findings. 2/14 patients (14%) with positive PET findings had no LGE on CMR. All patients who met HRS criteria for probable cardiac sarcoidosis had an abnormality on CMR or FDG-PET.

Conclusion: CMR and cardiac FDG-PET may produce discordant findings in patients with suspected CS. There may be a role in performing both investigations in patients with suspected CS.

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Cardiomyocyte ErbB4 Receptors are Essential for Developmental Hypertrophy and Growth in Neonatal Mice and Maintenance of Cardiac Function in Adult Hearts

M. Reichelt [1,*], Z. Wang [2], T. Paravicini [3], Z. Lu [1], L. Walheim [1], W. Thomas [1]

[1] *University of Queensland, St Lucia, Australia*
[2] *University of California, Davis, USA*
[3] *RMIT, Bundoora, Australia*

Activation of ErbB4 by neuregulin 1 (NRG1) promotes cardiomyocyte hypertrophy and proliferation in mice, while deletion of ErbB4 from cardiomyocytes mid-gestation results in development of dilated cardiomyopathy and reduced survival. However, the role of ErbB4 in the heart after maturation remained unknown. Thus, we deleted ErbB4 in αMHC-MerCreMer (cCre Tg+/)/ErbB4 homozygote floxed (ErbB4 fl/fl) mice at ~2 months of age with 10 injections of tamoxifen (20 mg/kg/day). Contractile function was reduced *in vivo* (echocardiography, 16%) and *ex vivo* (isolated-perfused, 33%) 3 months after gene deletion, while survival in mice up to 8 months after tamoxifen treatment was not modified. We next evaluated the role of ErbB4 in response to physiological and pathological hypertrophic stressors. Cardiomyocyte ErbB4 deletion in adults did not modify cardiac enlargement in response to Angiotensin II (1000 ng/kg/min, 14 days) or exercise (twice daily swimming for up to 90 min). Taken together, this suggested that ErbB4 was not essential for survival and adaptation in the adult heart, pointing instead towards a critical window for ErbB4 in neonatal heart development. To test this hypothesis, ErbB4ff and ErbB4ww neonates were injected at P1 with AAV9-cTNT-eGFP-iCre and culled at P6. We confirmed the presence of iCre mRNA, and suppression of ErbB4 in ErbB4 ff/ff mice, coincident with increased NRG1α, and reduced body and ventricular weights. By day 28, a number of hearts showed evidence of dilated cardiomyopathy. Thus, ErbB4 is critical to cardiac hypertrophy and growth in neonatal mice, and maintains adult heart function.

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Cardiovascular Outcomes in Patients with Abnormal Global Left Ventricular Contractile Response on Exercise Stress Echocardiogram

P. Thein [*], S. Dodic, S. Nicholls, J. Cameron, S. Moir, P. Mottram, A. Nasis

MonashHeart and Monash Cardiovascular Research Centre, Monash Health and Monash University, Melbourne, Australia

Background: Failure to increase left ventricular ejection fraction (LVEF) post-exercise may be seen in the absence of established causes in patients with suspected obstructive coronary artery disease (OCAD) investigated with exercise

stress echocardiography. This is associated with long-axis left ventricular dysfunction, however, cardiovascular outcomes of patients with such an abnormal contractile response are unknown.

Aim: To determine long-term major adverse cardiovascular events in patients with failure to increase LVEF post-exercise.

Methods: Amongst 1275 patients with suspected obstructive coronary artery disease (OCAD) undergoing both exercise stress echocardiography and anatomic coronary imaging, failure to increase LVEF post-exercise was observed in 138 (11%) patients in the absence of established causes. The primary endpoint was defined as major adverse cardiovascular events (MACE: composite endpoint of cardiac mortality, acute myocardial infarction, new heart failure, life threatening ventricular arrhythmias, coronary artery revascularisation and stroke) at 5-year follow-up.

Results: Twenty-eight percent experienced MACE (53% with OCAD). Patients in MACE group, compared to those without MACE, were older (72 ± 7 vs. 62 ± 10 years, $P < 0.0001$), predominantly male (47% vs. 24%, $P = 0.016$), and had higher prevalence of hypertension (90% vs. 61%, $P = 0.003$); diabetes (37% vs. 20%, $P = 0.06$) and dyslipidemia (60% vs. 42%, $P = 0.09$). On multivariate analysis, older age (OR = 1.12, 95% CI = 1.06–1.20, $P < 0.0001$) and hypertension (OR = 4.5, 1.16–17.5, $P = 0.03$), but not OCAD (OR = 1.25, 0.48–3.26, $P = 0.647$) were independent predictors of MACE.

Conclusion: Patients with failure to increase LVEF post-exercise have a high incidence of MACE at 5-year follow-up. Older age and hypertension predicts MACE in this population independent of coronary anatomy. The study indicates that the clinical trajectory of patients with this abnormal response is not benign and warrants long-term surveillance.

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072

Cardiovascular Risk Factors Over the Life Course as Determinants of Subclinical Myocardial Disease

Q. Huynh[1,*], A. Venn[2], C. Magnussen[2], T. Marwick[1]

[1] *Baker Heart And Diabetes Institute, Melbourne, Australia*
[2] *Menzies Institute for Medical Research, Hobart, Australia*

Background: This study investigated the association of markers of subclinical myocardial disease with cardiorespiratory fitness (CRF), body mass index (BMI) and mean arterial pressure (MAP) across the life-course.

Methods: This study followed 562 schoolchildren (aged 7–15 years in 1985) and followed them into adulthood (aged 26–36 years during 2004–06 and 39–49 years during 2017–19). CRF, BMI and MAP were measured at baseline and follow-up. Echocardiogram was used to detect abnormal global longitudinal strain (GLS>−18% in 102/562 participants), left ventricular hypertrophy (LVH in 55/562), left atrial enlargement (LAE in 268/562) and increased LV filling pressure (E/e'>8 in 32/562) at the latest follow-up.

Results: Current physical measurements were generally stronger than previous measurements in predicting myocardial function and structure. Abnormal GLS was associated with childhood CRF (OR = 0.77 [0.62, 0.96]) independently of adult CRF. While the association of abnormal GLS with BMI was influenced primarily by the most current BMI, its association with MAP appeared to be similar over the life-course. Dilated LA was associated with childhood CRF (OR = 1.32 [1.08, 1.60]) independently of adult CRF, and was not associated with BMI or MAP in either childhood or adulthood. The associations of LVH with CRF, BMI and MAP were primarily dependent on current rather than earlier CRF, BMI and MAP. LV filling pressure was not associated with any childhood measurements but was associated with current BMI and MAP.

Conclusions: Different aspects of myocardial physiology appear to have different associations over the lifecycle, supporting the concept of different phenotypes of asymptomatic myocardial disease.

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073

Characterisation of Cardiac Neurohormonal and Inflammatory Changes Induced by Brain Death in a Novel Ovine Heart Transplant Model

L. See Hoe[1,*], T. Shuker[1], N. Bartnikowski[1], M. Passmore[1], M. Bouquet[1], N. Obonyo[1], S. Engkilde-Pedersen[1], C. McDonald[1], M. Wells[1], A. Boon[1], K. Hyslop[1], L. James[4], K. Wildi[1], L. Cullen[1,3], G. Li Bassi[1], J. Suen[1], D. McGiffin[2], J. Fraser[1]

[1] *Critical Care Research Group, University of Queensland, Brisbane, Australia*
[2] *The Alfred Hospital, Melbourne, Australia*
[3] *Royal Brisbane and Women's Hospital, Brisbane, Australia*
[4] *Princess Alexandra Hospital, Brisbane, Australia*

Heart transplantation (HTx) from brain dead (BD) donors is the current gold-standard treatment for end-stage heart failure. Our understanding of BD pathophysiology in the donor, and resultant effects upon the HTx recipient, is limited. We sought to determine the temporal inflammatory and cardiac neurohormonal patterns in BD donors, and recipients post-HTx.

Twenty-four female merino cross sheep (12 donors, 12 matched recipients, $n = 6$/group, BD vs. Sham) were anaesthetised, intubated and haemodynamically monitored. Donor sheep underwent BD or sham instrumentation, and were monitored for 24 hrs. Donor hearts were then flushed with cold St Thomas cardioplegia, excised and preserved on ice for ~2 hrs. Standard orthotopic HTx was performed, the recipient weaned off bypass, and monitored for up to 6 hrs. Blood samples were collected at regular intervals in the donor and recipient, and assayed for inflammatory cytokines (IL-6, IL-8, IL-1beta, IL-10, TNFalpha) and cardiac markers (troponin I, ANP and BNP).

Brain death in donors induced transient increases in pro-inflammatory IL-6 and IL-8, and cardiac markers troponin I (cTnI), ANP, and BNP. However, these changes normalised by 24 hrs, and were comparable to Sham at 24 hrs. Post-HTx, IL-6 and cTnI increased, but no differences in biomarkers were observed between groups in recipients.

A distinct BD-mediated pathophysiological profile in donors was evident, with normalisation of biomarkers over 24 hrs. Normalisation of BD-induced inflammation was critical to enable successful transplantation of BD ovine hearts. Extended recovery of the BD donor heart may assist strategies targeting heart preservation, HTx and reperfusion to positively impact cardiac function post-HTx.

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074

Characterisation of Heart Failure Patients with Reduced Ejection Fraction: The GenesisCare Heart Failure Clinic Experience

S. Delacroix*, P. Srivastava, R. Hamilton, J. McGillion, S. Kim, M. Duong, D. Eccleston, L. Kearney

Genesiscare, Leabrook, Australia

Introduction: Heart failure (HF) registries and clinics play an important role in describing the clinical epidemiology of patients and, are pivotal in assessing adherence with evidence-based HF management guidelines in real world patients.

Methods: We present the baseline biological and clinical characteristics of patients with HF and reduced ejection fraction (HFREF) and the clinical outcomes achieved (all-cause mortality [ACM] or HF hospitalisation) within the GenesisCare Heart Failure Management Clinics (GC-HFMC). GC-HFMCs are a HF specialist led, nurse-facilitated model providing comprehensive pharmacological and non-pharmacological management, HF education and a HF nurse support service.

Results: The cohort ($n = 516$) was predominantly male (69%) with mean age 73 ± 12 years, median LVEF of 33% (IQR 25,40) and NYHA class II (59%) and III (23%). Community referrals accounted for 82% of patients, with 18% referred post hospitalisation. There was a high incidence of comorbidities, such as dyslipidaemia (66%), hypertension (65%), arrhythmia (61%), chronic renal failure (37%), myocardial infarction (30%), diabetes (30%), airway disease (25%) and anaemia (20%). Medication utilisation at baseline included BB (83%), ACEI/ARB/ARNI (78%) and diuretics (76%) with MRA being (44%). HF device utilisation was CRT-P (18%), CRT-D (8%) and ICD (19%). Fluid and salt restriction was advised for 79% and 93% of patients, respectively. Net promoter score >80% indicates high level of patient satisfaction at the Clinic. At one year, the combined end point of ACM or HF hospitalisation occurred in 13%, with ACM occurring in 7%.

Conclusions: The findings demonstrate the positive impact of documented registries and of nurse-facilitated GC-HFMCs that not only provide evidence-based care, but also a support-ive follow-up service resulting in low rates of hospitalisation and mortality.

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075

Characteristics and Outcomes After Index Heart Failure Admission to Hunter New England LHD by Speciality of Admission

M. Al-Omary [1,2,3,*], S. Sugito [1], H. Al-Khalil [1], T. Senanayake [1], C. Robson [1], A. Boyle [1,2,3], A. Sverdlov [1,2,3]

[1] *Cardiovascular Department, John Hunter Hospital, New Lambton Heights 2305, Australia*
[2] *Hunter Medical Research Institute, New Lambton Heights 2305, Australia*
[3] *School of Medicine and Public Health/The University of Newcastle, Callaghan 2308, Australia*

Background: Patients with heart failure (HF) are frequently admitted under various medical teams as well as under cardiology. Their relative characteristics and outcomes have not been evaluated in our LHD.

Aim: To compare characteristics and outcomes of HF patients admitted under cardiology versus other medical units (OMU).

Methods: We identified all index HF hospitalisations in 2014 at Tamworth and John Hunter Hospitals in NSW using ICD10 I50 code in the first four diagnoses. Data on admitting unit, patients' characteristics and outcomes were extracted.

Results: 249 patients were admitted under cardiology while 388 patients were under OMU. HFrEF accounted for 30%, HFpEF for 39%; remaining 31% did not have echocardiography. Patients under OMU were older (median age of 78 vs 81 years, $P < 0.001$) and had longer hospitalisation (median 5 vs 6 days, $P = 0.023$). Ischaemic heart disease was the commonest co-morbidity in cardiology-admitted patients, while chronic kidney disease and chronic respiratory disease were more prevalent in OMU-admitted HF patients. Main precipitants of HF admission were arrhythmia (27%) and cardiac ischaemia (32%) in patients under cardiology, while infection (39%) was the main cause in OMU-admitted patients. ACEi/ARB (67 vs 49%), B-Blocker (80 vs 55%), aldosterone antagonists (44 vs 17%) were prescribed more in cardiology-admitted patients ($P < 0.001$). 1-year outcomes in cardiology-admitted vs OMU-admitted patients were: mortality (19 vs 35%, $P < 0.001$), all-cause readmission (54 vs 51%, NS) and cardiovascular readmission (49 vs 30%, $P < 0.001$).

Conclusion: HF patients admitted under OMU were older, had more co-morbidities and less guideline-directed therapy utilisation, which might explain worse outcomes.

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076

Characteristics, Management and Outcomes of Patients after an Index Heart Failure Admission

E. Mahmoodi*, M. Al-Omary, M. Lycett, S. Sugito, T. Williams, A. Sverdlov

Department of Cardiovascular Medicine, John Hunter Hospital, Newcastle, Australia

Background: Heart failure (HF) is a worldwide health problem and it is associated with substantial in-hospital and post-discharge mortality, as well as high rates of readmission.

Aims: To describe patient characteristics, management and outcomes after index HF hospitalisation.

Methods: We extracted all index HF admissions to John Hunter and Belmont hospitals in 2014, with an ICD I50 code as a principal diagnosis.

Results: 289 patients were identified, 20% had HFrEF (EF <50%), 28% had HFpEF (EF ≥50%) and 51% did not have an inpatient echocardiography. The aetiology for acute decompensation of HF was arrhythmia (24%), infection (18%), ischaemia (9%), non-adherence (6%) and 42% had no identifiable cause. The most common comorbidities were hypertension (75%), chronic kidney disease (45%), ischaemic heart disease (43%), and atrial fibrillation/flutter (43%). Of 289 patients, 46% had iron studies and 68% of those had iron deficiency anaemia. On admission, 52% of the patients were on ACEi/ARB, β-blocker and loop diuretics, respectively, 12% were on mineralocorticoid receptor (MRA) antagonists, and 6% on thiazide diuretics. At discharge, prescription of all HF medications was higher compared to the admission: loop diuretics (82%), β-blocker (67%), ACEi/ARB (63%), and MRA (34%) ($P < 0.001$). 1-year all-cause mortality was 28%, 1-year all-cause readmission was 55% and 1-year HF readmission rate was 26%.

Conclusion: HF patients have multiple comorbidities and precipitants of HF decompensation. Index HF hospitalisation, irrespective of HF aetiology, was associated with significant 1-year morbidity and mortality despite prescription of guideline-directed HF therapies during that admission.

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077

Clinical Outcomes for Patients with Left Ventricular Non-Compaction

G. Femia*, P. Choudhary, D. Zhu, S. Barratt Ross, C. Semsarian, R. Puranik

University of Sydney, Sydney, Australia

Background: Left ventricular non-compaction (LVNC) is characterised by prominent LV trabeculae. The diagnosis is based on clinical and morphologic criteria but remains difficult without a gold standard. The most commonly used CMR criteria defines LVNC as an end-diastolic non-compacted to compacted ratio of >2.3 (Peterson, 2005).

Methods/results: Between 2008 and 2015 we clinically followed up 100 patients with an average age of 45.5 ± 3.5 years (59 males) that satisfied the Peterson criteria. The average follow-up time was 75 ± 23 months. Amongst this group, 69 patients had normal LV systolic function and 31 had abnormal LV systolic dysfunction (LVEF <55%). We evaluated the CMR scans for LV wall thickness, NC location, maximal NC/C ratio and scar. We then followed up all patients for ICD insertion, shock and death; Table. Comparing the two groups, there was no statistically significant difference in LV wall thickness, NC/C ratio or NC location; however, the LV dysfunction group had a higher incidence of scar ($p = 0.0033$). ICDs and death were also higher in the LV dysfunction group (RR = 3.39, 95% CI 1.31 to 8.56 $p = 0.0141$ and RR = 30.3, 95% CI 1.76 to 521.47, $p = 0.0006$, respectively).

	Normal LVEF (N = 69)	Abnormal LVEF (N = 31)	P value
Gender, Male, *n*	41 (59.4%)	18 (58.1%)	
LVEF, %	64.6 ± 6.1	45.2 ± 9.6	0.0001
Age, years	44.8 ± 15.1	47 ± 21.2	0.7648
Referred for VT	4	4	0.2492
LV wall thickness, mm	8.2 ± 2.4	8.5 ± 1.9	0.8419
NC/C ratio	4.11 ± 0.53	4.02 ± 0.49	0.7912
Isolated apical NC	30 (43.4%)	9 (29.0%)	0.1869
Scar	3 (4.3%)	8 (26.2%)	0.0033
ICD	6 (8.7%)	9 (29.1%)	0.0141
Recorded VT/Shock	1 (1.5%)	1 (3.2%)	1.0000
Death	0	6 (19.4%)	0.0006

Conclusion: In patients with LVNC, the risk of ICD and death is significantly higher in those with LV dysfunction irrespective of NC/C ratio, location of NC and scar.

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078

Cost Consequence Analysis for Optimising Medical Therapy in an Australian Heart Failure with Reduced Ejection Fraction (HFrEF) Cohort

R. Chatterjee*, D. Drak

University of Sydney, Sydney, Australia

Heart failure poses a substantive economic burden on the Australian healthcare system, with known underutilisation of evidence-based pharmacotherapy. Herewith, we estimate the annual cost of optimising pharmacotherapy for heart failure with reduced ejection fraction (HFrEF) in an Australian adult cohort across 6 metropolitan hospitals in NSW.

This retrospective cohort study applied best available data to determine the relative risk reduction in mortality and heart failure-related rehospitalisation for guideline-based medical therapies (Beta-blockers, ACE-Inhibitors, Neprilysin Inhibitors, Diuretics, Aldosterone Antagonists and Ivabradine). Our cohort comprised ≈ 26% of annual heart failure

admissions across NSW, of which 815 met inclusion criteria for HFrEF.

Cost estimates were calculated from the Pharmaceutical Benefits Scheme (PBS) data for the cheapest agent within a drug class. The cost of hospital admission for heart failure was estimated using The National Efficient Price (NEP) 2018 calculator issued by the Independent Hospital Pricing Authority (IHPA) in Australia.

Of the 815 patients that met inclusion criteria for hospital admission due to HFrEF, the annual rate of readmission for heart failure was 52%, with all cause mortality rate being 14%. We found a 77% average reduction in mortality benefit and a 71% average increase in rehospitalisation due to suboptimal pharmacotherapy. In our cohort, 28 deaths and 123 rehospitalisations could have been prevented by pharmacotherapy optimisation. The annual cost per patient of optimising pharmacotherapy was $135.35, resulting in a total projected cost of $303387.48 to optimise HFrEF pharmacotherapy across NSW.

The gap in optimal pharmacotherapy prescription for heart failure is a major contributing factor to hospital readmission, thus posing a significant economic burden to the NSW healthcare system. More comprehensive Australia-specific cost-benefit analyses including recommended device therapies will better elucidate this major public health burden.

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079

Decline in Left Ventricular Ejection Fraction in Patients Undergoing Pacemaker Implantation

H. Thakkar [1,*], K. Negishi [1,2], J. Lipton [1]

[1] Royal Hobart Hospital, Hobart, Australia
[2] Menzies Institute of Research, Hobart, Australia

Background: RV pacing has been associated with impaired left ventricular function resulting in heart failure. Prediction of patients susceptible to this condition is important as implantation of an LV lead may prevent it.

Aim: The aim of this study was to identify clinical, ECG and echocardiographic predictors of decrease in LV function in patients undergoing pacemaker implantation.

Methods: Retrospective analysis of 106 consecutive patients with preserved LVEF receiving a pacemaker at a tertiary hospital from 2010 to 2018 with follow up echo >6 months post implantation. We stratified the patients into groups based on tercile of LVEF change.

Results: Mean ± SD age was 72.7 ± 12.6 yrs; 34.9% were female; baseline mean LVEF was 58 ± 9%. Pacing indication was sinus node diseases (39%) or AV conduction diseases (61%). After a median (25–75 percentile) follow up of 3 (1–4) yrs, LVEF decreased by 8.4 ± 11.2%, ranging from +20%∼-4% (first tercile), -4∼-12% (second), and -12∼-45% (third).

Patients with greatest LVEF decrease ($n = 72$; 4–45% drop) were less likely to have atrial fibrillation/flutter pre-implant (49% vs 79%; $p = 0.003$), had a higher pre-implant LVEF (60% vs 54%; $p < 0.05$) than patients with LVEF being no change or increase ($n = 34$).

Pacing indication, baseline QRS width, RV lead position, and pacing burden did not significantly differ between groups.

Conclusion: LVEF reduction occurred in 73.6% of patients undergoing pacemaker implantation for bradycardia; standard clinical, ECG and echo parameters failed to identify this group.

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080

Defining the Characteristics of a More Clinically Relevant Mouse Model of Type-2 Diabetes (T2D)-Induced Cardiomyopathy

M. De Blasio [1,2,*], M. Tate [1,3], D. Prakoso [1,2], A. Willis [1], M. Deo [1], J. Walsh [1], C. Cohen [1], A. Rofe [1], S. Peng [1], C. Qin [1,3,5], H. Kiriazis [4], D. Donner [4], A. Watson [3], R. Ritchie [1,3,5]

[1] Heart Failure Pharmacology, Baker Heart And Diabetes Institute, Melbourne, Australia
[2] School of BioSciences, University of Melbourne, Melbourne, Australia
[3] Department of Diabetes, Central Clinical School, Monash University, Melbourne, Australia
[4] Preclinical Cardiology Microsurgery & Imaging Platform, Baker Heart and Diabetes Institute, Melbourne, Australia
[5] Department of Pharmacology and Therapeutics, University of Melbourne, Melbourne, Australia

Diabetes is associated with an increased risk of heart failure due to altered structure and function of the heart, commonly termed diabetic cardiomyopathy. Mice are the most widely utilised for experimental studies investigating diabetes, however most are genetic models of diabetes (e.g. *db/db*, *ob/ob*) and do not reflect the human condition due to their altered leptin signalling. We sought to characterise the altered cardiac, kidney and liver structure and function in a mouse model of T2D-induced cardiomyopathy incorporating low-dose streptozotocin (STZ) and high-fat diet.

Male 6-week-old FVB/N mice received three consecutive daily i.p. injections of STZ (55 mg/kg body weight) followed by 26 weeks of high-fat diet (42% energy from lipids, SF04-001, Speciality Feeds) to induce T2D. Non-diabetic (ND) mice received vehicle and normal chow diet. Blood glucose (fortnightly), Doppler and tissue Doppler echocardiography, body composition, plasma insulin, markers of myocardial, kidney and liver structure, remodelling and function, were assessed.

T2D mice had significantly increased weight and fat mass, exhibited increased blood glucose and plasma insulin, and albuminuria ($P < 0.05$ for all). Heart weight and left ventricular weight, as well as kidney weight were unaltered with T2D, however liver and spleen weights were significantly increased ($P < 0.05$). Markers of fibrosis (MMP9, PAI-1), hypertrophy (β-myosin heavy chain) and apoptosis p-P46 JNK) were increased in T2D hearts ($P < 0.05$ for all). At endpoint, there was clear evidence of diastolic dysfunction in terms of reduced E/A ratio and e′/a′ ratio, and prolonged deceleration time and IVRT ($P < 0.05$ for all). In the kidney,

mesangial area and collagen IV gene expression were increased with T2D ($P < 0.05$). In the liver, plasma markers of liver function (ALT, AST), expression of ProCol3, NAFLD activity score and steatosis grade were all increased with diabetes ($P < 0.05$ for all).

This study reveals that the combination of low-dose STZ and high-fat diet mimics several clinical features of T2D, and importantly, produces robust diastolic dysfunction at 26 weeks which is a characteristic of patients with T2D-induced cardiomyopathy.

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081

Device Therapy Optimisation in Patients with Heart Failure with Reduced Ejection Fraction: Single Centre Analysis

S. Nandal[1,*], U. Mohamed[1], W. Van Gaal[1,2]

[1] The Northern Hospital, Epping, Australia
[2] The University of Melbourne, Melbourne, Australia

Device therapy has emerged as standard of care in patients with heart failure with reduced ejection fraction (HFrEF). The aim of this study was to assess uptake of device therapy in HFrEF patients in a real-life patient cohort.

We included 127 patients who were commenced on Entresto from 1st January 2017 to 31st July 2018 at a tertiary centre in Melbourne, Victoria who were already on optimal heart failure therapy. The mean ejection fraction was 30% ($\pm$9%). 58 patients already had devices (CRT or ICD) in situ at the time of commencement of Sacubitril/Valsartan. 78 patients in the cohort met indications for new or upgrade of their device therapy according to recommendations from Australian guidelines. 7 patients were excluded from device based therapies due to death, refusal or already being worked up. There were 23 patients who met recommendation for Cardiac Resynchronisation Therapy (CRT). Of these, 13 patients met strong recommendation for high quality of evidence for CRT, 6 met strong recommendation for moderate quality of evidence and 4 met weak recommendation. 27 patients met criteria for implantable cardioverter defibrillator (ICD) as a primary prevention indication with HFrEF associated with ischaemic cardiomyopathy and 21 patients with non-ischaemic cardiomyopathy.

CRT/ICD recommendation
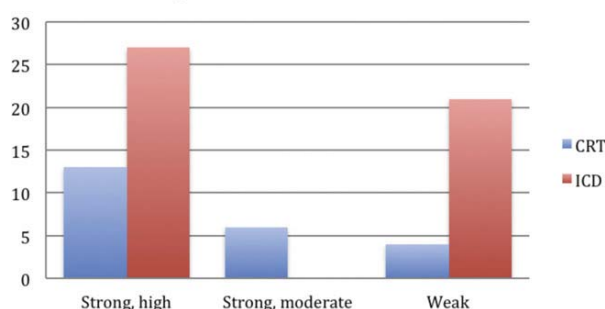
Our study highlights the gap in device optimisation in an already treated population with a high percentage of device-based therapy and the need for ongoing education in both hospital and community setting.

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082

Direct Oral Anticoagulants for Left Ventricular Thrombus

S. Conte*, K. Jones, N. Molan, C. Holloway

St Vincent's Hospital Sydney, Darlinghurst, Australia

Background: Left ventricular thrombus (LVT) is serious complication of myocardial hypokinesis resulting from acute myocardial infarction, aneurysms, or cardiomyopathic processes. LVT portends an increased morbidity and mortality due to thromboembolic sequelae. Current guidelines recommend warfarin for treatment of LVT and prevention of embolic complications. Direct oral anticoagulants (DOACs) including rivaroxaban have exploded in popularity in the last decade and are now more frequently prescribed than warfarin.

Methods: A best evidence topic was written addressing the question "is left ventricular thrombus amenable to management with direct acting oral anticoagulants in terms of efficacy and safety outcomes?" Altogether, 27 papers describing 52 cases were found searching Medline, Embase, and Pubmed databases from 2014 to February 2019, which represented the best evidence to answer the clinical question.

Results: Of the 52 cases described, DOAC thearpy resulted in LVT resolution in 88%. Rivaroxaban was the most commonly used agent (40%). Duration of therapy ranged from 1–12 months most commonly three months. Low-dose regimens were more common than standard-dose regimens owing to the co-administration of dual antiplatelet therapy in 58%. The rate of serious bleeding complications was low, occurring in only two patients (3.8%).

Conclusions: We conclude that while data surrounding use of DOACs in the treatment and prevention of LVT are limited to case series, they appear to be highly efficacious. Randomised data is needed to demonstrate clear noninferiority to warfarin as well as optimum dosing and during of DOAC therapy for treatment of LVT prior to changing guideline recommendations.

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083

Early Treatment of Pulmonary Arterial Hypertension: Is a PVR > 3 Threshold too High?

S. Ratwatte[1,2,*], G. Strange[3,4], C. Corrigan[5], E. Kotlyar[5], F. Kermeen[6], T. Williams[7], D. Celermajer[2,9], N. Dwyer[8], H. Whitford[7], J. Wrobel[3,10], J. Feenstra[6], M. Lavendar[10], K. Whyte[11], N. Collins[12], P. Steele[13], S. Proudman[14], V. Thakkar[15], D. Keating[7], A. Keogh[5], E. Lau[2,9]

[1] *Concord Repatrician General Hospital, Concord, Australia*
[2] *Royal Prince Alfred Hospital, Camperdown, Australia*
[3] *Pulmonary hypertension Society of Australia and New Zealand*
[4] *School of Medicine, University of Notre Dame, Freemantle, Australia*
[5] *Heart Transplant Unit, St Vincent's Hospital, Darlinghurst, Australia*
[6] *Queensland Lung Transplant Service, Prince Charles Hospital, Chermside, Australia*
[7] *Department of Allergy, Immunology and Respiratory Medicine, The Alfred Hospital, Melbourne, Australia*
[8] *Department of Cardiology, Royal Hobart Hospital, Hobart, Australia*
[9] *University of Sydney, Sydney, Australia*
[10] *Advanced Lung Disease Unit, Fiona Stanley Hospital, Murdoch, Australia*
[11] *Greenlane Clinical Centre, Auckland City Hospital, Auckland, Australia*
[12] *Department of Cardiology, John Hunter Hospital, Newcastle, Australia*
[13] *Department of Cardiology, Royal Adelaide Hospital, Adelaide, Australia*
[14] *Rheumatology Unit, Royal Adelaide Hospital, Adelaide, Australia*
[15] *Department of Rheumatology, Liverpool Hospital, Liverpool, Australia*

Introduction: A pulmonary vascular resistance (PVR) criterion of >3 Wu was introduced into the haemodynamic definition of pulmonary arterial hypertension (PAH) in 2013. Lower levels of PVR can be abnormal, particularly in the younger population. There is limited data on the natural history and response to PAH therapy in patients with precapillary pulmonary hypertension with PVR <3 Wu.

Methods: Using the PHSANZ registry, we analysed outcomes of all patients fulfilling the haemodynamic criteria: mPAP $\geq$25 mmHg, PAWP $\leq$15 mmHg and PVR <3 Wu. Patients with left-to-right cardiac shunts, chronic liver, lung, and left heart disease were excluded.

Results: 82 patients (mean age 63 ± 11 years, 82% female) were included. Underlying diagnosis included idiopathic ($n = 39$), connective tissue disease ($n = 42$) and HIV infection ($n = 1$). At diagnosis, haemodynamics showed mPAP 28 ± 4 mmHg, PAWP 12 ± 2 mmHg and PVR 2.3 ± 0.5 Wu. Baseline exercise capacity revealed mean 6MWD of 341 ± 124 m with 77% in NYHA FC 3/4. All patients were commenced on initial monotherapy with endothelin receptor antagonists ($n = 66$) or phosphodiesterase type 5 inhibitors ($n = 16$). At first post-treatment evaluation (median 5 months; IQR 4-12), 6MWD increased by 46 m (IQR 7-96) and 35% demonstrated improvement in NYHA FC status. After a median follow-up of 65 months (IQR 32-101), 22% were deceased, with estimated 1-yr, 3-yr and 5-yr survivals of 98%, 88%, 84%, respectively.

Conclusions: Our data suggest that selected patients with precapillary PH with PVR <3 Wu may benefit from PAH therapy. Further studies are needed to determine whether early treatment of these patients confers beneficial impact on exercise capacity and outcomes.

084

Echocardiographic Outcomes of MitraClip[TM] Repair for Patients with Severe Mitral Regurgitation and Pre-Existing Left Ventricular Dysfunction

S. Hungerford[1,2,3,*], N. Bart[1,2], S. Emmanuel[1,2,3], V. Shah[1], C. Hayward[1,2,3], D. Muller[1,2,3]

[1] *St Vincent's Hospital, Sydney, Australia*
[2] *University of New South Wales, Sydney, Australia*
[3] *Victor Chang Cardiac Research Institute, Sydney, Australia*

Mitraclip[TM] repair has been shown to improve clinical outcomes in patients with severe mitral regurgitation (MR) and prohibitive surgical risk. Echocardiographic (TTE) outcomes, particularly with regards to the right ventricle (RV), following MitraClip[TM] repair in patients with pre-existing left ventricular dysfunction (LVD) (LV ejection fraction [EF] $\leq$55%) are less well established.

Objectives: To examine the short- and intermediate-term echocardiographic outcomes of MitraClip[TM] repair in patients with pre-existing LVD.

Methods: This is a single-centre, retrospective, observational cohort study of patients with LVEF $\leq$55% who underwent of MitraClip[TM] repair between November 2011–November 2018. Baseline and post-operative TTE's (day 1; 3 months) were analysed by two-blinded investigators (Epsilon Imaging®) for: LVEF; LV end-diastolic and end-systolic volumes (LVEDV/LVESV); MR; RV fractional area change (FAC); RV free wall longitudinal strain (FWLS); pulmonary artery systolic pressure (PASP); tricuspid regurgitation (TR); tricuspid annular plane systolic excursion (TAPSE), and; RVS'.

Results: 50 patients (age 80 ± 9 years; 32 men) with pre-existing LVD and grade 3–4 MR underwent MitraClip[TM] repair. MR aetiology was primary in 50% of patients, and secondary/mixed in 50%. At 3-months, $\leq$1+MR was achieved in 71% of patients. 10% had residual MR $\geq$3+. Overall there was no significant reduction in LVEDV/LVESV or improvement in LVEF. There was no significant improvement in RVFAC, RVFWLS, RVS', TAPSE or PASP at day-1 or 3-months.

Conclusions: Whilst MitraClip[TM] repair is an effective therapy for the reduction of MR in patients with pre-existing LVD, in this cohort, there was no immediate or short-term reduction in LVEDV/LVESV or improvement in bi-ventricular function.

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085

Endomyocardial Biopsy at Auckland City Hospital: a 5 Year Audit – Safety and Clinical Utility

M. Stubbs *, P. Ruygrok

Auckland District Health Board, Auckland, New Zealand

Background: Endomyocardial biopsy (EMB) is a specialised procedure essential for diagnosis of specific myocardial disorders. Despite a low complication rate, utilisation remains variable. We aim to enrich the available evidence on utility of EMB in a post cardiac transplant rejection surveillance (PTS) and diagnostic setting.

Methods: EMB results from 01 January 2013–31 December 2017 were obtained from Labplus Auckland City Hospital. EMB results and electronic clinical records were reviewed and two cohorts established – PTS and diagnostic. Baseline characteristics, complications and results were reviewed.

Results: Over the audit period 1137 EMBs were performed on 181 patients, 1030 (75 patients) for PTS and 107 (106 patients) diagnostic. In the former group mean age was 42.1 years, 54 males, 21 females; with 790/1030 (76.7%) EMB's performed as an outpatient. In the diagnostic group all patients had abnormal cardiac biomarkers/imaging studies pre-EMB. Their mean age was 51.4 years (<1 year to 85 years), 67 males, 40 females; 75 EMBs (70.1%) were abnormal. A specific histologic diagnosis was made in 35 (32.7%) biopsies. "Non-specific myocyte hypertrophy" and "interstitial fibrosis" were the most common findings in histologically abnormal, but non-diagnostic samples. Cardiac amyloidosis was the most common diagnostic histologic abnormality (19.6%, or 42.0% if referred for undifferentiated infiltrative disease), followed by myocarditis (10/107) and sarcoidosis (3/107). One major complication was reported in the diagnostic group.

Conclusions: Our local EMB experience supports its productive and safe use in a specialist centre, particularly with respect to investigation of suspected infiltrative disease and post cardiac transplant rejection surveillance**.**

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086

Evidence for Significance of Serine 1487 in Beta-Adrenergic Regulation of Cav1.2 Subunit Function

H. Cserne Szappanos [1,*], L. Hool [1,2]

[1] *School of Human Sciences, The University of Western Australia, Crawley, Australia*
[2] *Victor Chang Cardiac Research Institute, Sydney, Australia*

Stress responses are mediated through activation of the β-adrenergic signalling pathway. Chronic sympathetic stimulation can result in the development of hypertrophy, arrhythmia and sudden cardiac death but the molecular mechanisms are still not understood.

We identified a single serine, following phosphorylation by cAMP-dependent protein kinase A, responsible for the increase in function of the human cardiac Cav1.2 channel protein in artificial cells. To confirm whether the serine is involved in in vivo channel stimulation by β-adrenergic signalling, we created CRISPR/Cas9 mutant mouse lines with glutamate and alanine-substitution of the serine1487 on Cav1.2 protein to mimic the phosphorylated and the non-phosphorylated protein.

The size of the litters (6.7 ± 0.7; $N = 16$ and 6.1 ± 0.4; $N = 24$ respectively) and survival rate (48.6% vs 42.5%) were similar in the two lines, but homozygous mutation of Cav1.2 S1487E caused 100% mortality with a median survival of 1 day. The relative size of the hearts of homozygous S1487A mice were smaller than S1487E (heart weight/tibial length: 7.0 ± 0.1; $N = 3$ vs 7.8 ± 0.3; $N = 3$).

Administration of intraperitoneal injection of 20 mg/kg isoproterenol increased the heart rate up to 30% in both glutamate and alanine-substituted heterozygous mutants in a similar manner to the negatively genotyped littermates, but it was no change for homozygous S1487A mutants. Chronic isoproterenol treatment (20 mg/kg isoproterenol daily injection for 2 weeks) induced hypertrophy in the wild type and heterozygous S1497A mutant mice, but not in homozygous S1487A mutants.

Our results demonstrate that serine1487 on Cav1.2 protein plays critical role in the β-adrenergic activation of the channel.

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087

Exaggerated Myocardial Torsion may Contribute to Dynamic Left Ventricular Outflow Tract Obstruction in Patients with Hypertrophic Cardiomyopathy

A. Lo [1,*], K. Guppy-Coles [1], A. Ng [2],
T. Mew [1], A. Dahiya [1], S. Prasad [1],
J. Atherton [1]

[1] *Royal Brisbane And Women's Hospital, Brisbane, Australia*
[2] *Princess Alexandra Hospital, Brisbane, Australia*

Background: Dynamic left ventricular outflow tract obstruction (LVOTO) is associated with symptoms and risk

of developing heart failure in hypertrophic cardiomyopathy (HCM). The association between LVOTO and LV torsional mechanics has not been well studied.

Aim: Compare standard echocardiographic measures and myocardial deformation in patients with HCM.

Methods: Echocardiography using GE Vivid 7/9 was performed in 172 patients with HCM, who were divided according to the absence (LVOTO-, $n = 108$) or presence (LVOTO+, $n = 64$) of LVOTO (peak pressure gradient >30 mmHg either at rest and/or with Valsalva manoeuvre).

Table 1. *Probability (Odds Ratio) with 95% CI and significance.*

	Odds Ratio	95% CI	P value
Peak torsion	1.11	1.02–1.20	0.016
E/e′ septum	1.21	1.09–1.33	<0.001
LVESD	0.84	0.76–0.92	<0.001
AMVLL	1.25	1.12–1.40	<0.001

Results: Patients with LVOTO were older with smaller LV end-systolic dimension (LVESD) and LV end-diastolic dimension, higher LV ejection fraction, longer anterior mitral valve leaflet length (AMVLL), higher early transmitral pulsed-wave to septal tissue Doppler velocity ratio (E/e′) and higher peak torsion. Using stepwise forward logistic regression, LVESD, AMVLL, E/e′ and peak torsion were independently associated with LVOTO (see Table 1). Peak torsion was similarly enhanced in patients with LVOTO manifest only during Valsalva (20.5 ± 5.0, $P = 0.005$) and patients with resting LVOTO (19.5 ± 7.9, $P = 0.009$) compared to patients without LVOTO (15.8 ± 6.3).

Conclusion: Peak torsion is independently associated with LVOTO in patients with HCM. Peak torsion was similarly exaggerated in patients with only latent LVOTO suggesting it may play a contributory role to LVOTO in HCM.

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Familial Dilated Cardiomyopathy – Enhancing Detection Using Systematic Screening

M. Stubbs *, J. Skinner, P. Ruygrok

Auckland District Health Board, Auckland, New Zealand

Background: Dilated cardiomyopathy (DCM) is the leading indication for heart transplantation in New Zealand (NZ). The familial subtype (FDCM) is aggressive, presents early, and is implicated in up to 50% of idiopathic DCM (IDCM). Diagnosis requires an affected individual having ≥2 affected close relatives. Adequate family pedigree analysis is diagnostically essential, and screening relatives is imperative as pre-symptomatic therapy improves outcomes. We utilised a validated family history survey to screen our NZ heart transplant population for FDCM more systematically.

Methods: Medical records of living heart transplant patients with IDCM or FDCM diagnoses (77/339 patients)

were reviewed. Patients were provided our survey via post/email and at clinic visits. We evaluated our 12 question clinical survey's efficacy in obtaining a complete three-generation family history and compared that to information documented in the medical records.

Results: Fifty-one (66%) surveys were returned. Complete family history was obtained in 47/51 (92.2%), compared with 10/51 (19.6%) specifically documented in medical records. Responders identified 16 relatives who were also referred for heart transplantation, or who died ≤50 years with cardiomyopathy.

The tool diagnosed FDCM in 25/51 (49.0%, with a further 3 possible FDCM), already yielding 6 additional patients not previously diagnosed. The mean age at first presentation of FDCM was 37 years (23 were male, 2 female), compared with 43 years in the IDCM group.

Conclusion: Utilising a formal family screening tool improves pedigree analysis ensuring more effective detection of FDCM, which is prevalent in the NZ transplant cohort. Formalised systematic screening has great potential to improve outcomes.

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Generation of Novel Cardiac Specific AAV Vectors by Directed Evolution in Human iPSC Derived Cardiomyocytes

C. Kok [1,2,*], S. Igoor [1], R. Skelton [1], J. Chong [1,2,3], D. Kimberley [4], M. Cabanes-Creus [5], I. Alexander [6,7], L. Lisowski [4,5,8], E. Kizana [1,2,3]

[1] *Center for Heart Research, Westmead Institute For Medical Research, Westmead, Australia*
[2] *Westmead Clinical School, Faculty of Medicine and Health, University of Sydney, Sydney, Australia*
[3] *Department of Cardiology, Westmead Hospital, Westmead, Australia*
[4] *Vector and Genome Engineering Facility, Children's Medical Research Institute, Westmead, Australia*
[5] *Translational Vectorology Group, Children's Medical Research Institute, Westmead, Australia*
[6] *Gene Therapy Research Unit, Children's Medical Research Institute, The University of Sydney, Faculty of Medicine and Health and Sydney Children's Hospitals Network, Westmead, Australia*
[7] *The University of Sydney, Sydney Medical School, Discipline of Child and Adolescent Health, Westmead, Australia*
[8] *Military Institute of Hygiene and Epidemiology, The Biological Threats Identification and Countermeasure Centre, Pulawy, Poland*

Recombinant adeno-associated viral (rAAV) vectors have emerged as one of the most promising gene therapy vectors. However, recent evidence has indicated that successful rAAV-mediated gene therapy in animal models may not translate to the same therapeutic benefit in humans. This is

mainly due to the species difference in rAAV transduction efficiency, thus leading to the search for new capsids which exhibit high efficiency in human cells. This may be achieved through capsid shuffling, in which rAAV capsid gene sequences can be reconstituted from fragments of naturally occurring rAAV capsids to generate a library comprised of novel rAAVs with unique capsid protein sequences. This library could be screened using Directed Evolution (DE) in human cardiomyoctyes to select for cardiotropic rAAVs. In the development of strategies for personalised medicine, patient-specific iPSC-CMs could be used to evolve patent specific rAAVs. To test this strategy, we have used an rAAV library (rAAV1-12) to perform DE in human iPSC-CMs. The resulting rAAVs were then recovered from cell lysates and used for subsequent rounds of selection in fresh iPSC-CMs. After six rounds of selection, the recovered rAAVs were analysed for enrichment of cardiotropic candidates. Five candidates emerged. Functional analysis using rAAV-GFP indicated that while rAAV6 was the most efficient at transducing iPSC-CM among natural rAAVs, two of our novel variants led to higher GFP expression at the same vector dose. Our results validate the use of DE to develop novel, highly functional rAAVs for use in clinical studies.

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090

Heart Failure Outcomes in Patients with Diabetes With and Without Atrial Fibrillation – Data From the EMPA-REG OUTCOME Study

M. Böhm [1,*], M. Brueckmann [2], D. Fitchett [3], J. George [2], S. Inzucchi [4], N. Marx [5], M. Mattheus [2], A. Ofstad [6], J. Slawik [1], S. Verma [7], C. Wanner [8], B. Zinman [9]

[1] Department of Internal Medicine and Cardiology, Saarland University Hospital, Homburg/Saar, Germany
[2] Boehringer Ingelheim International GmbH, Ingelheim, Germany
[3] St Michael's Hospital, University of Toronto, Toronto, Canada
[4] Section of Endocrinology, Yale University School of Medicine, Yale-New Haven Hospital, New Haven, USA
[5] Department of Internal Medicine I, Cardiology University Hospital Aachen, RWTH Aachen University, Aachen, Germany
[6] Boehringer Ingelheim Norway KS, Asker, Norway
[7] Division of Cardiac Surgery, Li Ka Shing Knowledge Institute of St Michael's Hospital, University of Toronto, Toronto, Canada
[8] Department of Medicine, Würzburg University Clinic, Würzburg, Germany
[9] Lunenfeld-Tanenbaum Research Institute, Mount Sinai Hospital, University of Toronto, Toronto, Canada

Introduction: This analysis from EMPA-REG OUTCOME examined (1) classical and expanded heart failure (HF) outcomes in type 2 diabetes (T2D) patients with and without pre-existing atrial fibrillation (AF), and (2) effects of empagliflozin on these endpoints in patients with and without AF.

Methods: 7020 T2D patients with cardiovascular (CV) disease received empagliflozin 10 mg, 25 mg or placebo. We explored the association between AF at baseline and time to first HF hospitalisation (HHF), CV death, HHF or CV death, introduction of loop diuretics, oedema occurrence, and incident or worsening of nephropathy. We also assessed consistency of empagliflozin's effects in patients with and without baseline AF.

Results: 389 patients had AF at baseline. Patients with AF were more often male, older, had higher BMI, and lower eGFR. Furthermore, patients with AF vs without baseline AF had higher rates [HR (95%CI) of empagliflozin vs placebo] of HHF or CV death (placebo/empagliflozin, 23.2%/15.4% [0.58 (0.36, 0.92)] vs 7.5%/5.1% [0.67 (0.55, 0.82)], $p_{interaction} = 0.5630$). Increased rates were also detected for HHF (12.7%/8.5% [0.60 (0.32, 1.12)] vs 3.5%/2.4% [0.67 (0.50, 0.90)], $p_{interaction} = 0.7509$), introduction of loop diuretics (25.6%/18.5% vs 12.7%/8.2%), oedema occurrence (16.2%/5.7% vs 9.7%/5.3%) and incident or worsening nephropathy (24.6%/12.6% vs 18.5%/12.7%). Empagliflozin consistently reduced HHF, CV death, HHF or CV death, introduction of loop diuretics, oedema occurrence and incident or worsening nephropathy in patients with and without AF (interaction p-values all >0.05).

Conclusion: AF was associated with increased risk of CV/HF outcomes and mortality. Empagliflozin's effects were consistent in patients with and without AF.

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091

High Prevalence of HFpEF in Patients Undergoing AF Ablation: Stall HFpEF - A Prospective Study with Invasive Haemodynamics

H. Sugumar

Alfred Health/Rmh, Melbourne, Australia

Background: Atrial fibrillation (AF) and heart failure (HF) are modern cardiovascular epidemics each associated with high burdens of morbidity and mortality. Despite increasing recognition of HF with preserved ejection fraction (HFpEF) among AF patients, diagnosis is challenging with invasive haemodynamic study remaining the gold standard.

Objective: To determine, using invasive haemodynamic study, the prevalence of HFpEF in patients referred for first time AF ablation, and to compare their characteristics against their non-HFpEF counterparts.

Methods: Consecutive qualifying patients (EF ≥50%) scheduled for index AF ablation underwent exercise right heart catheterisation, cardiac MRI, echocardiogram, QOL questionnaires and BNP testing. Diagnosis of HFpEF was made when patients had signs or symptoms of HF, elevated BNP with resting PCWP ≥15 mmHg peak exercise PCWP ≥25 mmHg and EF ≥50%.

Results: Of 70 eligible patients, 41 consented to participate and 3 were excluded due to decline in EF after enrolment, leaving 38 in the final analysis. Of these, 61% had HFpEF with characteristics detailed below. Prevalence was higher in patients with persistent vs paroxysmal AF (89% vs 35%, $p = 0.003$; and higher in women vs men (93% vs 4.3%, $p = 0.004$). HFpEF was not associated with obesity (30% vs 29%, $p = 0.249$). QOL questionnaires did not correlate with HFpEF diagnosis

Conclusion: HFpEF is prevalent in patients referred for AF ablation as demonstrated by exercise right heart catheterisation. Further studies are needed to understand the impact of catheter ablation and outcomes in this patient population.

Baseline characteristics in AF population: HFpEF vs Non HFpEF

	Total	HFpEF	Non HFpEF	P Value
Total patients, n (%)	38 (100)	23 (61)	15 (39)	NA
Persistent AF, n (%)	18 (47)	16 (70)	2 (13)	0.003
Female, n (%)	16 (42)	16 (70)	2 (13)	0.004
Age (yrs), $n \pm$ SD	59.9 ± 11.9	65.7 ± 8.0	51.5 ± 11.1	<0.001
BMI (kg/m^2), $n \pm$ SD	29.7 ± 4.1	30.4 ± 4.2	28.6 ± 3.5	0.249
BNP (ng/L), $n \pm$ SD	98.9 ± 86.4	133.5 ± 87.1	42.1 ± 39.3	<0.001
AFEQT Symptom score, $n \pm$ SD	57.5 ± 25.1	54.8 ± 24.3	61.3 ± 26.6	NS
AFEQT Disability score, $n \pm$ SD	41.1 ± 26.5	36.1 ± 23.5	48.7 ± 29.7	NS
MLHF score, $n \pm$ SD	42.7 ± 29.2	54.0 ± 24.1	36.2 ± 29.1	NS

092

Hospital in the Home in the Treatment of Heart Failure in Australia

S. Montalto [1,*], P. McElduff [2], K. Hardy [3], M. Montalto [4]

[1] *Royal Melbourne Hospital, Parkville, Australia*
[2] *University of Newcastle, Newcastle, Australia*
[3] *Baxter Healthcare, Old Toongabbie, Australia*
[4] *Epworth Healthcare, Richmond, Australia*

Introduction: In-home treatment of heart failure is a rapidly growing field in Australia, taking many forms. Hospital in the Home (HITH) is one service that may aid in preventing readmissions, and decreasing length of stay (LOS), however to date there are no published data on the current activity and outcomes of HITH in heart failure.

Methods: Data were collected on all hospital inpatient admissions across the 19 Australian public principal referrer hospitals that submit inpatient activity data to the Health Round Table. All cases involving a diagnosis of 'heart failure and shock' between 2011 and 2017 were extracted for analysis.

Results: Of the 48,891 total cases of heart failure, 1,014 (2.1%) involved an HITH admission. There was no significant difference between HITH and non-HITH groups in baseline characteristics such as age and gender. Average total LOS was longer in HITH 7.2 days vs non-HITH 4.7 days ($p < 0.01$). Average in-hospital LOS was shorter in HITH 1.8 days vs 4.7 days ($p < 0.01$). In-hospital mortality was lower in HITH 1.3% vs 4.4% ($p < 0.01$). There was no difference in patient complexity in HITH 48% vs non-HITH 50.4%, $p = 0.76$. There were less 28-day readmissions in HITH 6.6% vs non-HITH 9.2% ($p = 0.21$), however this did not reach statistical significance.

The number of episodes involving an HITH admission has risen from 0.8% (2011) to 5.4% (2017).

Conclusion: HITH admission is associated with a shorter in-hospital LOS, lower in-hospital mortality rates, and shows a trend towards reduced re-admission rate. Despite this, it is utilised in only 5.4% of current admissions. HITH may be under-utilised in the management of heart failure.

093

Hypophosphataemia is Common After Intravenous Ferric Carboxymaltose Infusion Among Patients with Symptomatic Heart Failure

A. Dashwood [1,2,3,*], F. Chui [1], S. Laher [1], C. Vale [1,2,3], W. Chan [1,2,3], S. McKenzie [1,2], Y. Wong [1,2,3]

[1] *The Prince Charles Hospital, Brisbane, Australia*
[2] *The University of Queensland, Brisbane, Australia*
[3] *Cardio-Vascular Molecular & Therapeutic Translational Research Group, Brisbane, Australia*

Intravenous ferric carboxymaltose (IV FCM) has been shown to improve symptoms among patients with heart failure (HF). However, hypophosphataemia has been reported in IV FCM for iron deficiency anaemia. We sought to report the prevalence and predictors of hypophosphataemia after IV FCM among HF patients.

Methods: In this single-centre analysis, patients receiving IV FCM with symptomatic HF between Jan 2015–19, with at least one follow-up biochemistry within 30-day of administration were included. Outcome measurements include lowest serum phosphate, severe (<0.64 mmol/L) and extreme (<0.04 mmol/L) hypophosphataemia.
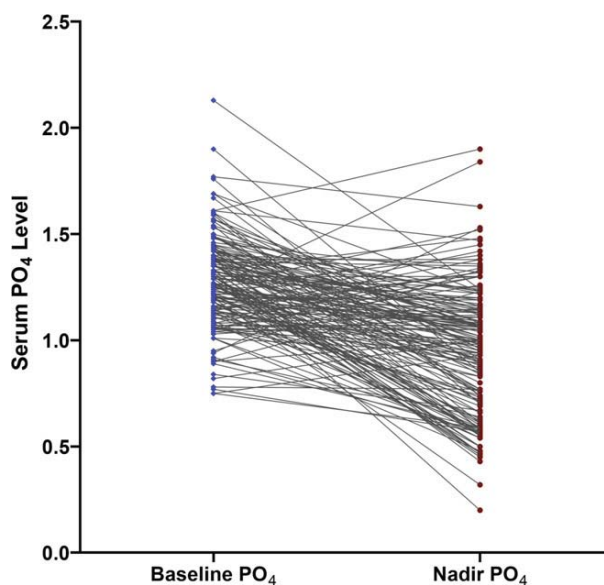
Results: A total of 170 patients (66% male; mean age 57-years SD17.5, 65% non-ischaemic cardiomyopathy, 5.3% HFpEF were included. Most patients have significant iron deficiency (median ferritin 58.50 [27.25, 116.75]; median transferrin saturation 0.10 [0.06, 0.15]). Significant proportion of patients developed severe hypophosphataemia ($n = 33$; 19.4%) (Fig). However, risk factors associated with severe hypophosphataemia remains unclear (age $P = 0.32$;

female $P = 0.37$; baseline PO_4 $P = 0.18$, baseline cholecalciferol $P = 0.54$).

Conclusion: Hypophosphataemia is common after IV FCM administration among HF patients. Further studies are required to identify predictors and clinical significance of the observed hypophosphataemia.

094

ICD Implantation in Hypertrophic Cardiomyopathy: A Single Centre Experience

L. Segan [*], J. Amerena

Barwon Health, Geelong, Australia

Background: Hypertrophic Cardiomyopathy is a common, heritable heterogeneous condition. High risk characteristics form the basis of the European Society of Cardiology (ESC) and American College of Cardiology/American Heart Association guidelines for device implantation to prevent sudden cardiac death.

Aims: This study reviewed the pattern of implantable cardiac defibrillator (ICD) placement among 55 patients with hypertrophic cardiomyopathy in a tertiary centre over a 10-year period and the concordance with existing guidelines.

Methods: We identified 55 patients from a single institution with a diagnosis of hypertrophic cardiomyopathy from hospital medical records.

Results: 20 of 55 patients (36%) underwent device implantation between 2008–2018. The ICD cohort was younger (mean age 45 ± 19 years vs 69 ± 11 years, $p < 0.001$), predominantly male (75% vs 20%, $p < 0.001$) with greater wall thickness (23.9 ± 6.0 vs 18.3 ± 4.5, $p = 0.001$), though lower left ventricular outflow tract (LVOT) gradient (2.8 ± 1.2 vs 3.6 ± 1.5, $p = 0.003$). High-risk clinical features were more prevalent in the ICD group (30–40% vs 3–6%). Half of patients undergoing ICD implantation had other indications independent of this diagnosis. 2 of 20 patients with an ICD had ventricular tachycardia requiring anti-tachycardia pacing, and 1 patient had an inappropriate shock for atrial fibrillation with rapid ventricular rate.

Discussion: This study highlights contemporary clinical practice is consistent with current recommendations regarding ICD implantation in HCM. Despite high-risk clinical features, arrhythmia requiring device therapy was infrequent in this cohort of patients.

095

Identifying Treatment Gaps in HFrEF Management in Metropolitan Australian Hospitals

D. Drak[1,*], J. Fulcher[1,2], J. Kilian[3], J. Chong[4], R. Grover[5], A. Keech[1,2]

[1] NHMRC Clinical Trials Centre, Sydney, Australia
[2] RPA Hospital, Sydney, Australia
[3] Bankstown-Lidcombe Hospital, Sydney, Australia
[4] Westmead Hospital, Sydney, Australia
[5] Canterbury Hospital, Sydney, Australia

Background: Several evidence-based therapies are recommended to reduce morbidity and mortality in heart failure with reduced ejection fraction (HFrEF), but data on physician adherence to therapy guidelines in Australia are limited.

Aims: To audit HFrEF treatment utilisation across a representative sample of metropolitan hospitals against current evidence-based guidelines.

Methods: A retrospective review was conducted of patients admitted to six hospitals in metropolitan Sydney with a primary diagnosis of HFrEF, between Jan 2015 and Jun 2016. HFrFF therapy use was compared with guideline recommendations.

Results: Discharge treatment information was available for 815 HFrEF patients. The figure shows the average treatment gap for each therapy across all sites combined and the upper and lower limits of treatment gaps by individual site.
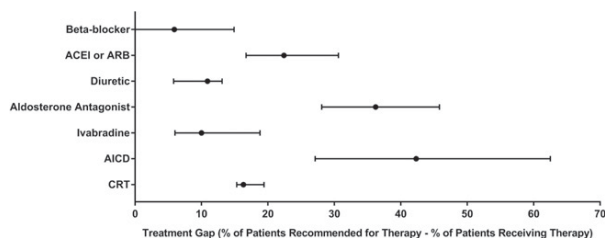
Conclusion: Trends in treatment gaps were generally similar between sites. Increasing the usage of ACEIs/ARBs and, particularly, aldosterone antagonists are important avenues for improving the medical management of HFrEF.

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This abstract has been withdrawn

097

Impact of Hospital Readmissions on Subsequent Mortality: a Temporal Trend Analysis of Hospital Admissions for Acute Heart Failure

A. Driscoll[1,2,*], D. Diem[3], D. Prior[4], D. Hare[2,5], D. Kaye[6,7], C. Neil[8], S. Lockwood[9], A. Brennan[2], H. Carruthers[2], J. Lekovits[2], J. Amerena[1,10], J. Cooke[11], G. Vaddadi[12], V. Nadurata[13], C. Reid[3,14]

[1] Deakin University, Viewbank, Australia
[2] Austin Health, Heidelberg, Australia
[3] Monash University, Prahran, Australia
[4] St Vincents Hospital, Melbourne, Australia
[5] University of Melbourne, Melbourne, Australia
[6] Baker IDI, Melbourne, Australia
[7] Alfred Health, Melbourne, Australia
[8] Western Health, Footscray, Australia
[9] Monash Health, Melbourne, Australia
[10] Barwon Health, Geelong, Australia
[11] Eastern Health, Boxhill, Australia
[12] Northern Health, Epping, Australia
[13] Bendigo Health, Bendigo, Australia
[14] Curtin University, Perth, Australia

Background: Patients admitted to hospital with acute heart failure (AHF) are at increased risk of readmission and mortality post-discharge. This study assessed the impact of hospital readmissions on subsequent mortality rates in patients discharged from hospital with AHF.

Methods: Sixteen Victorian hospitals participated in a prospective statewide HF snapshot of patients admitted to hospital with AHF over one month and followed up for 30 days post-discharge. The project was conducted annually over three consecutive years from 2015–2017.

Results: Of the 1197 patients, 56.3% were male with an average age of 77 years (SD 13.17 years). Hypertension, chronic renal disease and atrial fibrillation were the most common comorbidities (75.2%, 64% and 54.7%, respectively). Overall 50.4% of patients were admitted to General Medicine and 33.9% to Cardiology. In-hospital mortality rate was 5.1% with 30 day-mortality of 4.2% and readmission rate of 24.4%. Patients who experienced a subsequent readmission within 10 days of discharge from index hospitalisation had a 4.6-fold increase in risk of mortality (adjusted HR 4.6, 95% CI 2.16–9.81) compared to patients who were not readmitted and patients readmitted within 11–20 days post-discharge had a 4.3-fold increase in risk of mortality (adjusted HR 4.36, 95% CI 2.04–9.27).

Conclusion: Patients admitted to hospital with AHF who experience a subsequent readmission within 20 days post-discharge are at increased risk of dying. It is vital that early post-discharge follow-up within 20 days is implemented to address this vulnerable period after an HF admission.

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Incidence of Viral Infections as a Cause of Acute Decompensation of Heart Failure and the Prevalence of Viral Testing in a Tertiary Referral Centre

M. Thangarajah [1,*], G. Gan [1,2,3], T. Tan [1,2,3,4], R. Porter [2], R. MacIntyre [2,3,4], E. Hitchen [2]

[1] *Western Sydney University, Stanhope Gardens, Australia*
[2] *Department of Cardiology, Blacktown Hospital, Blacktown, Australia*
[3] *University of New South Wales, Sydney, Australia*
[4] *The Kirby Institute, Sydney, Australia*

Background: In patients with heart failure (HF), viral infection is postulated to cause acute exacerbations, resulting in more frequent hospitalisations and longer hospital stays. Early diagnosis of a viral cause for decompensation could streamline HF treatment and reduce unnecessary investigations, potentially reducing length of admission. However, the prevalence of viral testing is unclear.

Objectives: Our aims were to determine viral testing uptake in patients with acute decompensated HF, and the impact of viral infection on length of admission.

Methods: We retrospectively examined all admissions categorised as acute decompensated HF (based on DRG coding) in a tertiary hospital from 2014–2018. Demographic information, comorbidities and evidence of viral infection (defined by positive viral swabs or serology) were obtained from medical records. Length of admission was compared between patients with positive viral testing and those without.

Results: We examined 470 admissions for acute HF exacerbation, in a cohort of 248 HF patients (age 66.1 ± 15.6 years; 34% female). Investigations for viral cause of decompensation only occurred in 172 (37%) admissions. A respiratory virus was identified in 43 cases (24%). Compared to those who experienced a non-infective exacerbation of HF, patients who tested positive for a viral pathogen had significantly longer length of stay (13.4 days vs 9.1 days, $p = 0.04$).

Conclusions: Our results suggest that there is significant under-testing and under-diagnosis of viral infection in patients presenting with acute decompensated HF. The uptake of viral screening in these patients should be further encouraged to better streamline management of HF exacerbations and optimise preventative strategies.

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Inclusion of Left Atrial Strain Evaluation with the "H2FPEF Score" Enhances Diagnostic Accuracy for Heart Failure with Preserved Ejection Fraction

L. Segan [1,3,*], A. Beale [2,3], F. Telles [3], S. Evans [2], D. Kaye [2,3], S. Nanayakkara [2,3]

[1] *Department of Cardiology, Barwon Health, Geelong, Australia*
[2] *Department of Cardiology, Alfred Hospital, Melbourne, Australia*
[3] *Heart Failure Research Group, Baker Heart and Diabetes Institute, Melbourne, Australia*

Background: Invasive catheterisation remains the gold standard diagnosis of Heart Failure with Preserved Ejection Fraction (HFpEF). Non-invasive assessment remains challenging due to variable diagnostic accuracy of clinical and echocardiographic features. We assessed the added utility of a sensitive and specific marker, LA strain, to the recently proposed "H$_2$FPEF score".

Methods: This retrospective study analysed 240 patients with unexplained dyspnoea referred for invasive and non-invasive haemodynamic assessment to differentiate HFPEF from non-cardiac dyspnoea (NCD). Logistic regression was performed on 77 patients with valid left atrial (LA) strain data using the H$_2$FPEF score and assessing the added effect of LA global strain on predictive power.

Results: Regression analysis was conducted on 54 HFpEF and 23 NCD patients, using the H$_2$FPEF score (age >60, BMI >30 kg/m^2, atrial fibrillation, echocardiographic E/e' ratio >9 and RVSP >35 mmHg). The second model incorporated LA strain using a regression-derived beta coefficient.

The odds of HFPEF was doubled for each 1-unit score increase (OR 2.79, 95% CI, 0.589–0.839, $p = 0.003$) with an area under the curve (AUC) of 0.714. LA global strain augmented the predictive power of the H$_2$FPEF score (OR 3.83, 95% CI, 0.766–0.948, $p \leq 0.001$) with an AUC 0.857 ($p = 0.006$).

Conclusions: We propose that a modification of the H$_2$FPEF score which incorporates LA strain may augment the non-invasive diagnosis of HFpEF and also provide a tool for the development of more accurate inclusion in HFpEF clinical trials.

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Increasing General Adiposity is not Associated with Hypertrophy of Epicardial Adipocytes in Cardiac Surgery Patients

H. Aitken-Buck[1,*], M. Moharram[2],
A. Babakr[1], I. van Hout[1],
I. Fomison-Nurse[1], R. Reijers[1],
K. Bhagwat[3], P. Davis[3], M. Williams[2],
P. Jones[1], S. Coffey[2], R. Lamberts[1]

[1] Department of Physiology, HeartOtago, School of Biomedical Sciences, University of Otago, Dunedin, New Zealand
[2] Department of Medicine, HeartOtago, Dunedin School of Medicine, University of Otago, Dunedin, New Zealand
[3] Department of Cardiothoracic Surgery, HeartOtago, Dunedin School of Medicine, University of Otago, Dunedin, New Zealand

Epicardial adipose tissue (EAT) is an active secretory fat depot located between the visceral pericardium and the myocardium. EAT deposition, whether measured as volume or thickness, is strongly associated with prevalent cardiac diseases like atrial fibrillation and heart failure. Despite these clinical associations of macroscopic EAT dimensions with cardiac disease, very little is known about the microscopic morphology of the adipocytes comprising EAT.

Within other adipose depots (subcutaneous and visceral), an increase in body mass index (BMI), a general measure of adiposity, is strongly correlated with hypertrophy of individual adipocytes. However, correlations of basic anthropometric indices, like BMI, and EAT adipocyte morphology have not been comprehensively studied.

After informed consent, we collected EAT samples from cardiac surgery patients during cardiopulmonary bypass ($n = 25$). Histological sections of EAT were stained with haematoxylin and eosin, and the area of each adipocyte was measured. Further, the thickness of EAT from each patient was measured pre-operatively using trans-thoracic echocardiography.

We have found that while EAT thickness positively correlated with BMI ($p < 0.0001$, $R^2 = 0.6049$), EAT adipocyte size did not ($p = 0.07356$, $R^2 = 0.005$). Furthermore, there was no correlation between adipocyte size and EAT thickness ($p = 0.4259$, $R^2 = 0.0278$).

In conclusion, macroscopic increases in EAT dimensions correlating with increased BMI is not caused by hypertrophy of the adipocytes comprising the EAT depot. This suggests that EAT is a very distinct and highly dynamic adipose tissue compared to other adipose depots.

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In-Hospital Initiation of Sacubitril/Valsartan in Stabilised Patients with Heart Failure and Reduced Ejection Fraction Naïve to Renin-Angiotensin System Blocker: An Analysis of the Transition Study

R. Wachter[1,*], S. Michele[2], K. Witte[3],
E. Straburzynska-Migaj[4], J. Belohlavek[5],
C. Fonseca[6], C. Mueller[7], E. Lonn[8],
W. Bao[9], A. Noe[10], H. Schwende[10],
D. Butylin[10], D. Pascual-Figal[11], on behalf of
TRANSITION investigators

[1] University of Göttingen, Clinic for cardiology and pneumologie, Basel, Switzerland
[2] Cardiology Division, Cardiovascular Department Hospital Papa Giovanni XXIII, Italy
[3] Leeds Institute of Cardiovascular and Metabolic Medicine, University of Leeds, Leeds, United Kingdom
[4] 1st Dept of Cardiology, University of Medical Sciences, Poznan, Poland
[5] General Teaching Hospital, Charles University in Prague, Prague, Czech Republic
[6] Heart Failure Unit, Internal Medicine Department, Hospital de São Francisco Xavier, CHLO. NOVA Medical School, Faculdade de Ciências Médicas, Universidade Nova de Lisboa, Lisbon, Portugal
[7] University Hospital Basel, Basel, Switzerland
[8] Hamilton Health Sciences General Site, Hamilton, Canada
[9] Novartis Pharmaceuticals Corporation, East Hanover, USA
[10] Novartis Pharma AG, Basel, Switzerland
[11] Cardiology Department, Hospital Universitario Virgen de la Arrixaca, Universidad de Murcia, Murcia, Spain

Background: In the PIONEER-HF study, in-hospital initiation of sacubitril/valsartan (S/V) versus enalapril in patients with heart failure (HF) and reduced ejection fraction (HFrEF), stabilised after acute decompensation, was associated with superior reduction of NT-proBNP, irrespective of prior use of angiotensin-converting enzyme inhibitor (ACEi) or angiotensin receptor blocker (ARB).

Methods: In TRANSITION (NCT02661217), 1002 patients with HFrEF, hospitalised for acute decompensated HF after haemodynamic stabilisation, were randomised 1:1 and initiated open-label S/V either pre- or post-discharge (1–14 days). Primary endpoint was the proportion of patients achieving the target dose (97/103 mg, bid) at 10 weeks postrandomisation. Endpoints, adverse events (AEs) and serious AEs (SAEs) were compared by ACEi/ARB status in the combined pre- and post-discharge arms.

Results: ACEi/ARB-naïve group [326 (32.9%)] had lower systolic blood pressure, serum creatinine, higher heart rate, and more often had non-ischaemic HF aetiology. Similar proportions of ACEi/ARB-naïve and non-naïve patients achieved the target dose of S/V (48.3% vs 47.9%, RRR 1.01

[0.88–1.16]) (Figure) and 88% patients from both groups were maintained on any S/V dose at Week 10. The rate of permanent discontinuation of S/V due to AEs was low and comparable. Overall incidence of AEs was 65.3% in ACEi/ARB-naïve and 68.3% in non-naïve patients (RRR 0.96 [0.87–1.05]) and incidence of SAEs was 16.3% and 19.4% respectively (RRR 0.83 [0.63–1.12]) (Table).

Conclusion: In hospitalised patients with HFrEF naïve to ACEi/ARB, S/V can be safely initiated pre-discharge or shortly after discharge, and up-titration is well tolerated.

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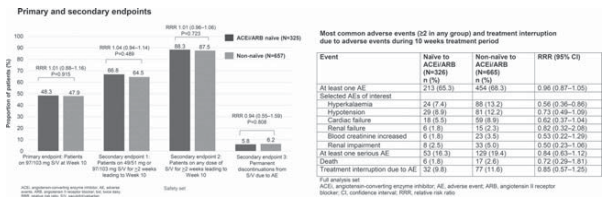
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Initiation of Sacubitril/Valsartan in Patients with De Novo Heart Failure with Reduced Ejection Fraction: An Analysis of the Transition Study

R. Wachter [1,*], S. Michele [2], K. Witte [3], E. Straburzynska-Migaj [4], J. Belohlavek [5], C. Fonseca [6], C. Mueller [7], E. Lonn [8], W. Bao [9], A. Noe [10], H. Schwende [10], D. Butylin [10], D. Pascual-Figal [11], on behalf of TRANSITION investigators

[1] University of Göttingen, Clinic for Cardiology and Pneumologie, Gottingen, Germany
[2] Cardiology Division, Cardiovascular Department Hospital Papa Giovanni XXIII, Bergamo, Italy
[3] Leeds Institute of Cardiovascular and Metabolic Medicine, University of Leeds, Leeds, United Kingdom
[4] 1st Dept of Cardiology, University of Medical Sciences, Poznan, Poland
[5] General Teaching Hospital, Charles University in Prague, Prague, Czech Republic
[6] Heart Failure Unit, Internal Medicine Department, Hospital de São Francisco Xavier, CHLO. NOVA Medical School, Faculdade de Ciências Médicas, Universidade Nova de Lisboa, Lisbon, Portugal
[7] University Hospital Basel, Basel, Switzerland
[8] Hamilton Health Sciences General Site, Hamilton, Canada
[9] Novartis Pharmaceuticals Corporation, East Hanover, USA
[10] Novartis Pharma AG, Basel, Switzerland
[11] Cardiology Department, Hospital Universitario Virgen de la Arrixaca, Universidad de Murcia, Murcia, Spain

Background: Initiation of sacubitril/valsartan (S/V) in hospitalised patients with heart failure (HF) with reduced ejection fraction (HFrEF), stabilised after admission due to decompensated HF (ADHF), was associated with superior NT-proBNP reduction compared to enalapril in the PIONEER-HF study. Treatment effect was similar in patients with and without a prior diagnosis of HFrEF.

Methods: In TRANSITION (NCT02661217), 1002 patients with HFrEF, hospitalised for ADHF, after haemodynamic stabilisation, were randomised 1:1 to start open-label S/V either pre- or post-discharge (1–14 days). Primary endpoint was the proportion of patients achieving the target dose (97/103 mg bid) at 10 weeks post-randomisation. Endpoints, adverse events (AEs) and serious AEs (SAEs) were compared by HF history status in the combined pre- and post-discharge arms.

Results: 286 patients had *de novo* HFrEF and 705 had a prior diagnosis of HFrEF. At baseline, *de novo* HF patients were younger, had lower systolic BP, serum creatinine, and hs-TnT levels; and higher pulse rate and, eGFR; more non-ischaemic HF, and fewer had comorbidities. More *de novo* HF patients achieved the target dose versus subjects with a prior diagnosis of HF (56.0% vs 44.8%, RRR1.30 [1.12–1.52]) and 90% were able to achieve and maintain any dose (Figure). The number of SAEs and treatment interruptions due to AEs was lower in patients with *de novo* HFrEF (Table).

Conclusions: Patients with *de novo* HFrEF can be safely initiated on S/V and are more likely to achieve the target dose and maintain treatment by Week 10, compared to patients with a previous diagnosis of HFrEF.

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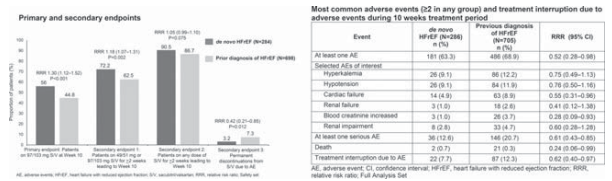
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Interrogating Gradient Hydrogels for Studying Cardiac Muscle Mechanobiology

I. Chin [1,*], L. Hool [1,2], Y. Choi [1]

[1] University of Western Australia, Perth, Australia
[2] Victor Chang Cardiac Research Institute, Sydney, Australia

Sensing and transducing mechanical signals from the cellular microenvironment is essential for controlling cell fate and maintaining cell function, however the mechanical properties of this environment can be pathologically altered by disease. For example, the stiffness of myocardium is dramatically increased following myocardial infarction and this change is associated with the progression of heart disease towards heart failure. To appreciate the contribution of aberrant mechanical signals to disease progression, it is crucial to understand mechanosensation across a physio- pathological range. Cardiomyocytes are mechanosensitive, as cell morphology and contractility are mediated by substrate stiffness, however the mechanisms of cardiomyocyte mechanosen-

sation are not well characterized. Mechanosensation has traditionally been modelled using stem cells but unlike stem cells, cardiomyocytes have muscle actomyosin and are mechanically linked to adjacent cells through intercalated discs, so traditional models of mechanosensation may not be suitable for understanding cardiomyocyte mechanobiology. To better understand cardiomyocytes mechanobiology, gelatin methacryloyl (GelMA) was used to create a stiffness gradient hydrogel platform, with a linear stiffness gradient from 9 to 29 kPa. This platform was used to screen the mechanobiology of H9C2 cells. To investigate the relationship between mechanosensation and cardiomyocyte development and behaviour, the expression of the mechanomarkers (YAP and MRTF-A) were measured in relation to physical characteristics of the cell (size, shape and stiffness). Present data suggests that cell stiffness increases with substrate stiffness (Pearson's Correlation Coefficient, $R^2 = 0.76$, $P < 0.05$) but no correlation was found between substrate stiffness and cell size, form factor, YAP expression or MRTF-A expression (Pearson's Correlation Coefficient, $P > 0.05$).

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Lavare Cycle Does not Induce Pulsatility in HVAD Patients

J. Engelman[1,2,*], K. Muthiah[1], P. Jain[1], D. Robson[1], P. Jansz[1], C. Hayward[1]

[1] Heart Failure and Transplant Unit, St Vincent's Hospital, Sydney, Australia
[2] University of New South Wales, Sydney, Australia

Background: Lavare cycle (LC) is a pre-programmed speed modulation algorithm (SMA) in the HeartWare continuous-flow left ventricular assist device (HVAD) designed to increase ventricular and pump washout. Whether the LC can induce artificial pulsatility or influence autonomic physiology in CF-LVAD patients remains unproven.

Methods: LC impact was prospectively assessed in a 10-patient crossover study. Blood pressure (BP) pulsatility, flow pulsatility and heart rate variability (HRV) were assessed during two 24-hour periods (LC off/on). Patients were monitored using: 1) SphygmoCor 24-hour ambulatory oscillometric/tonometric BP monitoring to calculate pulse pressure (PP) and mean arterial pressure (MAP), 2) CDAS continuous pump data recorder to calculate a flow pulsatility index (PI), defined as $(maximum - minimum\ flow)/(mean\ flow)$ and 3) Holter monitor (1000 Hz) to calculate time domain measures of HRV. BP, flow and PI analyses were dichotomised for awake and asleep hours to assess diurnal variation.

Results: PP and MAP results were available for 9 patients, PI for 8 and HRV for 7. Results reported as [median (interquartile range)]. Heart rate was higher in the LC on [81.2 (74.0–107.1)] compared with the LC off [78.7 (71.2–103.9)] group ($p = 0.028$). There was no difference between groups in time domain measures of HRV (SDNN, RMSSD), markers of sympathetic and parasympathetic activity, respectively. Similarly, PP, MAP or PI did not differ significantly between groups. MAP was lower whilst asleep [68.8 (64.1–73.8)] than awake [78.5 (72.9–84.8)], unaffected by LC ($p = 0.004$).

Conclusion: LC did not induce meaningful artificial pulsatility or influence autonomic physiology in HVAD patients.

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Left Ventricular Ejection Fraction Improvement Post Commencement of Sacubitril/Valsartan in Heart Failure Patients

S. Nandal[1,*], V. Hannah[1], G. Vaddadi[1], W. Van Gaal[1,2]

[1] The Northern Hospital, Epping, Australia
[2] The University of Melbourne, Melbourne, Australia

Sacubitril/Valsartan decreases HF hospitalisation, cardiovascular mortality and all-cause mortality in patients with HF with reduced ejection fraction (HFrEF) [1]. Since addition of Sacubitril/Valsartan to Pharmaceutical Benefit Scheme in June 2017, there has been considerable uptake of this drug. The aim of this study was to assess the effect of Sacubitril/Valsartan on left ventricular ejection fraction (LVEF) in clinical practice using an intention to treat analysis in order to provide a real world experience.

Data were collected to include patients from 1st January 2017 to 31st December 2017 at a major metropolitan centre in Melbourne, Victoria via the pharmacy dispensing and clinic database. 65 patients were assessed in this study and the majority of patients had NYHA score III with pre-dominant male representation with 49 male and 16 females in the cohort. The mean age of the patients was 65.1 years (SD 12.5 years). 49% patients were diagnosed with ischaemic cardiomyopathy and 51% non ischaemic cardiomyopathy. In a 6–12 month follow-up, there was a significant improvement in LVEF from $29.1 \pm 9.7\%$ at baseline to $33.8 \pm 9.9\%$ at follow up ($p < 0.05$).

Sacubitril/Valsartan is a much needed therapeutic advancement in treatment of heart failure and supplements the current evidence-based maximal medical therapy. It provides LVEF improvement even in low doses and in a short time interval as evident in our study. However, further research is necessary to demonstrate whether these outcomes are sustained in the longer-term in the HFrEF population.

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Left Ventricular End Diastolic Pressure as a Predictor of Left Ventricular Thrombus Formation After Anterior ST Elevation Myocardial Infarction

S. Tan [1,*], P. Thein [1], S. Lee [2], T. Tsay [1], A. Ngoi [2], E. Kalman [2], J. Nogic [3], A. Nasis [1]

[1] Monash Heart, Clayton, Australia
[2] Monash Health, Clayton, Australia
[3] Eastern Health, Box Hill, Australia

Left ventricular thrombus (LVT) is a well-described complication of anterior ST elevation myocardial infarction (aSTEMI), with a 9% incidence in the primary percutaneous coronary intervention era. Numerous risk factors predispose to LVT formation, including infarct size and apical akinesis, however measurable predictors during coronary angiography remain elusive. This study aimed to investigate left ventricular end diastolic pressure (LVEDP), a surrogate marker for left ventricular dysfunction, as a predictor for LVT formation.

We performed a dual-centre retrospective analysis of patients presenting between January 2010 and September 2017 with aSTEMI. Patients thought to be at high risk for LVT were evaluated via transthoracic echocardiogram (TTE) during index admission. LVEDP measurements were obtained from index coronary angiography. Landmark analysis was performed at LVEDP of 20 mmHg using multivariable logistic regression. Results were reported as odds ratio (OR) with 95% confidence intervals (CI).

Of 514 aSTEMI patients, TTE results confirming presence or absence of LVT were available in 240 patients. The incidence of LVT was 12.1% ($n = 29$). 70.8% of patients had LVEDP of ≥ 20 mmHg. Patients with LVEDP of ≥ 20 mmHg were found to have an increased risk of LVT formation (OR = 4.03, CI = 1.18–13.79, $p = 0.03$). Similar findings were found after adjusting for age and sex (OR = 4.24, CI = 1.23–14.65, $p = 0.02$). For each 1 mmHg increase in LVEDP above 20 mmHg, risk of LVT formation also increased (OR = 1.12, CI = 1.03–1.21, $p = 0.01$).

LVEDP of ≥ 20 mmHg after aSTEMI is associated with an increased risk of LVT formation. This finding highlights the importance of routine TTE during index admission for aSTEMI patients with LVEDP ≥ 20 mmHg.

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Long-term Prognostic Implication of Gender-Specific Predictors for Heart Failure

J. Lim [1,2,3,*], M. Al Omary [1,2,3], H. Al-Khalil [1], D. McIver [1], A. Boyle [1,2,3]

[1] John Hunter Hospital, New Lambton Heights, Australia
[2] University of Newcastle, Callaghan, Australia
[3] Hunter Medical Research Institute, New Lambton Heights, Australia

Background: Gender differences in HF are increasingly being recognised. We therefore aim to characterise gender-specific predictors of HF and its contribution on cardiovascular outcomes.

Methods: A multi-centre review of hospital separations in the Hunter New England Area Health District between 2005–2014 with an ICD10 code for index HF in their first four diagnoses. We performed a gender-based analysis on the effect of patient demographics and risk factors for HF on one-year mortality and all-cause readmission.

Results: 21,851 patients with an index admission for HF were identified. 10,662 were male (49%) with a median age of 78 years (IQR: 70–84). Females were significantly older with a median age of 82 years (IQR: 75–88; $p < 0.001$). There were no gender differences in Indigenous status, rural residential status or socio-economic status. Gender differences, however, existed in the comorbidities associated with HF including hypertension, ischaemic heart disease (IHD), diabetes mellitus (DM), chronic kidney disease (CKD) and respiratory disease ($p < 0.001$).

Overall, males had higher rates of one-year mortality and all-cause readmission (70% vs 68%; $p < 0.001$), but decreased length of stay (5 vs 6 days; $p < 0.001$). Predictors of these outcome in males included age, IHD, CKD and respiratory disease. Interestingly, hypertension and atrial fibrillation/flutter (AF) decreased the odds of these outcomes in males only. In females, predictors included age, IHD, DM, CKD and respiratory disease.

Conclusion: Female HF patients were older than males. Gender-specific predictors were hypertension and AF in males and DM in females.

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This abstract has been withdrawn

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Low Brain Natriuretic Peptide in Hemodynamically Proven Heart Failure Preserved Ejection Fraction: An Invasive-Echocardiographic Characterisation Study

S. Nanayakkara [1,2,3,*], A. Beale [1,2,3], L. Segan [2,4], D. Kaye [1,2,3]

[1] The Alfred, Melbourne, Australia
[2] Baker Heart And Diabetes Institute, Melbourne, Australia
[3] Monash University, Melbourne 3004, Australia
[4] Barwon Health, Geelong 3004, Australia

Background: Exercise right heart catheterisation (RHC) is the gold standard for diagnosis of HFpEF, however in its absence BNP constitutes part of the diagnostic criteria. A proportion of patients demonstrate low BNP values at rest despite elevated filling pressures at exercise, often attributed to body mass index (BMI) or renal function. We aimed to characterise the demographic, echocardiographic and haemodynamic features of patients with HFpEF and both a low and high BNP, at rest and exercise.

Methods: 97 patients undergoing invasive RHC with haemodynamically confirmed HFpEF were included. BNP was measured immediately prior to catheterisation and echocardiography was performed simultaneously.

Change in Cardiac Index from Rest to Exercise
Low vs High BNP
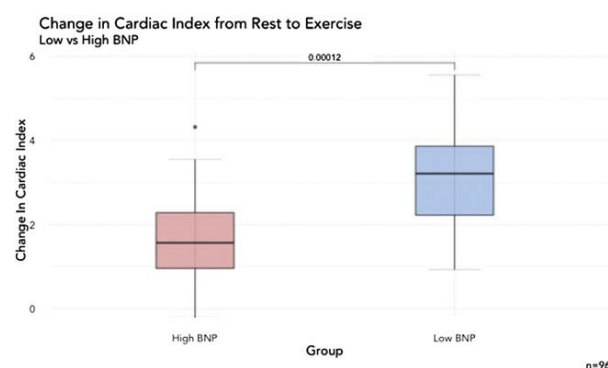
Results: 15% had a BNP value <35 pg/mL. Patients with a low BNP (<35) were of similar age 67 ± 9 vs 70 ± 9, $p = 0.15$), more likely to be female (74% vs 60%), and had a similar BMI (32 ± 6 vs 31 ± 7, $p = 0.7$) and creatinine (76 ± 15 vs 84 ± 26, $p = 0.28$). LA volume index was markedly lower (32 ± 7 vs 44 ± 14, $p = 0.001$). Low BNP patients had a slightly lower PCWP at rest (12 vs 14 mmHg, $p = 0.02$) which was similar at peak exercise (27 vs. 30 mmHg, $p = 0.12$). Peak exercise SBP was similar (186 vs 174 mmHg, $p = 0.21$). Peak cardiac index was significantly higher in those with a low BNP (5.8 ± 1.5 vs 4.2 ± 1.3 L/min/m2, $p < 0.001$).

Conclusion: Patients with HFpEF and a low BNP have similar peak pulmonary capillary wedge pressures but significantly higher augmentation in cardiac index. Resting natriuretic peptide levels may be closely linked with systolic dysfunction in HFpEF. Further studies are required to determine the diagnostic utility of natriuretic peptide levels in HFpEF, particularly in regard to the different haemodynamic phenotypes of the disease.

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Low Expression of Secreted Frizzled Receptor Protein 5 (Sfrp5) in Human Right Atrial Appendage is Associated with Diastolic Dysfunction

C. Kelly [1,2,*], A. Nesbitt [1,2], A. Croft [1,2], T. Senanayake [1,2,3], L. Simoes [1,2,3], N. Mabotuwana [1,2], A. Boyle [1,2,3], D. Ngo [1,2], A. Sverdlov [1,2,3]

[1] Hunter Medical Research Institute, New Lambton Heights, Australia
[2] University of Newcastle, Callaghan, Australia
[3] John Hunter Hospital, New Lambton Heights, Australia

Background: Secreted frizzled-related protein 5 (Sfrp5) has been described as a novel anti-inflammatory adipokine similar to adiponectin. Sfrp5 deficiency is associated with impaired metabolic phenotype, and hindlimb ischaemia. Furthermore, Sfrp5 deficiency leads to greater myocardial infarct size following ischaemia reperfusion injury with increased apoptosis and inflammation in the infarct zone. In this study, we aimed to examine expressions of Sfrp5 in human cardiac right atrial appendages (RAA); and the associated cardiac functional significance.

Methods and Results: A total of 21 right atrial appendage biopsies were collected from patients (mean age: 65 ± 8 years) who underwent coronary artery bypass graft (CABG). A majority of patients (91%) were male; 40% of patients had previous MI. Protein expressions of Sfrp5 were measured in tissue lysates using commercially available ELISA (MyBiosource) indexed for total sample protein levels. There was no difference in Sfrp5 levels in RAAs from patients with previous MI, or hypertension. Patients with diabetes had significantly lower RAA Sfrp5 levels ($p = 0.02$). On univariate analysis, there was no relationship between RAA Sfrp5 levels with age or BMI, or measure of cardiac diastolic function (E/E') ($p = 0.07$). On multivariate analysis, adjusted for age, BMI, previous MI, diabetes, hypertension, dyslipidaemia, low RAA Sfrp5 levels were significantly associated with high E/E' ($\beta = -0.56$, $p = 0.01$).

Conclusions: Sfrp5 is expressed in human cardiac tissue. Deficiency of cardiac Sfrp5 levels is associated with regulations of diastolic cardiac function. Our data are in support of the potential role of Sfrp5 in the pathogenesis of metabolic-induced cardiac dysfunction.

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Low levels of IgG Antibodies Against Malondialdehyde Conjugated with Human Serum Albumin, Associates with Higher Risk of Stroke in 60-year-old males

S. Samal [1,*], M. Vikström [2], J. Frostegård [1]

[1] Unit of Immunology and Chronic Disease, Karolinska Institutet, Sweden
[2] Cardiovascular and Nutritional Epidemiology, Karolinska Institutet, Sweden

Malondialdehyde (MDA) is by-product of lipid peroxidation as in oxidised low-density lipoprotein. We here studied the association between IgG antibodies against Malondialdehyde (anti-MDA) and risk of cardiovascular events such as stroke, angina and myocardial infarction in this cohort. Low levels of IgG anti-MDA conjugated with human serum albumin concentrations were measured by Enzyme Linked Immunosorbent Assay (ELISA). The association between IgG anti-MDA was examined. 84 months follow-ups were conducted in Stockholm County for 60-year-old men and women in which the risk factors associated in the screening of cardiovascular events for 2039 men and 2193 women along with 209 incident cardiovascular disease cases were evaluated (they are defined as new events for ischaemic stroke, myocardial infarction, coronary heart disease, and for angina pectoris) along with 620 age and gender matched controls were tested for IgG anti-MDA by ELISA. Antibodies peptide/protein characterisation was done using de novo sequencing approach. After adjusting the crude model for type 2 diabetes mellitus, hyperlipidaemia, hypertension, smoking, body-mass index, etc. an increased CVD risk was observed in low IgG anti-MDA below 10th Percentile and found to be more protective above 66th Percentile. Especially the stoke data in males, percentiles below 10th and 25th (Hazard ratio and 95% CI: 2.333; 0.406–13.394 and 2.636; 0.687–10.122, respectively) versus above 66th and 75th percentile (Hazard ratio and 95% CI: 0.336; 0.094–1.200 and 0.267; 0.060–1.195, respectively). IgG anti-MDA is a risk marker for cardiovascular disease mostly with stroke in males. This finding can have diagnostic and therapeutic implications.

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Mind the Gap: Clinician Perceptions of Quality of Life in Advanced Heart Failure. What are We Missing?

R. Prichard [1,*], P. Davidson [2], S. Goodall [4], C. Hayward [3]

[1] Health Faculty, University of Technology Sydney, Ultimo, Australia
[2] School of Nursing, Johns Hopkins University, Baltimore, United States
[3] Heart Lung Program, St Vincent's Hospital, Sydney, Australia
[4] CHERE, University of Technology Sydney, Ultimo, Australia

Objectives: Quality of life (prQoL) is rarely measured in the clinical setting. But in the absence of patient-reported data, clinicians will rely on formal and informal assessments to support clinical and shared decision-making . This study compares clinician estimates with patient-reported QoL and examines the factors influencing the gap between them (inter-rater gap).

Methods: 75 advanced heart failure patients (22 female, 53 males) completed the EQ5D-5L; 39 clinicians (11 medical, 23 nursing and 5 allied health) completed the proxy version (V1) producing 194 dyads. Bland Altman analyses examined bias and confidence intervals, and Spearman rank coefficients were used to assess correlation. The inter-rater gap between paired utility were compared using independent student t-tests.

Results: Clinician EQ5D utility scores were moderately correlated ($r = 0.38$) with patient scores ($r = 0.38$), but were significantly higher on average at 0.60 vs 0.54 ($p = 0.008$), with negative bias apparent in 3/5 of the prQoL domains.

No significant improvement in correlation was found with clinician experience, profession, or how long the patient was known to the clinician. However patient sex = female, depressed mood and measured frailty all significantly increased the inter-rater gap.

Conclusions: Specialist clinicians in this sample overestimate quality of life for patients assessed. Factors affecting clinician perceptions of QoL including patient sex, mood and measured frailty suggest that formal screening for Patient-reported QoL could enhance clinical conversations and decision-making.

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Modern Classification and Outcomes of Heart Failure in Hunter New England Local Health District (HNELHD)

M. Al-Omary [1,2,3,*], S. Sugito [1], D. McIvor [1], T. Majeed [2,3], A. Boyle [1,2,3], A. Sverdlov [1,2,3]

[1] Cardiovascular Department, John Hunter Hospital, New Lambton Heights 2305, Australia
[2] Hunter Medical Research Institute, New Lambton Heights 2305, Australia
[3] School of Medicine and Public Health/The University of Newcastle, Callaghan 2308, Australia

Background: There are limited data comparing treatment and outcomes between heart failure (HF) types in Australia. We analysed the outcomes according to the 2018 Australian HF guidelines definitions.

Aim: Comparison of outcomes and adherence to guideline-directed therapy between HF with reduced ejection fraction (HFrEF) and HF with preserved ejection fraction (HFpEF).

Methods: We identified all index HF hospitalisations in 2014 at John Hunter and Tamworth Hospitals in HNELHD using ICD10 I50 code in the first four diagnoses. Patient characteristics, echocardiography and outcomes data were analysed.

Results: 664 patients were identified: 193 patients with HFrEF (29%), 247 patients with HFpEF (37%) and the remainder (224, 34%) were not classified due to lack of echocardiography data (non-class-HF). Non-class-HF patients were older with a median age of 82 years ($P < 0.001$). HFrEF patients were predominantly male (66%, $P < 0.001$). Predominant reason for admission was myocardial ischaemia in HFrEF group (27%) and infection in the other two categories. Ischaemic heart disease (IHD) was the predominant aetiology of HF (48%). IHD and hypertension were the commonest co-morbidities (50% and 60%, respectively). At discharge, ACEi/ARB were prescribed in 61% of HFrEF, 55% of HFpEF and 50% of non-class-HF patients ($P < 0.001$). β-blockers and mineralocorticoid receptor antagonists were prescribed in 74% and 39% of patients, respectively, in the HFrEF group. 1-year mortality was 30% overall and highest in non-class-HF (38%) ($P = 0.003$). 1-year all-cause readmission was highest in HFpEF (59%) ($P = 0.001$).

Conclusion: Echocardiography and guideline-directed therapy were under-utilised. All types of HF are associated with high morbidity and mortality.

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Neutralisation of the Anti-Angiogenic Isoform of Vascular Endothelial Growth Factor-A: VEGF-A165b is Associated with Weight Gain Independent of High Fat/High Sucrose Feeding

A. Nesbitt [1,2,*], C. Kelly [1,2], A. Croft [1,2], D. Chen [1,2], A. Sverdlov [1,2,3], D. Ngo [1,2,3]

[1] Hunter Medical Research Institute, Newcastle, Australia
[2] The University of Newcastle, Newcastle, Australia
[3] John Hunter Hospital, Newcastle, Australia

Introduction: Adipose tissue (AT) microvascular function is important in regulating AT health, and overall metabolic function. Overexpansion of AT in obesity is associated with microvascular dysfunction. The anti-angiogenic isoform of VEGF-A: VEGF-A165b has been shown to modulate AT angiogenesis and vascular endothelial function in obesity. In this study, we aim to determine whether targeted inhibition of VEGF-A165b will result in changes in AT and metabolic function.

Methods and Results: C57bl/6 mice were fed either normal chow (NC) or high-fat/high-sucrose (HF/HS) diet (36% fat/34% sucrose) for 1 month to induce obesity. Mice were divided into 4 groups of treatment ($n = 8$ per group): (1) NC + IgG isotype control intraperitoneal injection (IP) (100 ug/100 uL), (2) NC + VEGF-A165b neutralising antibody (IP, 100 ug/100 uL), (3) HF/HS diet + IgG injection, and (4) HF/HS + VEGF-A165b neutralising antibody. Mice fed a NC diet with VEGF-A165b treatment had significant weight gain vs IgG control ($p < 0.05$). While there was significant weight gain between NC vs HF/HS ($p = 0.01$) in the IgG control group; there was no difference in weight gain between NC vs. HF/HS feeding in the VEGF-A165b group. Upon glucose tolerance test (2 g/kg), NC + VEGF-A165b treatment had some impairment in glucose tolerance vs IgG control ($p = 0.06$); HFHS+VEGF-A165b resulted in significant impairment in glucose tolerance vs. NC + EGF-A165b ($p < 0.05$). Neutralisation of anti-angiogenic VEGF-A165b resulted in significant increase in aortic sprout counts using Matrigel assays ($p < 0.05$).

Conclusions: At 1 month of diet-induced obesity, neutralisation of the anti-angiogenic isoform VEGF-A165b resulted in increase in weight gain and metabolic impairment.

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Non-Invasive Blood Pressure Monitoring Underestimates Exercise-Induced Hypertension in Heart Failure with Preserved Ejection Fraction (HFpEF)
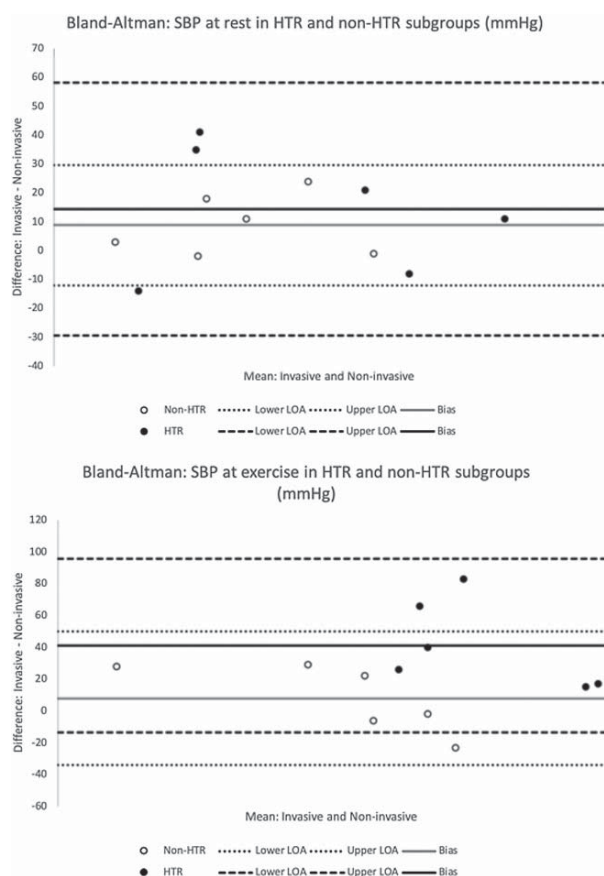
L. Cieslik [1,*], H. Patel [1], A. Beale [1,2,3], J. Mariani [1,2,3], S. Nanayakkara [1,2,3], D. Kaye [1,2,3]

[1] *Department of Cardiology, The Alfred Hospital, Melbourne, Australia*
[2] *Baker Heart and Diabetes Institute, Melbourne, Australia*
[3] *Department of Medicine, Monash University, Melbourne, Australia*

Hypertensive response to exercise (HTR - peak systolic blood pressure (BP) ≥ 190 mmHg in women; ≥ 220 mmHg in men during exercise) contributes to the development of HFpEF and subsequent exercise intolerance. This study assesses the reliability of non-invasive (NI) BP monitoring for the diagnosis of HTR in suspected HFpEF patients undergoing exercise right heart catheterisation (ExRHC).

Bland-Altman: SBP at rest in HTR and non-HTR subgroups (mmHg)

Bland-Altman: SBP at exercise in HTR and non-HTR subgroups (mmHg)

Methods: Data from 12 patients with suspected HFpEF undergoing ExRHC were retrospectively analysed. BP was recorded simultaneously from invasive radial arterial monitoring (IBP) and NI cuff measurements. 6 patients met HTR criteria from IBP monitoring, and 6 did not (non-HTR). BP

at rest and peak exercise in the HTR and non-HTR subgroups were correlated and also analysed for agreement using the Bland-Altman method and plotted graphically as shown.

Results: NIBP monitoring detected HTR in only 2 of 6 (33%) cases. Poor correlation between IBP and NIBP at exercise in HTR is demonstrated from Pearson correlation coefficient analysis: Non-HTR – rest $r = 0.88$; exercise $r = 0.87$ – HTR: rest $r = 0.81$; exercise $r = 0.44$. Agreement between measurement techniques diverges at peak exercise; with this discrepancy exaggerated in patients with HTR.

Conclusion: Invasive BP monitoring may be required to accurately diagnose HTR in this patient cohort, and its use could be considered during ExRHC.

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Optimal Design of Dendrimer Nanotechnology to Deliver a Peptide as a Therapeutic to the Heart

A. Shah [1,*], H. Viola [1], M. Norret [2], J. Kretzmann [2], K. Iyer [2], L. Hool [1,3]

[1] *School of Human Sciences, The University of Western Australia, Perth, Australia*
[2] *School of Molecular Sciences, The University of Western Australia, Perth, Australia*
[3] *Victor Chang Cardiac Research Institute, Sydney, Australia*

A current strategy for the effective delivery of therapeutic peptides, proteins and nucleic acids is *via* conjugation with multifunctional nanoparticles. We have designed novel branched polymers (dendrimers) to deliver a peptide derived against the alpha-interaction domain (AID) of the L-type Ca^{2+} channel (LTCC) into the heart. Generation 5 dendrimers with 8% branching (G5F8) at a dendrimer: peptide ratio of 100:1 (100:1G5F8), effectively deliver AID to cardiomyocytes, but are not well cleared from the kidneys. We reduced the dendrimer:peptide ratio to 8:1, and assessed *in vitro* and *in vivo* cardiac uptake and function.

Uptake of rhodamine labelled 8:1G5F8 conjugated peptide occurred in a similar manner to 100:1 G5F8 (8:1G5F8: 49 ± 3min, $n = 28$ versus 100:1 G5F8: 53 ± 2min, $n = 30$, $p = $NS) in adult C57BL6J cardiomyocytes. We have demonstrated that activation of LTCC increases mitochondrial membrane potential (MMP) in cardiomyocytes. We monitored alterations in MMP following activation of LTCC with agonist BayK(-) in the presence of AID-tethered 8:1 or 100:1 G5F8(G5F8-AID). Both 8:1 and 100:1 G5F8-AID attenuated BayK(-) induced increases in MMP, assessed as changes in JC1 fluorescence (8:1G5F8-AID: $18.04 \pm 4.04\%$ increase, $n = 15$ and 100:1G5F8-AID: $19.26 \pm 2.55\%$ increase, $n = 15$ versus BayK(-) alone: $32.72 \pm 2.02\%$ increase, n=13; $p < 0.05$). We performed *in vivo* biodistribution studies in BALB/c nude mice administered *sulfo*-cyanine7 labelled 8:1 G5F8-AID (8:1G5F8-AID-Cy7) via intraperitoneal injection. Significant cardiac uptake occurred within 1 hr versus scrambled peptide (3-fold longer, $n = 8$, $p < 0.05$). Additionally, 8:1G5F8-AID treatment was not toxic (liver and kidney enzyme assays).

We conclude that the use of 8:1 G5F8 dendrimers are safe and effective delivery vehicles for the AID peptide.

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Performance Outcome Measure Comparison between Multidisciplinary Team Approaches and Traditional Cardiologist Care Approaches within GenesisCare Cardiology for Patients with Heart Failure

R. Hamilton [1,*], J. McGillion [2], M. Duong [3], D. Eccleston [2], P. Srivastava [2], S. Delacroix [3], L. Kearney [2]

[1] GenesisCare Cardiology, Brisbane, Australia
[2] GenesisCare Cardiology, Melbourne, Australia
[3] GenesisCare Cardiology, Adelaide, Australia

Introduction: The 2018 Australian Heart Failure (HF) guidelines recommend inclusion of key process and outcome measures into HF care models to optimise outcomes.

Methods: We retrospectively compared conformance with these recommendations in a 1:1 comparison study of 400 patients managed for HF within the multidisciplinary GenesisCare HF Management Clinics (GC-HFMC) and the traditional GenesisCare Cardiologist clinic (GC-TCC) between 1st July 2016–31st June 2018.

Results: Both models achieved high conformance with pharmacological management strategies. The GC-HFMC achieved higher rates for non-pharmacological measures. The high adherence with performance measures within the GC-HFMC translated into excellent clinical outcomes with very low 30-day and 1-year HF-admission rates (1.6% and 8.1%), 30-day and 1-year all-cause mortality (0.5% and 5.6%). Outcome measurement was not routinely collected within the GC-TCC.

Performance Outcome Measure (POM)	GC-HFMC	GC-TCC	p-value
Documented Cardiac Rehab referral (POM 5)	20%	7%	$P < 0.0001$
Documented exercise advice	88%	7%	$P < 0.0001$
Documented screening for depression (POM 7)	89%	9%	$P < 0.0001$
Prescription: ACE Inhibitor/ARNI/ARB (POM 9)	65%	78%	$P = 0.004$
Prescription: Beta Blocker (POM 10)	90%	84%	$P = 0.075$
Prescription: MRA (POM11)	52%	24%	$P < 0.0001$

Conclusion: This study supports the development of quality, evidence-based multidisciplinary HF clinics to achieve the best outcomes for Australian HF patients.

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Persistent Renal Dysfunction Preceding Left-Ventricular Assist Device Implantation Predicts Increased Mortality and Diminished Left-Ventricular Unloading

J. William [1,*], N. Dayawansa [1], V. Mak [1,2], A. Leet [1], D. Kaye [1,2], S. Nanayakkara [1,2]

[1] The Alfred Hospital, Department of Cardiovascular Medicine, Melbourne, Australia
[2] Baker Heart and Diabetes Institute, Melbourne, Australia

Background: A significant proportion of left-ventricular assist device (LVAD) recipients have pre-implantation renal dysfunction. However, the renal and clinical outcomes for these patients have not been explored in an Australian cohort.

Methods: Data were retrospectively collected for 120 consecutive LVAD recipients at a single health service. Patients with persistent renal dysfunction pre-VAD were defined as having an average eGFR $<60\,\text{ml/min}/1.73\,\text{m}^2$ in the eight weeks preceding LVAD insertion (Group 1, $n = 38$), and were compared to patients with average eGFR $>60\,\text{ml/min}/1.73\,\text{m}^2$ in the same time frame (Group 2, $n = 82$).

Results: Improvement in eGFR between pre-VAD and 6-months post-VAD was similar in Groups 1 and 2 (16 ± 22 vs $23 \pm 26\,\text{ml/min}/1.73\,\text{m}^2$, $p = 0.18$). At six months post-LVAD, Group 1 patients demonstrated significantly higher left-atrial volume index ($54 \pm 31\,\text{ml/m}^2$ vs $41 \pm 19\,\text{ml/m}^2$, $p = 0.01$) and pulmonary capillary wedge pressure (PCWP) ($16 \pm 7\,\text{mmHg}$ vs $11 \pm 5\,\text{mmHg}$, $p = 0.01$). In a multivariate regression analysis controlling for pre-VAD PCWP, LV end-diastolic diameter, LV ejection fraction and body surface area, eGFR pre-VAD was found to be an independent predictor of PCWP 6 months post-VAD ($R^2 = 0.43$, $p = 0.001$). All-cause mortality was higher for Group 1 patients at 1 month (6% vs 18%, $p = 0.03$) and 6 months (7% vs 24%, $p = 0.02$) post-VAD. Mean time to transplant waitlisting was higher in Group 1 (4.8 ± 1.8 months vs 3.7 ± 1.5 months, $p = 0.01$).

Conclusion: Patients with concomitant heart failure and persistent renal dysfunction may demonstrate partial renal recovery following LVAD implantation. However, these patients are less likely to achieve optimal reduction in pulmonary pressures and have higher rates of LVAD mortality.

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Predictors and Consequences of Optimal Mechanical Unloading in LVAD Recipients

J. William [1,*], V. Mak [1], A. Leet [1], D. Kaye [1,2], S. Nanayakkara [1,2]

[1] The Alfred Hospital, Department of Cardiovascular Medicine, Melbourne, Australia
[2] Baker Heart and Diabetes Institute, Melbourne, Australia

Background: Left-ventricular assist devices (LVADs) elicit reverse remodelling by mechanically unloading the left

ventricle. Current guidelines target a reduction in LV end-diastolic diameter (LVEDD) of 15% compared to pre-LVAD dimensions, however there is significant heterogeneity in the degree of unloading achieved. We sought to investigate what factors predict optimal unloading at 6 months of LVAD support.

Methods: Data were retrospectively collected for 75 LVAD recipients at five time points: pre-LVAD, within 14 days post-LVAD, then at 1, 3 and 6 months. The percentage change in LVEDD comparing pre-LVAD and 6 months was termed ΔLVEDD. Optimal LV unloading was defined as ΔLVEDD of ≤-15% at 6 months. Patients who achieved optimal unloading (Group A, $n = 30$) were compared with patients who did not (Group B, $n = 45$).

Results: At 6 months, optimally unloaded patients (Group A) demonstrated higher fractional shortening ($15 \pm 10\%$ vs $10 \pm 7\%$, $p = 0.007$), lower rates of moderate-severe mitral regurgitation (10% vs 33%, $p = 0.02$) and lower pulmonary wedge capillary pressure (9 ± 4mmHg vs 16 ± 7mmHg, $p = 0.02$). Right-ventricular (RV) dysfunction was more prevalent at 6 months in Group B patients (73% vs 43%, $p = 0.008$). Between hospital discharge and 6 months, percentage increase in device speed was higher in Group A (ΔRPM $4.4 \pm 3.7\%$ vs $0.1 \pm 2.6\%$, $p < 0.001$). In a multivariate analysis, ΔRPM and RV basal diameter were independent predictors of 6-month ΔLVEDD.

Conclusion: Optimal unloading, defined as a reduction in LVEDD of 15% compared to pre-LVAD dimensions, is associated with improved mitral valve function and reduced PCWP. LVAD-induced RV dysfunction and failure to uptitrate LVAD pump speeds may predict patients with sub-optimal unloading.

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Predictors of Congestive Readmission Within 6 Months Following Acute Decompensated Heart Failure

R. Moriswala [1,*], A. Antoo [1], E. Scholes [2], M. Seman [1], K. Simons [1], A. Mulligan [1], N. Cox [1], C. Neil [2]

[1] *Department of Cardiology, Western Health, Footscray, Australia*
[2] *Department of Medicine, University of Melbourne, Melbourne, Australia*

Introduction: Acute decompensated Heart Failure (ADHF) is frequently followed by rehospitalisation, with or without the repeat development of congestion. Prediction of the specific mode of readmission may inform rehospitalisation prevention programs. Hence, we sought to determine predictors of "congestive readmission" within 6 months of discharge, controlling for multiple clinical factors, including comorbid acute kidney injury (AKI).

Method: Consecutive patients with ADHF admitted to a single tertiary centre (July 2015–July 2017) were included, with diagnosis adjudicated by the Boston Criteria. AKI was defined by KDIGO-criteria, at the time of admission (AKI_{ADM}) and the subsequent inpatient stay (AKI_{IP}). Read-

mission data were collected for up to 6 months post-discharge. Determinants of congestive readmissions were evaluated using univariate and multivariate regression models.

Results: Of 361 patients (median age 82 years, 55% male, 56% HFrEF), 206 experienced readmission episodes within 183 days; 40% of these were congestive readmissions. Univariate predictors of congestive readmission included admission creatinine ($p < 0.005$), type 2 diabetes ($p < 0.02$), severe LV-systolic dysfunction ($p < 0.03$) and ischaemic heart disease ($p < 0.05$). A multivariate regression model demonstrated that congestive readmissions were significantly associated with AKI_{ADM} ($p < 0.03$; OR 2.20), but not with AKI_{IP}.

Conclusion: Baseline characteristics of those experiencing congestive versus non-congestive modes of 6-month readmission appear to differ, with greater degrees of LV systolic dysfunction and a greater burden of diabetes and ischaemic heart disease. However, the association of AKI_{ADM} with subsequent congestive readmission is novel and the implications for risk-prediction and prevention should be further explored.

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Prevalence and Management of Cardiomyopathy in Adult Patients with Muscular Dystrophies

S. Monagle [1,*], D. Prior [1,2], T. Roberts [1], J. Coller [1]

[1] *St Vincent's Hospital Melbourne, Fitzroy, Australia*
[2] *University of Melbourne, Parkville, Australia*

Background: Cardiomyopathy is common in the setting of muscular dystrophy (MD). As life expectancy has improved with treatment of neuromuscular-associated respiratory failure, patients surviving into adulthood are at risk of developing cardiomyopathy. However, MD-associated cardiomyopathy is often underdiagnosed and undertreated.

Methods and results: We conducted a retrospective review of patients seen at the St Vincent's Neuromuscular Cardiology and Heart Failure Clinics between February 2018–February 2019. Twenty six patients were identified, with diagnoses of Duchenne MD ($n = 18$), Becker MD ($n = 3$), limb girdle MD ($n = 2$), congenital MD ($n = 2$) and Emery Dreifuss MD ($n = 1$).

Most patients were male ($n = 24$, 84.6%) and non-ambulant, with mean age 24.7 ± 7.1 years. Transthoracic echocardiogram had been performed in almost all patients ($n = 24$, 93.2%) in the past 12 months. A left ventricular ejection fraction (LVEF) $\leq 55\%$ was identified in a third of patients ($n = 8$, 34.8%). More severe LV dysfunction with LVEF $\leq 40\%$ was identified in 2 patients (7.7%). The majority of patients were prescribed an ACE inhibitor ($n = 22$, 84.6%), while nearly half of the cohort were prescribed a beta blocker ($n = 12$, 46.1%). Analysis of global longitudinal strain was performed in only a small proportion of patients (n = 5, 4.2%) due to limited image quality in this patient cohort.

Conclusion: Muscular dystrophy is associated with significant cardiomyopathy, which may shorten life expectancy. This unique population can benefit from careful cardiac surveillance with echocardiography to detect cardiomyopathy and allow early pharmacological treatment.

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Prevalence and Prognostic Significance of Chronic Kidney Disease in Patients with Heart Failure and Preserved Ejection Fraction in Australia

L. Kearney *, S. Kim, K. Lu, J. McGillion, M. Duong, S. Delacrix, D. Eccleston

Genesiscare, Leabrook, Australia

Introduction: Heart failure (HF) with preserved ejection fraction (HFPEF) is characterised by challenging fluid management with the potential to adversely affect renal function.

Methods: We assessed the prevalence and prognostic significance of stage 3–5 chronic kidney disease (CKD) in patients with HFPEF, managed within the GenesisCare Heart Failure Management Clinic (GC-HFMC) network in Australia. Baseline characteristics, all-cause mortality and HF hospitalisation at 1 year and intermediate term follow-up were compared between those with and without stage 3–5 CKD.

Results: 297 consecutive patients were included with a mean age of 79 ± 10 years. Of these, 62% were female, and there was a history of hypertension in 83% and diabetes in 34%. Prevalence of CKD stage 3–5 was 45%. Baseline diuretic utilisation was 81%, with 26% of patients being on ≥ 2 diuretic agents. Renin-Angiotensin system (RAS) blockade use was 59%. Over a prospective follow-up of 1.8 years (IQR 1.0–2.5 years), there were 38 deaths (13%) and 40 HF hospitalisations (14%). Univariate predictors of mortality included age ≥ 75 years (OR 5.9, $p = 0.004$), CKD (OR 2.4, $p = 0.02$) and RAS blockade (OR 0.46, $p = 0.03$) but not hypertension or diabetes. CKD stage 3–5 was also a predictor of HF hospitalisation (OR 3.9, $p < 0.001$).

Conclusions: The combination of HFPEF and CKD stage 3–5 identifies high-risk patients in whom frequent review and close attention to fluid balance and diuretic use is warranted.

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Prevalence of Medications Linked to Heart Failure in Hospitalised Patients – A Retrospective Analysis

R. Sriamareswaran [1,*], M. Solomon [2], E. Subhas [1], M. Premaratne [3,4,5]

[1] *Department of Medicine, Peninsula Health, Wantirna South, Australia*
[2] *Department of Pharmacy, Peninsula Health, Frankston, Australia*
[3] *Peninsula Heart Service, Frankston, Australia*
[4] *Baker Heart and Diabetes Institute, Melbourne, Australia*
[5] *Monash University, Clayton, Australia*

Approximately 2% of the Australian population suffer from heart failure. Exacerbations of heart failure affect 158,000 patients costing $2 billion annually. The American Heart Association (AHA) Scientific Statement lists 77 medications that cause exacerbations in heart failure leading to increased hospitalisation. We sought to identify the number of patients admitted to a tertiary hospital with exacerbations of heart failure having been prescribed medications as per the scientific statement.

Patients receiving an ICD-10 coding for heart failure, admitted to Frankston hospital in 2017 were included in this study while patients with new diagnosis of heart failure were excluded. Pharmacy reconciliation performed on admission for each patient was analysed to identify medications implicated in causing exacerbations of heart failure.

601 patients were admitted in the 2017 calendar year. 277 patients were prescribed at least one medication listed in the AHA statement, prior to their admission. 75 of those patients were on two undesirable medications, 11 patients were on three undesirable medications whilst 1 patient was on five of those medications. Metformin was the most commonly prescribed medication (97 patients) followed by pregabalin (87 patients). Other commonly used medications included sitagliptin, tricyclic antidepressant and prazosin. During their hospitalisation, 157 patients had a reduction of one or more medications that are undesirable in heart failure.

The exact contribution of these medications to heart failure exacerbations is unclear. We are currently in the process of analysing if adjustment of these medications has led to a reduction in admissions with exacerbations of heart failure.

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This abstract has been withdrawn

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Protection of Cardiomyocytes against Doxorubicin-Induced Toxicity by Drug Transporter Mediated Efflux

C. Kok [1,2,*], R. Skelton [1], S. Igoor [1],
G. Ghossein [1], R. Rao [1], J. Chong [1,2,3],
E. Kizana [1,2,3]

[1] Centre for Heart Research, Westmead Institute For Medical Research, Westmead, Australia
[2] Westmead Clinical School, Faculty of Medicine and Health, The University of Sydney, Westmead, Australia
[3] Department of Cardiology, Westmead Hospital, Westmead, Australia

Doxorubicin is an anti-cancer drug used in treating a variety of malignancies. However, its major adverse effect is cardiotoxicity, which is dose dependent and can be either acute or chronic. Doxorubicin causes injury by DNA damage, formation of free reactive oxygen radicals and induction of apoptosis. Our aim is to induce expression of the multiple drug transporter gene (MRP1) in cardiomyocytes derived from human iPS cells (iPSC-CM), to determine whether this will allow cells to effectively remove doxorubicin. We generated a lentivirus vector for inducing expression of MRP1 (LV.MRP1) and validated its function in iPSC-CM by qPCR and western blot. We successfully showed increase of MRP1 mRNA and protein in transduced cells. The activity of the overexpressed MRP1 was also tested, by using an efflux assay to quantify the amount of CDFA dye exported from the cell by the transporter. We demonstrated reduced dye sequestration in cells overexpressing MRP1. We also determined the dose of doxorubicin at which cell viability is significantly reduced. Finally, we demonstrated that iPSC-CM transduced with LV.MRP1 were protected against doxorubicin, and resulted in a reduced level of apoptosis. In conclusion, we have optimised the conditions for gene delivery to human iPSC-CM *in vitro*. We have also shown that we can successfully over-express MRP1 protein in iPSC-CM, with functional transporter activity leading to protection against doxorubicin-induced toxicity.

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Taking the Pulse of Timor-Leste's Cardiac Needs: a Ten-Year Descriptive Time Trend Analysis

E. Paratz [1,*], N. Mock [2], S. Gutman [1],
A. Horton [3], L. Creati [4], A. Appelbe [5],
V. Kushwaha [6], I. da Silva Almeida [7],
A. Monteiro [7], N. Bayley [2]

[1] Baker Heart & Diabetes Institute, Melbourne, Australia
[2] East Timor Hearts Fund, Melbourne, Australia
[3] Monash Medical Centre, Melbourne, Australia
[4] St Vincent's Hospital, Melbourne, Australia
[5] Geelong Hospital, Geelong, Australia
[6] Prince of Wales Hospital, Sydney, Australia
[7] Hospital Nacional Guido Valadares, Dili, Timor Leste

Background: The East Timor Hearts Fund (ETHF) is a charitable organisation involving Australian cardiologists providing outreach screening and cardiac interventions.

Methods: The ETHF database was sectioned into two-year intervals (2009/10, 2011/12, 2013/14, 2015/16, 2017/18). Patient demographics and clinical outcomes were compared to assess temporal change, with subgroup analysis of adult (>18 years old), paediatric and interventional patients.

Results: Over 10 years, 2,050 patient encounters have occurred. ETHF reviewed 14 times as many patients in 2017/18 as in 2009/10 (1,119 vs 80 patients). Rheumatic and congenital cardiac disease remain very common (39.1% of adult and 74.2% of paediatric new patients), with 1.4% of new patients exhibiting both pathologies simultaneously. Amongst adult patients, median age and proportion of male patients are rising ($p < 0.0001$). The number of new patients identified with serious rheumatic or congenital heart disease tripled in 2017/18 compared to 2009/10 (99 vs 34 patients, respectively, $p < 0.0001$). Paediatric case volume has increased over ten-fold (288 new patients in 2017/18 vs 24 in 2009/10, $p < 0.0001$), with corresponding increase in proportion of paediatric interventions (59.4% in 2017/18 vs 25.0% in 2009/10, $p = 0.027$). Patients undergoing intervention ($n = 87$) have extremely low post-procedural complications and mortality (3.4% and 1.1%, respectively), and 100% of eligible patients attend at least one post-procedure appointment.

Conclusions: Timorese demand for cardiac services has grown exponentially over the decade, with half ETHF's clinical volume undertaken in the most recent two-year period. Patient demographics are altering over time and an increasing number of interventions are being conducted, with excellent outcomes and patient follow-up.

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Takotsubo Cardiomyopathy (TCM) Snapshot 2018: A Contemporary Analysis from a Rural Tertiary Referral Centre

M. Tierney [1,*], K. McMaster [1], A. Elder [1], R. Arnold [1], D. Amos [1], H. Lowe [1,2]

[1] *Orange Health Service, Orange, Australia*
[2] *Sydney University, Sydney, Australia*

Background: Limited data exist examining TCM in rural populations.

Objective: To examine the current features of TCM in a single, rural, tertiary referral centre.

Methods: Retrospective database analysis of all patients undergoing angiography with TCM in 2018 at Orange Health Service, NSW.

Results: 35 patients with TCM were identified, from 1580 diagnostic procedures. Incidence was 13/100,000 population/year. Mean age = 71 ($\pm$11). $N = 32$ (91%) were female. Physiological stressors were present in $n = 16$ (46%), emotional triggers in $n = 12$ (34%), of which major grievance (family death/illness) occurred in $n = 7$ (58%). Males ($n = 3$) had exclusively physiological stressors. Chest pain was present in $n = 24$ (69%). Mean initial Ejection Fraction was 39% ($n = 26$). $N = 30$ (86%) patients had an Inter-TAK score of >40, with those $\leq$40 ($n = 5$) all diagnostic of TCM by imaging.

"Classical" apical TCM accounted for $n = 26$ (76%) with midventricular ($n = 4$, 12%), focal ($n = 3$, 9%) and basal ($n = 1$, 3%) variants. Eight (23%) patients had a prior cancer diagnosis, with 1 patient having prior chemotherapy. $N = 16$ (46%) patients had prior neurological or psychiatric diagnoses. $N = 11$ (31%) patients experienced significant complications, including systemic embolism ($n = 5$) and acute pulmonary oedema ($n = 4$). $N = 28$ (80%) patients had an admission <10 days. In all cases of >10 day admission ($n = 7$), this was secondary to the initial physiological stressor. 33/35 patients (94%) returned to premorbid function.

Conclusions: TCM in this rural population is common, and associated with significant acute morbidity but high recovery rates, comparable to previous reports. Recently suggested associations with prior cancer - though not chemotherapy - appear reflected in this population.

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Takotsubo Cardiomyopathy Triggered by Status Epilepticus - Review of Cases

S. Nandal [1,*], A. Vlachadis Castles [1], M. Asrar ul Haq [1], W. Van Gaal [1,2]

[1] *The Northern Hospital, Epping, Australia*
[2] *The University of Melbourne, Melbourne, Australia*

Takotsubo Cardiomyopathy (TC) is an acute stress-induced cardiomyopathy with characteristic transient wall motion abnormalities that may occur in the context of acute illness or emotional stress. A database search of Pubmed, Embase and Medline of stress, broken heart or TC with epilepsy, seizure and status epilepticus revealed 48 TC cases reported related to seizure activity, and our review revealed 16 articles which included 14 case reports and 2 articles related to status epilepticus in adults.

There were total of 48 patients with TC in setting of status epilepticus reported, with demographics of female gender (60%) and mean age of 58 ($\pm$18 years). Convulsive status epilepticus aetiology was more common than non-convulsive status. Interestingly, most patients remained asymptomatic despite significant electrocardiographic, biochemical or echocardiographic changes. ECG changes commonly elicited were ST and T wave changes and apical hypokinesis/akinesis were the most common echocardiography finding (11 of 14 reports).

A high index of suspicion is required to make the diagnosis of TC in patients with status epilepticus, given most are asymptomatic. TC after seizures has been suspected as cause of sudden unexplained death in epilepsy (SUDEP) in some observational studies. Cardiac abnormalities are found in up to 33% patients at the time of autopsy of SUDEP with histopathological findings being similar to catecholamine-induced myocardial disease. Our review highlights that suspicion of TC is important in patients with status epilepticus. Early diagnosis and treatment could prevent fatal complications such as SUDEP.

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Takotsubo Cardiomyopathy: Association with Malignancies and Endocrinopathies

K. Fendel [1,3,*], L. Segan [2], A. Vlachadis Castles [1], L. McFarlane [2], J. Amerena [2], G. Vaddadi [1,4]

[1] *Northern Health, Epping, Australia*
[2] *Barwon Health, Geelong, Australia*
[3] *Austin Health, Heidelberg, Australia*
[4] *Cabrini Health, Malvern, Australia*

Background: Takotsubo cardiomyopathy is often preceded by a physical or emotional trigger resulting in transient left ventricular systolic dysfunction. Previous studies have evaluated traditional cardiovascular risk factors, however, possible neurohormonal mechanisms remain uncertain. We sought to explore the neurohormonal milieu associated with takotsubo cardiomyopathy by characterising the prevalence of pre-existing endocrinopathies and non-cutaneous malignancies in patients with takotsubo cardiomyopathy.

Methods: This retrospective study analysed demographical and clinical data of 240 cases of takotsubo cardiomyopathy diagnosed across two tertiary centres in Victoria, Australia between 2008 to 2018.

Results: Patients were predominantly female (91%) with a mean age of 66 $\pm$ 12 years. Forty-two patients (17.5%) had pre-existing endocrinopathy, including thyroid disease (11%), parathyroid disease (1%) and osteoporosis (7%). Thirty-three patients (13%) had a history of non-cutaneous malignancy (see Figure); of these the most common types of malignancy

were breast cancer (5%), gastrointestinal (4%), and gynaecological (2%) malignancy.

Malignancies in Patients with Takotsubo Cardiomyopathy

- No malignancy (87%)
- More than one malignancy (1%)
- Breast (5%)
- Lung (1%)
- Gynaecological (2%)
- Gastrointestinal (4%)
- Haematological (<1%)
- Other (<1%)
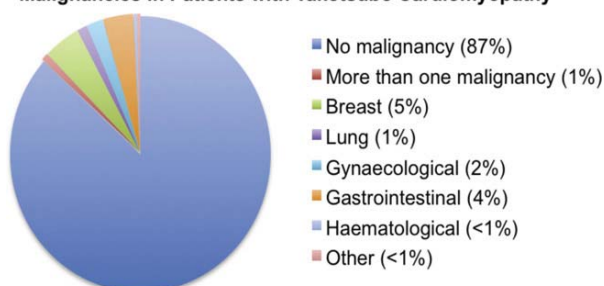
Discussion: Further studies are needed to clarify whether there may be an association between takotsubo cardiomyopathy and metabolic conditions such as endocrinopathies or malignancies. Understanding the neurohormonal milieu may facilitate targeted management of takotsubo cardiomyopathy.

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Takotsubo Cardiomyopathy: Phenotypic Diversity and Contemporary Management

L. Segan [1,2,*], A. Vlachadis Castles [3],
K. Fendel [3], L. McFarlane [1], G. Vaddadi [3],
J. Amerena [1]

[1] Barwon Health, Geelong, Australia
[2] Baker Heart and Diabetes Institute, Melbourne, Australia
[3] Northern Hospital, Melbourne, Australia

Introduction: Takotsubo Cardiomyopathy represents an acute transient decline in left ventricular (LV) function in the absence of an acute coronary event. Therapies vary due to a paucity of evidence-based guidelines.

Aims: Evaluate clinical and biochemical characteristics, management approach and outcomes in a contemporary cohort with Takotsubo Cardiomyopathy across two tertiary centres in Victoria, Australia.

Methods: 240 patients diagnosed between 2008–2018 identified from electronic medical records.

Results: Patients were predominantly female (91.3%, 66 ± 12 years), smokers (48.3%), and hypertensive (55%). Troponin rise was common (94.6%, peak troponin $6.4 \pm 13\,\mu g/L$), presenting as ST elevation in 21.7%. Precipitants included stress (44.6%), physical illness (39.2%) or unknown precipitant (16.7%).

Management was heterogeneous. Many were prescribed aspirin (37.7%), dual antiplatelets (34%) or statins (35.9%) without obstructive coronary disease or other indication and frequently continued beyond 1 year. ACE inhibitors or ARBs were initiated in 83.7%, beta blockers in 84.9% or both (74.9%), continuing beyond 1 year in 60.4%.

LV dysfunction occurred in 81.7% (LV ejection fraction (LVEF) $45 \pm 11\%$), recovering in 91.3% (LVEF $62 \pm 8\%$; 17.2% increase, $p < 0.001$), on repeat echocardiography. Follow up occurred in 81.4%. Heart failure therapy continued despite

LV recovery in 83.6%. 12-month mortality was rare (7.0%) as was recurrence (5.1%).

Discussion: Management of Takotsubo Cardiomyopathy remains challenging due to phenotypic diversity, variable management and unclear treatment duration. Antiplatelets and statins are not substantiated yet continue to feature in the treatment armamentarium. Further studies should target underlying mechanisms and establish a standardised therapeutic approach to promote LV recovery and prevent recurrence.

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Target Heart Rate Versus Beta Blocker Dosage in Patients with Heart Failure with Reduced Ejection Fraction

A. Bhat [1,3,4,*], H. Chen [1], A. Rao [2],
A. Latumahina [1], T. Tan [1,3,4], G. Gan [1,2,3,4]

[1] Department of Cardiology Blacktown Hospital, Sydney, Australia
[2] Department of Cardiology Ryde Hospital, Sydney, Australia
[3] University of New South Wales, Sydney, Australia
[4] Western Sydney University, Sydney, Australia

Background: Beta blocker (BB) remain the cornerstone of heart failure (HF) treatment. Uncertainty remains however regarding the importance of achieving guideline recommended doses of BB relative to target heart rate (HR) in patients with heart failure with reduced ejection fraction (HFrEF). The aim of this study was to compare the impact of achieving target BB dose compared to target HR on outcomes in this group.

Methods: Consecutive patients with HFrEF admitted to our institution from 2015–2017 were assessed. Patients who received cardio-selective BB were included and these patients were followed for up to five years for the end point of all-cause death. Dosage of BB and mean resting HR was determined from medical records. Target HR was defined as resting HR <70 bpm.

Results: 383 patients (70.31 ± 13.74 y, 65% males) were assessed. 106 (28%) patients achieved target HR. 85 (22%) patients achieved targe doses of BB. 209 patients met the outcome over a mean follow up period of 29.0 ± 15.8 months. Patients who died had higher rates of DM ($p = 0.04$) and AF ($p = 0.05$). On Kaplan Meier analysis, achieving target HR ($p < 0.01$) was associated with a survival benefit whereas achieving target dose of BB was not ($p = 0.11$). On Cox regression analysis, achieving target HR was the only predictor of survival in a model accounting for DM, AF, age and target BB dose with a hazard ratio of 1.52 (CI 1.09–2.12, $p < 0.01$).

Conclusion: Our study demonstrates that achieving target HR confers a survival benefit in HFrEF patients on cardio-selective BBs relative to achieving target BB doses.

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This abstract has been withdrawn

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The Baker Biobank: Understanding Cardiovascular Outcomes

T. Haregu [1], S. Nanayakkara [1,2,*],
B. Kingwell [1], G. Jennings [1], A. Dart [1,2],
M. Carrington [1], D. Kaye [1,2]

[1] *Baker Heart and Diabetes Institute, Melbourne, Australia*
[2] *Alfred Hospital, Melbourne, Australia*

Background: Cardiovascular diseases (CVDs) and diabetes are two of the most important public health problems. Outcomes for patients with these disorders vary considerably due to the added influence of a range of interacting clinical, metabolic, environmental, lifestyle, genetic and psychosocial risk factors. The Baker Biobank study was designed to characterise these factors to inform better risk prediction, earlier diagnosis and better treatment of CVDs and diabetes.

Methods: This paper describes the detailed methods for the establishment of the Baker Biobank. The study collected extensive phenotypic detail about the participants recruited mainly from the Departments of Cardiology and Respiratory Medicine at the Alfred Hospital, Healthy Hearts Program at the Baker Institute.

Results: A total of 6,530 adults were recruited into the Biobank. Majority of these participants (63%) were male. The mean (SD) age of the Biobank Cohort at the time of data collection was 57 (15) years. The study collected data on socio-demographic characteristics, behavioural/lifestyle factors, physical and biomarker measurements, medical and medication history. The study also collected and stored Guthrie cards, serum, plasma, buffy coat, whole blood collected in Tempus tubes (for RNA extraction). For some samples extracted DNA and RNA is stored. The Biobank data is also linked to echocardiogram and mortality datasets. The Biobank data and samples are available for researchers with approval of Biobank Steering Group and Human Research Ethics Committee.

Conclusion: The Baker Biobank provides a comprehensive baseline data and samples for the development of a series of cohorts for follow up studies in Australia.

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The Effects of Cardiac and Non-cardiac Comorbidities on Survival in Patients with Heart Failure and Reduced Ejection Fraction

L. Kearney[*], D. Eccleston, J. McGillion,
K. Lu, W. Thai, M. Duong, S. Kim,
R. Hamilton, S. Delacroix

Genesiscare, Leabrook, Australia

Introduction: The management of "real world" patients with heart failure and reduced ejection fraction (HFREF) requires consideration of the incremental prognostic influence of advancing age, cardiac and non-cardiac comorbidities.

Methods: We evaluated the prognostic utility of the age-adjusted Charlson comorbidity index (age-CCI) with respect to all-cause mortality in 516 consecutive patients with HFREF, enrolled within the GenesisCare Heart Failure Management clinics (GC-HFMCs). Age-CCI was dichotomised for analysis (above or below mean). Baseline characteristics and all-cause mortality at 1 year and intermediate term follow-up were compared between groups.

Results: Mean age was 73 ± 12 years, 69% were male, and there was a history of myocardial infarction in 30%, atrial fibrillation (AF) in 55%, anaemia in 20% and 83% were NYHA class II-III. The mean age-CCI was 6 ± 3. Over a median follow-up of 1.7 years (IQR 1.0–2.6), there were 93 deaths (18%). High age-CCI was a strong predictor of mortality, however variables not within age-CCI also predicted mortality as seen in Table 1. **Conclusions:** The age-CCI is a power-

Table 1.

All-cause mortality at 1.7 years	OR	95% CI	*p* value
Age-CCI > mean (6)	9.4	2.2–40.6	0.003
Male Gender	2.3	1.3–4.1	0.004
Anaemia	4.7	2.9–7.7	<0.001
AF	2.0	1.3–3.3	0.004
NYHA		NYHA II (OR 3.4, *p* = 0.02); NYHA III (OR 8.2, *p* < 0.001); NYHA IV (OR 9.1, *p* = 0.01)	

ful predictor of mortality in patients with HFREF however additional cardiac and non-cardiac comorbidities need to be considered when evaluating the prognosis of complex patients.

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The Interaction Between Pericardial Fat Volume and Myocardial Strain in ST-Elevation Myocardial Infarction Patients

M. Malaty [1,2,*], T. Nguyen [1,2], T. Vo [1], C. Mussap [1,2], J. French [1,2], D. Richards [3], L. Thomas [3], J. Otton [1,2], H. Dimitri [1,2]

[1] Liverpool Hospital, Liverpool, Australia
[2] UNSW, Sydney, Australia
[3] Westmead Hospital, Westmead, Australia

Background: Global longitudinal strain (GLS) reflects left ventricular (LV) contractility. GLS is more sensitive than LV ejection fraction as a marker of LV dysfunction and has better prognostic value for future adverse cardiovascular events. Larger pericardial fat volumes (PFV) tend to be associated with larger infarct scar volumes and predict the presence of microvascular obstruction. Our study aimed to assess the relationship between PFV and GLS.

Methods: 140 STEMI patients underwent paired cardiac magnetic resonance imaging (CMR) and transthoracic echocardiography (TTE) studies at a median of 4 days (early) and 55 days (late). PFV was quantified on CMR by tracing pericardial fat on consecutive end-diastolic short axis cine images and indexed to body surface area. GLS was determined by 2D speckled tracking strain using offline software from TTE. A change in GLS >10% from baseline was considered clinically significant.

Results: With increasing PFV, there was a statistically significant absolute decrease in early and late GLS ($r = 280$, $p < 0.001$; $r = 256$, $p = 0.002$ respectively), independent of sex, age, diabetes, hypertension, affected coronary arteries and the degree of ST segment elevation. Early PFV did not predict change in GLS from early to late.

Conclusion: The magnitude of GLS is inversely related to early and late PFV after STEMI. Early PFV does not appear to predict which patients positively remodel, as pericardial fat may be protective for LV function at follow-up after STEMI. Further studies are required to evaluate whether PFV may have a protective effect on LV remodelling post myocardial infarction.

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The Overlap between Cancer and Cardiovascular Diseases Mortality

T. Haregu, M. Carrington, S. Yiallourou, S. Nanayakkara [*], D. Kaye

Baker Heart And Diabetes Institute, Melbourne, Australia

Introduction: Cardiovascular diseases (CVD) and cancer, the two most common causes of death globally, have several shared risk factors. However, evidence on the extent of their overlap as causes of death is limited.

Objective: To examine the overlap between CVD and cancer mortality.

Methods: We used Baker Biobank data that were linked to Australian National death index. Of the 6530 participants in the Biobank, there were 1584 deaths. Underlying, associated and multiple causes of death were used in determining the overlap. Hazards of overlap and shared prognostic factors were also considered in the analysis. Proportions, logistic regression and Cox regression models were used in the analysis.

Results: Overall, 141 (8.9%) of the deaths had both CVD and Cancer mentioned as causes of death. About 21% of ischaemic heart disease deaths, 13% of heart failure deaths and 13% of stroke deaths had cancer as a co-occurring cause of death. Deaths with cancer as underlying cause of death were 2.8 times more likely to have CVD as an associated cause of death. Among deaths where CVD was mentioned as a cause of death, there was a 93% higher probability of cancer being reported as a co-occurring cause of death. Patients with history of CVD were 5 times more likely to have cancer as cause of death; and 6 times more likely to have both CVD and cancer as causes of death.

Conclusion: There is a significant overlap between CVD and cancer mortality. Integrated screening and management of CVD and cancer is recommended.

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The Prevalence and Prognostic Significance of Atrial Fibrillation in Patients with Heart Failure and Preserved Ejection Fraction

L. Kearney [*], K. Lu, M. Duong, J. Joanne McGillion, S. Kim, D. Eccleston, S. Delacroix

Genesiscare, Leabrook, Australia

Introduction: Heart failure (HF) with preserved ejection fraction (HFPEF) accounts for around half of the HF cases in Australia, yet management strategies are limited. Typically, patients with HFPEF are complex with a high burden of comorbid disease which impacts adversely on prognosis.

Methods: We evaluated the prevalence and prognostic significance of atrial fibrillation (AF) in a large cohort of patients with HFPEF managed within the GenesisCare Heart Failure Management Clinics (GC-HFMCs) throughout Australia. Patients maintained on evidence-based medications were stratified into those with a history of AF or not. Baseline characteristics, all-cause mortality at 1 year and intermediate term follow-up were compared between groups.

Results: 297 consecutive patients were included in the analysis, mean age 79 ± 10 years, female 62%, history of hypertension (83%), diabetes (34%) and myocardial infarction (13%). Left atrial enlargement was common (LA area 26 cm^2, IQR 22–31 cm^2). 180 patients (61%) had a history of AF, although only 21% had AF on ECG at initial review. Patients were followed prospectively for a median of 1.8 years (IQR 1.0–2.5 years) during which there were 38 deaths (13%). Logistic regression analysis demonstrated that history of AF was significantly associated with all-cause mortality at one year (Table 1).

Table 1.

All cause mortality	OR AF vs no AF	95% CI	p
1 year	3.7	1.1 – 13.0	0.04
Median follow-up (1.8 yrs.)	2.7	1.2 – 6.2	0.02

Conclusions: AF is common, frequently paroxysmal and, associated with worse prognosis in HFPEF. Whilst the role of AF ablation in HFPEF remains uncertain, proactive strategies to identify, risk stratify and treat AF in HFPEF are critical to optimise outcomes of patients with HFPEF.

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The Role of Cardiac Biomarkers in the Prediction of Cardiotoxicity in Patients Treated for Cancer: A Systematic Review

A. Murphy [1,*], A. Koshy [1], O. Farouque [1], D. Clark [1], B. Yeo [1,2,3], M. Yudi [1]

[1] *Austin Health, Heidelberg, Australia*
[2] *Olivia Newton-John Cancer Research Institute, Heidelberg, Australia*
[3] *School of Cancer Medicine, La Trobe University, Heidelberg, Australia*

Background: The adverse morbidity and mortality due to cardiotoxicity in patients treated for cancer has prompted a move for earlier diagnosis of myocardial injury. Current guidelines recommend biomarker screening during cardiotoxic treatment. However, the risk conferred by biomarker elevations in this subgroup remains unclear.

Methods: A systematic search of MEDLINE, PubMed and EMBASE was conducted for studies utilising cardiac biomarkers for detection of LV dysfunction in adults treated for cancer. Cardiotoxicity was defined as a reduction of the LVEF of $\geq 5\%$ points to <55% with symptoms of heart failure or an asymptomatic reduction of $\geq 10\%$ points to <55%.

Results: 782 studies were screened and twenty-two studies representing 2366 patients were included. 14.8% ($n = 333$) of patients were reported to have cardiotoxicity. Most studies examined breast cancer patients ($n = 17$) receiving anthracyclines and/or trastuzumab ($n = 18$). Follow-up varied from 3 days to 5 years. Most studies reported on brain natriuretic peptide (BNP) or Troponin (TnI, $n = 14$ and TnT, $n = 13$) with 11 studies correlating a rise in biomarker with a significant change in LVEF. TnI was the most robust biomarker for prediction of cardiotoxicity ($n = 7$) with the largest study reporting a multivariate adjusted HR of 3.76 (95% CI 2.05–6.90). BNP was the most studied biomarker ($n = 16$), although its diagnostic accuracy was limited. Due to heterogeneity in data reporting, we were unable perform a meta-analysis.

Conclusion: Cardiac biomarkers show promise in the detection of subclinical cardiotoxicity during cancer treatment. However, there is conflicting data due to varying study design and lack of standardised reference ranges. Uniform reporting of biomarkers is imperative to assess their clinical utility and cost-effectiveness in screening of patients following cancer therapy.

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The Role of Extracellular Matrix Stiffness on Cardiac Metabolic Activity

T. Solomon *, Y. Choi, L. Hool, H. Viola

The University of Western Australia, Crawley, Australia

The cardiac L-type Ca^{2+} channel (LTCC) can regulate mitochondrial metabolic activity via calcium-independent mechanisms. The sarcomeric network plays an important role in this response. Hypertrophic cardiomyopathy (HCM) occurs due to mutations in sarcomeric proteins. Using murine models of human HCM, we have shown that mutations in sarcomeric proteins are associated with altered LTCC kinetics, impaired structural-functional communication between LTCC and mitochondria, and increased metabolic activity (consistent with the human phenotype). However, the mechanisms by which mutations in sarcomeric proteins lead to alterations in metabolic activity remain unknown.

Cardiomyocytes can 'sense' extracellular matrix (ECM) mechanics via a process called mechanotransduction. This involves conversion of mechanical stimuli into biochemical events that can alter myocardial function. Since human HCM is characterised by a stiff myocardium, we developed an *in vitro* model to determine the role of increased ECM stiffness on metabolic activity.

Wild-type cardiomyocytes were cultured on hydrogels with stiffnesses mimicking healthy (10 kPa) or HCM (40 kPa) myocardium. Cardiomyocytes on 40 kPa hydrogels exhibited increased stiffness versus 10 kPa (atomic force microscopy; 3.8 ± 0.4 kPa, $n = 53$ versus 1.5 ± 0.2 kPa, $n = 31$; $p < 0.05$). Cardiomyocytes on 40 kPa hydrogels also exhibited a larger increase in metabolic activity in response to activation of LTCC (flavoprotein autofluorescence; 40 kPa: $64.6 \pm 4.3\%$ increase, $n = 35$ versus 10 kPa: $20.3 \pm 1.8\%$, $n = 27$ $p < 0.05$), that was attenuated by sarcomeric protein depolymerising agents latrunculin A (F-actin) or colchicine (β-tubulin).

We conclude that ECM stiffness may regulate cardiac metabolic activity. Increased ECM stiffness may contribute to increased metabolic activity and development of HCM.

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The Role of Serum Cardiac Biomarkers and Left Ventricular Strain Imaging for Detecting Early Radiation Induced Myocardial Damage in Women Undergoing Left-Sided Breast Radiation Therapy: A Pilot Study

A. Murphy [1,*], O. Farouque [1], F. Faroudi [1,2], M. Chao [1,2], M. Yudi [1], B. Yeo [1,2,3], A. Koshy [1], M. Horrigan [1], S. Undrill [1], T. Lancefield [1]

[1] Austin Health, Heidelberg, Australia
[2] Olivia Newton-John Cancer Research Institute, Heidelberg, Australia
[3] School of Cancer Medicine, La Trobe University, Melbourne, Australia

Background: Radiation therapy (RT) is an established adjuvant treatment for breast cancer and is associated with a significant reduction in disease recurrence and death. Incidental exposure of the heart to radiation can result in cardiac disease. The use of ultra-sensitive biomarkers and global longitudinal strain (GLS) allows for a sensitive assessment of myocardial function and detection of early cardiac damage.

Methods: 20 women with Stage I left-sided breast cancer, receiving RT monotherapy were prospectively recruited. Sequential echocardiograms with GLS were performed before and immediately after RT (6 weeks) and analysed blinded to clinical information. NT-proBNP and hs-troponin T were measured throughout RT.

Results: Mean age was 63 ± 11 years, serial NT-proBNP and hs-troponin T throughout RT did not demonstrate significant change (NTproBNP 98 vs 98 ng/L, $p = 0.99$; hs-troponin T 6.3 vs 6.4 ng/L, $p = 0.42$). Baseline left ventricular ejection fraction was $62 \pm 4\%$ and GLS was -20 ± 2. No significant change was recorded post RT in the LVEF (62% vs 63%, $p = 0.77$) or GLS (-20 vs -20, $p = 0.95$). One patient experienced a significant fall in LVEF (LVEF decline >10%) and three patients demonstrated a significant fall in GLS (GLS decline >12%).

Conclusion: While the use of cardiac biomarkers and GLS have shown potential for detecting early signs of cardiotoxicity in patients treated with chemotherapy, it remains unclear if there is a role in the RT population. Contemporary RT techniques may have reduced the risk of cardiac complications or simply delayed the time to onset. Larger studies with longer follow up are needed to understand the relationship between radiation therapy and early cardiac damage.

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The Value of Serum Levels of Apela and Cystatin C in Evaluation of Renal Insufficiency in Patients with Heart Failure

Z. Wang [1,2,*], Y. Pan [1,2], J. Huang [1,2]

[1] Nanjing Brain Hospital of Nanjing Medical University, Nanjing, China
[2] Nanjing Chest Hospital, Nanjing, China

Objective: To explore the value of serum levels of Apela and Cystatin C (Cys-C) in evaluation of renal insufficiency in patients with heart failure (HF).

Methods: Total 89 patients were divided into HF with normal renal function group (HF group, 20 cases); HF with renal insufficiency (RI) in compensatory stage group (HF with compensatory RI group, 40 cases); HF with RI in decompensatory stage group (HF with decompensatory RI group, 29 cases). The serum concentration of Apela, Cys-C and nitrogen-terminal pro-brain natriuretic peptide (NT-pro BNP) was detected by ELISA, and left ventricular ejection fraction (LVEF) was determined by echocardiography.

Results: The LVEF level was significantly lower ($43.1\% \pm 1.7\%$ vs. $48.9\% \pm 2.0\%$, $P < 0.05$), but the average level of NT-pro BNP (6174 ± 1002 pg/ml vs. 3400 ± 661.3 pg/ml, $P < 0.05$) was remarkably higher in HF with decompensatory RI group than that in HF group. With the deterioration of renal function in patients with heart failure, the levels of BUN, Cr and Cys-C increased gradually, while the levels of eGFR decreased gradually. Compared to HF group (0.84 ± 0.55 ng/ml), the serum level of Apela was higher in patients with compensatory (1.16 ± 0.34 ng/ml) or decompensatory RI (1.23 ± 0.53 ng/ml). The serum Cys-C level was negatively correlated with eGFR ($r = -0.7763$, $p < 0.0001$).

Conclusion: With the occurrence of RI in HF patients, serum Apela and Cys-C increased gradually, and the level of serum Cys-C was well correlated with eGFR. It suggested that endogenous Apela and Cys-C levels could be used as biomarkers for evaluating early RI in patients with heart failure.

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Troponin Elevation in Takotsubo Cardiomyopathy- A Retrospective Cohort Study

A. Vlachadis Castles [1,*], K. Fendel [1,2], L. Segan [3], L. McFarlane [3], J. Amerena [3], G. Vaddadi [1]

[1] Northern Health, Epping, Australia
[2] Austin Health, Heidelberg, Australia
[3] Barwon Health, Geelong, Australia

Background: The characteristic rise and fall in troponin is a hallmark of myocardial infarction (MI), however the pattern and magnitude of troponin rise in Takotsubo cardiomyopathy (TC) is not well understood. This study aimed to assess tro-

ponin trends in TC to examine any pattern that may facilitate diagnosis of TC.

Methods: This retrospective study analysed troponin results of 240 patients diagnosed with TC from 2008 to 2018 at two tertiary centres in Victoria, Australia.

Results: 97% of patients in our cohort had at least one troponin I (TnI) level above reference range (<0.05 ug/L). The mean troponin peak was 6.0 ($\pm$12 ug/L), and the majority (67.5%) of peak troponin values were under 5 ug/L, with wide variation (see figure). The highest troponin rise observed was 97.5 ug/L. The mean peak to initial troponin ratio was 24.9, with a mean absolute change of 3.2 ug/L, indicating significant interval change. Mean time from symptom onset to peak troponin was 17 hours ($\pm$25.7 hours).
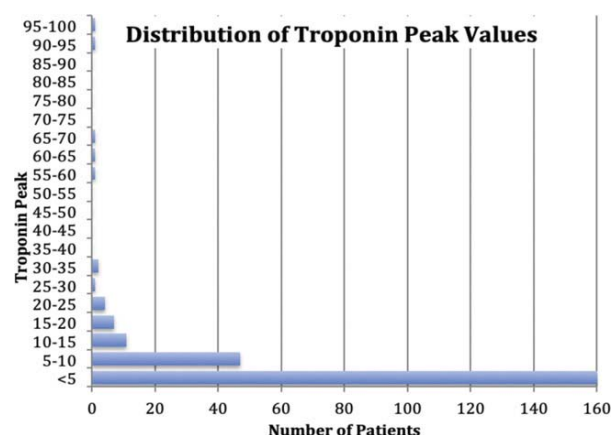
Conclusions: This study demonstrates that patients with TC have troponin elevation of a comparable magnitude and pattern to that seen in MI. As such, it appears that troponin alone is not a reliable discriminator between TC and MI. Further studies examining other biochemical markers may be useful to aid in earlier diagnosis of TC, which may minimise the potential risks associated with unnecessary use of antiplatelet and anticoagulant agents.

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Unanticipated Contribution of Pulsatility to Pump Thrombosis

J. Engelman[1,2,*], K. Muthiah[1], P. Jain[1], D. Robson[1], P. Jansz[1], C. Hayward[1]

[1] *Heart Failure and Transplant Unit, St Vincent's Hospital, Sydney, Australia*
[2] *University of New South Wales, Sydney, Australia*

Background: Whether diminished pulsatility influences outcomes in patients with continuous-flow left ventricular assist devices (CF-LVAD) is largely undetermined. We sought to characterise the relationship between measured flow pulsatility and outcomes in patients with a HeartWare CF-LVAD (HVAD).

Methods: Log-files from 61 HVAD patients with pulsatility data were analysed. Mean, peak, trough flow and pulsatility (*peak − trough flow*) were extracted. A flow pulsatility index (PI) (*pulsatility/mean flow*) was calculated for each patient at 1, 3, 6, 9 and 12 months from HVAD patient log files. Patients were divided into tertiles reflecting low, intermediate and high pulsatility based on their average PI. Baseline demographics and outcomes were compared between groups. Outcomes compared were gastrointestinal bleeding (GIB), neurological events (NE) and pump thrombus (PT).

Results: Patients were divided into tertiles reflecting low ($n = 21$), intermediate ($n = 19$) and high ($n = 21$) pulsatility. There were no significant differences in demographics between groups according to pulsatility. Surprisingly, PT rates were significantly higher ($p = 0.013$) in the high pulsatility ($n = 6$, 29%) group compared to the low ($n = 0$, 0%) and intermediate ($n = 1$, 5%) groups. Binary logistic regression yielded low trough flow as an independent predictor of PT (OR 0.205, $p = 0.028$). NE ($p = 0.113$) and GIB ($p = 0.607$) did not differ significantly between groups.

Conclusion: Flow PI was positively associated with PT, likely due to an effect of low trough flow. This presents an important potential target for future therapeutic intervention.

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Understanding the Prevalence and Patient Characteristics of Pulmonary Hypertension According to the Updated Haemodynamic Definition

N. Bart[1,2,*], S. Hungerford[1], K. Kearney[1], K. Brown[1], C. Corrigan[1], A. Keogh[1,2], E. Kotlyar[1,2]

[1] *St Vincent's Hospital, Sydney, Australia*
[2] *Victor Chang Cardiac Research Institute, Sydney, Australia*

The widely accepted definition of pulmonary hypertension (PH) - a mean pulmonary artery pressure (mPAP) of >25 mmHg, has come under renewed focus at the 2018 6th world PH symposium with healthy human studies showing that, on average, the mPAP was 14 ± 3.3 mmHg at rest. The mPAP is also affected by pulmonary artery wedge pressure (PAWP) and cardiac output (CO).

Aims: To provide a descriptive analysis of all patients with a mPAP of 21–25 mmHg referred to a specialist quaternary PH centre.

Methods: All patients referred for right heart catheter (RHC) at our institution between 2008 and 2018, with: an MPAP of 21–25 mmHg; pulmonary vascular resistance $\geq$3 Wood units, and; PAWP $\leq$15 mmHg were included. Data were extracted from the medical records for: aetiology; six-minute walk test (6MWT), and mortality.

Results: 59 patients were included, representing 3.5% of all cases with an mPAP >20 mmHg. The average age was 66.3 ± 13.8 years. Average 6MWT was 339.5 ± 110.9 m. There were a total of 13 deaths over the study period. Patients were classified according to aetiology of PH: 13 (22%) of patients were classified as group 1; 12 (20%) group 2; 22 (37%) group 3; 8 (14%) group 4; 1 (1.7%) group 5; and 3 (5%) unclear pathology.

Conclusion: The updated haemodynamic definition of PH, whilst more closely reflecting human physiological values, is likely to detect patients earlier in the course of their disease and will be of prognostic significance. It could be argued that the same precision applied to mPAP could also be applied to PAWP.

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Unsupervised Machine Learning Identifies Treatment Response to Spironolactone in Patients with Heart Failure with Preserved Ejection Fraction: A TOPCAT Substudy

S. Nanayakkara [1,2,3,*], A. Beale [1,2,3], M. Inouye [2,4,5], D. Kaye [1,2,3]

[1] The Alfred, Melbourne, Australia
[2] Baker Heart and Diabetes Institute, Melbourne, Australia
[3] Monash University, Melbourne, Australia
[4] University of Cambridge, Cambridge, United Kingdom
[5] Alan Turing Institute, London, United Kingdom

Background: Heart Failure with Preserved Ejection Fraction (HFpEF) is a heterogenous condition with several subgroups. Spironolactone has been postulated as beneficial therapy in certain patients, i.e. lower ejection fractions or lower natriuretic peptide levels. We aimed to determine whether machine learning (ML) methods could identify treatment responders.

Methods: TOPCAT was a large international randomised trial of spironolactone in patients with HFpEF. We utilised data from 654 patients from the Americas echocardiographic arm. Dimensionality reduction was applied using t-stochastic neighbour embedding, followed by hierarchical cluster analysis, then long-term outcomes were stratified by treatment.

Time To Primary Endpoint Across Three Clusters
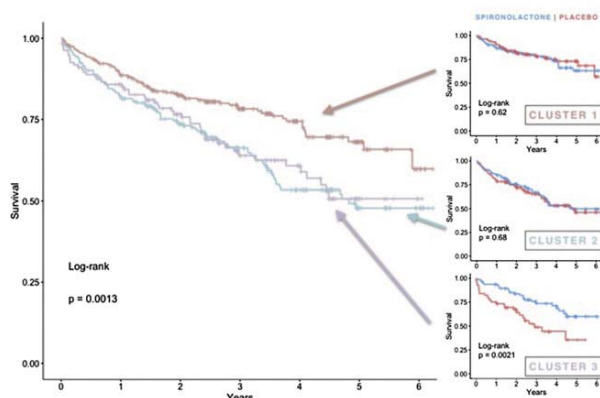
Results: Three clusters were identified. Patients in Cluster 1 ($n = 285$) demonstrated the most favourable long-term outcome across the follow up period with no significant response to spironolactone ($p = 0.62$). Of the two remaining clusters with similar long-term outcomes, Cluster 2 ($n = 234$)

patients demonstrated no significant response to spironolactone ($p = 0.68$) whereas those in cluster 3 ($n = 135$) had early divergence in survival curves with significant treatment response ($p = 0.002$). Compared with the other Clusters 1 and 2, Cluster 3 patients were younger (66 vs 72 vs 73, $p < 0.001$), had the lowest EF (57 vs 62 vs 58, $p < 0.001$) and lowest natriuretic peptides.

Conclusion: Unsupervised ML methods can identify homogenous subgroups within HFpEF and potentially determine patients who may respond more favourably to treatment with spironolactone.

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Uptake of Influenza, Pneumococcal and Herpes Zoster Vaccination as a Preventative Strategy for Adverse Cardiovascular Outcomes in a High-Risk Cohort of Patients with Chronic Heart Failure

M. Thangarajah [1,*], R. Porter [2], R. MacIntyre [2,3,4], T. Tan [1,2,3,4]

[1] Western Sydney University, Campbelltown, Australia
[2] Department of Cardiology, Blacktown Hospital, Blacktown, Australia
[3] University of New South Wales, Sydney, Australia
[4] The Kirby Institute, Sydney, Australia

Background: Vaccination is a cheap and effective intervention that may prevent infection, which is a recognised trigger for cardiovascular events, and contributes to all-cause mortality. The annual influenza, and five-yearly pneumococcal and herpes zoster vaccinations, are provided free of cost to high-risk patients (i.e. those with chronic conditions, indigenous people and those aged over 65). Western Sydney has a high prevalence of at-risk patients.

Objectives: The aim of our study was to determine the uptake of influenza, pneumococcal and herpes zoster vaccinations in patients with heart failure presenting to a tertiary referral hospital in Western Sydney.

Methods: Consecutive patients with LVEF <50% attending the outpatient Heart Failure Service Clinic at Blacktown Hospital between 2015–2018 were identified. Patient demographics, medical conditions and vaccination status were collected. Only patients whose vaccination status was verified with their general practitioner were examined.

Results: A total of 331 patients met the inclusion criteria but only 119 (mean age 67 ± 14 years; 62% male) had their vaccination status confirmed by their general practitioner. Influenza vaccination uptake increased from 46% in 2015 to 69% in 2018. Interestingly, only 0.2% was vaccinated against pneumococcus in 2015 and 12% in 2018, compared to 0% receiving the herpes zoster vaccination in 2015 and 7% in 2017.

Conclusions: The uptake of influenza and pneumococcal vaccinations amongst a cohort of high-risk patients in Western Sydney is increasing, but remains below the national average, highlighting the need for more effective strategies to

enhance vaccination uptake among high-risk patients with chronic cardiac conditions.

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Use of a High Sensitivity Troponin T Assay in the Assessment and Disposition of Patients Attending a Tertiary Australian Emergency Department

W. Alazrag [1,2,*], Y. Saad [1,2], A. Alazhary [1,2], I. Shugman [1,2,3], C. Mussap [1,2], C. Juergens [1,2], I. Ferguson [2,4], J. French [1,2]

[1] Cardiology Department, Liverpool Hospital, Sydney/Liverpool, Australia
[2] South Western Clinical School, University of New South Wales, Sydney, Australia
[3] Cardiology Department, Campbelltown Hospital, Sydney/Campbelltown, Australia
[4] Department of Emergency Medicine, Liverpool Hospital, Sydney/Liverpool, Australia

Objective: To examine the disposition and outcomes of patients presenting to the emergency department with symptoms suggestive of acute coronary syndrome undergoing measurement of high sensitivity troponin-T (HsTnT).

Methods and results: HsTn-T was measured in 2738 consecutive patients (mean age = 61 [±19] years, 52% male) presenting to the emergency department with symptoms suggestive of an acute coronary syndrome. Overall, 1567 patients predominantly had chest pain, 290 had dyspnoea, and the remainder had a variety of symptoms. Overall, 1089 patients had an Hs-TnT>14 ng/L (upper reference limit), of whom, 376 were admitted to the cardiology service (344 had a final cardiac diagnosis [44 ST-elevation myocardial infarction (STEMI), 62 Non-STEMI, 23 unstable angina, and 215 other cardiac disorders]). Among these 1089 patients, 581 had an eGFR <60 mL/min/1.73 m^2, 191 had heart failure, and 124 had sepsis. At 30-days, death rates among patients who had HsTnT levels(s) >14 ng/L with non-cardiac diagnoses and in patients who had ≥1 HsTnT >14 ng/L with a cardiac diagnosis were 6.7% and 4.8% ($p = 0.204$), while hospital death rates among those with a final ACS, non-ACS cardiac and non-cardiac diagnoses were 7.5%, 3.8% and 6.6% ($p = 0.153$); among patients with normal HsTnT levels, 4 (0.3%) non-cardiac deaths were reported. At late follow-up (median 16 months) that was obtained in 2450 (89.5% of 2738) patients, 32 had myocardial infarction and 253 died (45 cardiac deaths).

Conclusions: The majority of unselected consecutive patients attending emergency department in whom HsTnT levels were elevated did not have an acute coronary syndrome, suggesting chronic myocardial injury, most of whom were admitted to a non-cardiology service.

Key Words: acute coronary syndrome; chest pain; emergency department; troponin T.

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Using Shear Wave Elastography to Characterise Ischaemic Contracture in Rodent Hearts

W. Pavey [1,2,*], J. Hickey [1,2], S. Chitnis [1,2], U. Ali [1,2], A. Gupta [1,2], S. Abbott [2], H. Ludewick [1]

[1] Heart Lung and Research Institute of WA, Perth, Australia
[2] Fiona Stanley Hospital, Murdoch, Australia

Introduction: Shear wave elastography (SWE) quantifies stiffness by measuring the conduction velocity of sound waves through tissue. We hypothesised that SWE would be able to demonstrate global stiffness changes in both warm and cold isolated ischaemic hearts.

Methods:

Part 1

Hearts ($n = 8$) were explanted from anaesthetised male Sprague Dawley rats (300–400 g). Hearts were flushed with KH and immersed in a 37 °C KH bath. Organs were scanned at regular intervals to determine stiffness over 35 minutes.

Part 2

Rats ($n = 14$) were anaesthetised, hearts excised and baseline function assessed at 37 °C on a Langendorff apparatus. After 10 minutes, hearts were flushed and stored at 4 °C with either KH ($n = 6$) or 4 °C STS ($n = 8$), and scanned for stiffness at regular intervals. Hearts were then reperfused and assessed for function.

Results:

Part 1

Hearts increased in stiffness over 35 mins ($p = < 0.005$). There was a relatively linear increment in stiffness of 0.28 m/sec/min between 13 and 28 minutes. (Fig. 1)
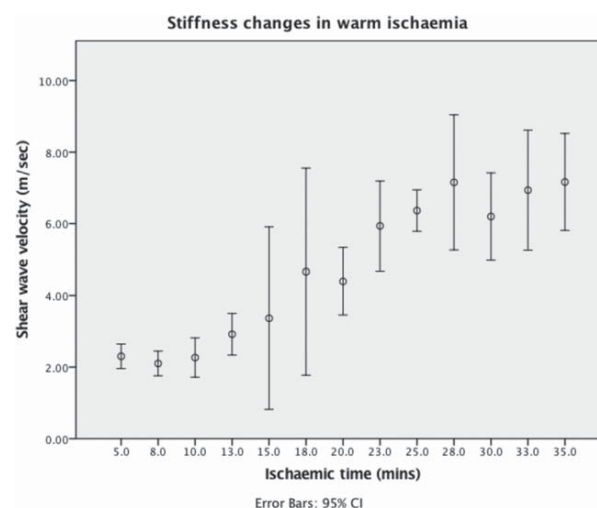

Fig. 1.

Part 2

More hearts recovered rhythmic contraction after STS storage than KH ($p = 0.06$).

There was no difference in stiffness between KH and STS hearts at the commencement of ischaemia ($p = 0.23$) or the end ($p = 0.74$).

There was no stiffness difference in hearts that did recover compared with those that did not, at the beginning ($p = 0.877$) or end of ischaemia ($p = 0.168$).

Conclusion: SWE demonstrates changes in stiffness over time in warm ischaemic hearts. This may be of use in assessing hearts donated after circulatory death. SWE could not discriminate on the basis of stiffness between preservation solution or functional recovery for cold ischaemic hearts.

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Heart Rhythm (149–233)

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A Catchment the Size of Switzerland: Outcomes for Patients Presenting with out of Hospital Cardiac Arrests Remains a Challenge

Q. Yang[*], C. McCallum, A. Kim, V. Moosavi, N. Ariyarathna, B. Nkoane-Kelaeng, R. Tan

The Canberra Hospital, Canberra, Australia

Introduction: In-hospital mortality (IHM) for cardiac arrest patients remains a challenge in our institution with a large catchment. Primary coronary intervention (PCI) continues to have poorer outcomes when patients present following cardiac arrest, in cardiogenic shock (CS) or receive cardiopulmonary resuscitation (CPR).

Method: We analysed all activations of the cardiac catheterisation laboratory in 2018. We assessed rates of IHM and 30 day MACE following PCI in relation to the following variables: in-hospital (IHCA) or out-of-hospital cardiac arrest (OHCA), shockable or non-shockable rhythms, intubation and cardiogenic shock. IHCA were classified as outside Canberra vs referral from peripheral hospitals.

Results: 203 consecutive activations were analysed. 76% were male with mean age 60.7 years. Females had a mean age of 69.4 years ($p < 0.0001$). 110 (54%) activations occurred afterhours. 170 met STEMI criteria; 30 OHCA, 18 IHCA and 12 in CS. 9 patients (4.4%) required intubation prior to PCI. 36 (17.7%) had a shockable rhythm and 33 (16.3%) received CPR. The mortality rates of OHCA compared to IHCA were 26.7% vs 44.4%, respectively (OR 0.45, 95% CI 0.13 to 1.56, $p = 0.21$). IHM rates were highest in patients receiving inotropes or intubation (42.9% and 39.1%). Mortality rates for females were higher their male counterparts (15.0% vs 7.7%, OR 2.03, 95% CI 0.75 to 5.50, $p = 0.16$). Excluding IHM, only 7 patients (3.4%) had MACE at 30 days.

Conclusion: Our institution's IHM rates in OHCA are higher than IHCA likely from referral hospital delays to PCI from inter-hospital transfers.

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A Prospective 3-Year Review of out of Hospital Cardiac Arrest Presentations to a University-Affiliated Tertiary Centre

P. Chandru[1], S. Barua[2,*], M. Dennis[3], A. Eslick[4], N. Kruit[4], A. Coggins[1]

[1] *Emergency Department, Westmead Hospital, Sydney, Australia*
[2] *Department of Cardiology, Westmead Hospital, Sydney, Australia*
[3] *Department of Cardiology, Royal Prince Alfred Hospital, Sydney, Australia*
[4] *Department of Anaesthetics, Westmead Hospital, Sydney, Australia*

Introduction: Outcomes for out of hospital cardiac arrest (OHCA) have traditionally thought to be poor. We sought to investigate current OHCA outcomes and interventions in a contemporary cohort of Emergency Department (ED) patients. Further, we set out to assess the cohort for cases that could benefit from extracorporeal membrane oxygenation (ECMO) using published ECMO cardiopulmonary resuscitation (eCPR) eligibility criteria.

Methods: A prospective observational cohort study of all OHCA patients from 2016–2019 using Utstein reporting methods at a single tertiary centre. Data were collected on audit forms and then cross-checked against electronic medical records. Use of cardiac catheterisation was assessed and patients were retrospectively matched against eligibility criteria used by the Melbourne eCPR (CHEER) study.

Results: Between July 2016 and February 2019 there were 193,750 ED presentations and 251 OHCA cases. 3 cases were excluded after identification as 'in-hospital' arrests. Overall survival (30 days) was 23.4% ($n = 58$). The mean age of survivors was 55.4 years. Proportion of bystander CPR was 70.2% ($n = 174$). Initial shockable rhythms were reported in 38.7% ($n = 96$). 72 OHCA patients were assessed to have met the CHEER study eligibility criteria, of these 32 did not survive to hospital discharge. 55 patients received percutaneous coronary intervention, of these 40 survived to hospital discharge.

Conclusion: The results reflect a higher than traditionally expected OHCA survival rate in a contemporary cohort of ED patients. Further studies are needed to identify where future local quality improvement strategies should be focused.

Reference: Stub et al. Refractory cardiac arrest treated with mechanical CPR, hypothermia, ECMO & early reperfusion (CHEER). Resuscitation. 2015 Jan;86:88–94.

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A Review of Pulse Generator Battery Life Amongst Explanted Pulse Generators

R. Velusamy[*], J. Hawson, I. Stevenson

Royal Melbourne Hospital, Parkville, Australia

Introduction: Cardiac implantable electronic devices (CIED) are becoming increasingly common in Australia, with

a steady increase in implants per capita over the past twenty years. Increased device longevity reduces replacement rate and minimises risk of complications. We aimed to evaluate CIED battery life using real-world experience.

Methods: Consecutive patients with CIEDs undergoing pulse generator replacement were retrospectively studied. Patients undergoing generator change for battery depletion were included. The duration from time of implant to generator change was calculated. The type of device, number of leads, indication, and manufacturer were recorded.

Results: 200 consecutive patients were included in the study. This included 54 single chamber devices, 138 dual chamber devices, and 8 biventricular devices. Fifty-seven of the devices were defibrillators. The manufacturer was Medtronic in 114 cases, St Jude Medical in 72 cases, and Boston Scientific in 15 cases. The mean battery life of single and dual chamber pacemakers was 9.6 ± 1.8 years. The mean battery life of implantable defibrillators was 7.57 ± 1.9 years. Pacemakers manufactured by St Jude Medical (9.7 ± 1.9 years) and Medtronic (9.8 ± 1.6 years) did not have a significantly different battery life ($P = 0.68$). Medtronic pacemakers lasted significant longer than those manufactured by Boston Scientific (8.7 ± 0.9 years; $P < 0.01$). There was no significant difference in defibrillator battery life between manufacturers.

Conclusion: The average battery life for single and dual chamber pacemakers is 9.7 ± 1.6 years. The average battery life of defibrillators is shorter at 7.6 ± 1.9 years.

	MDT	SJM	BS
Pacemaker	9.8	9.8	8.7
Defibrillator	7.7	7.4	8.4
CRT-D	5.7	5.5	6.9

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A Systematic Review and Meta-Analysis on the Incidence of Appropriate Implantable Cardioverter Defibrillator Therapy and Sudden Cardiac Death in Cardiac Sarcoidosis

K. Franke [1,2,*], H. Marshall [1], P. Kennewell [1], H. Pham [1], T. Rattanakosit [1,2], N. Aboustate [1,2], P. Tully [1,2], R. Mahajan [1,2,3,4]

[1] The University of Adelaide, Adelaide, Australia
[2] South Australian Health and Medical Research Institute, Adelaide, Australia
[3] Royal Adelaide Hospital, Adelaide, Australia
[4] Lyell McEwin Hospital, Adelaide, Australia

Background: Implantation of implantable cardioverter defibrillator (ICD) is a Class IIb indication in patients with Cardiac Sarcoidosis and with LVEF 36%–49% despite immunosuppression and optimal heart failure therapy.

Objective: This systematic review and meta-analysis aimed to provide an estimate on the incidence of ventricular arrhythmias and risk of sudden cardiac death (SCD) in patients with CS.

Methods: The terms "Cardiac Sarcoidosis*" AND "Implantable Cardioverter Defibrillator" AND "Sudden Cardiac Death" were searched on PubMed, EMBASE, and Scopus on 21st September 2018 yielding 759 articles. After exclusions, 12 studies met inclusion criteria.

Results: The 12 studies consisted of 612 patients with CS, of which 534 had ICD implanted for primary or secondary prevention. Assuming appropriate device therapy as a surrogate for SCD, the annual incidence of appropriate ICD therapies and SCD combined was 6.3% (95% CI 3.5–9.1) in primary prevention cohorts, 11.6% (95% CI 7.8–15.3) in secondary prevention cohorts, and 8.7% (95% CI 6.0–11.5) in both cohorts. The mean left ventricular ejection fraction (LVEF) was pooled as 59 ± 7 ($n = 155$) in primary prevention cohorts and 48 ± 15 ($n = 48$) in secondary prevention cohorts. However, the LVEF was 35 ± 13 ($n = 28$) in those with appropriate ICD therapy, and 49 ± 16 ($n = 47$) in those with ICDs without therapy.

Conclusion: The incidence of ventricular arrhythmias and SCD is high not only secondary but also in primary prevention cohorts of CS. This data support the role of implanting ICDs for primary prevention in patients with CS with mild to moderate reduction in LVEF.

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Abnormal Cardiac Electrical Remodelling in POTS: Mechanistic Insights on Potential Autonomic Dysregulation

V. Malik*, A. Thiyagarajah, D. Munawar, D. Linz, A. Elliott, M. Emami, R. Mishima, R. Mahajan, P. Sanders, D. Lau

Centre For Heart Rhythm Disorders, The University of Adelaide/Royal Adelaide Hospital, Adelaide, Australia

Background: Postural Orthostatic Tachycardia Syndrome (POTS) is a syndrome characterised by dysautonomia. It remains unknown if POTS individuals have abnormal cardiac electrical changes. Here we assessed electrocardiographic markers of interatrial and ventricular conduction delay in POTS compared to patients with vasovagal syncope (VVS).

Methods: Patients who met diagnostic criteria for POTS by tilt table test and free of other autonomic or structural heart disease were compared to VVS patients. 12 lead ECGs taken pre-treatment were digitised (minimum 8 good-quality signals) and analysed by a cardiologist blinded to treatment. P wave and RT dispersion (PWD, RTD) were calculated (maximum – minimum P wave/RT interval duration). Peak of T to end of T wave (TpTe), a marker of transmural dispersion of ventricular repolarisation, also sensitive to sympathetic stimulation, was measured in lead II.

Results: 11 POTS patients were compared to 9 age and sex - matched VVS patients. Mean age was similar. Atrial volumes and left ventricular ejection fraction (LVEF) were normal in all patients. There was no difference in LVEF. POTS was associated with abnormal PWD (48 ± 5, normal <38 ms) and higher RTD (66 ± 7 ms); compared to VVS (31 ± 4; $P = 0.02$ and 46 ± 6 ms; $P = 0.04$), despite lower left atrial volume. Baseline TpTe did not differ.

Conclusion: Compared to VVS, POTS is associated with both longer PWD (above normal limits) and increased RTD, whilst TpTe did not differ, despite systemic sympathetic predominance. Further clinical studies are warranted to assess the relative role of subclinical cardiac structural remodeling and impaired cardiac autonomic nervous system function.

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Acute Oestradiol Slows Conduction in Male, but not Female, Murine Left Atria

S. Wells [1,2,*], C. O'shea [2], H. Waddell [1],
P. Kirchhof [2], D. Pavlovic [2], L. Delbridge [1],
J. Bell [1]

[1] University of Melbourne, Melbourne, Australia
[2] Institute of Cardiovascular Sciences, University of Birmingham, Birmingham, UK

Pericardial adipose accumulation increases atrial fibrillation risk; however, the underlying mechanisms are not well understood.

We have demonstrated that pericardial adipose expresses aromatase, indicating capacity to locally synthesise oestrogens. In Langendorff-perfused mouse hearts, atrial arrhythmia incidence correlated with the total aromatase capacity of this adipose depot, and exogenous oestradiol increased arrhythmia vulnerability.

The aim of this study was to determine how acute administration of oestrogens modulate cardiac electrophysiology in male and female cardiomyocyte monolayers and intact left atria. Microelectrode array (MEA)-seeded neonatal rat ventricular myocytes (NRVMs) were exposed to increasing concentrations of oestradiol (0–100 nM) and synchronous field potentials recorded. Optical action potentials were measured from isolated adult mouse left atria stained with Di-4-ANEPPS, electrically paced and superfused with increasing concentrations of oestradiol ($n = 4$–10).

NRVM conduction velocity (CV) and field potential duration were unaffected by acute oestradiol. Acute oestradiol prolonged action potential duration at 70% repolarisation (APD_{70}) in both male (ΔAPD_{70}, 100 nM oestradiol vs vehicle: 5.8 ± 0.9 ms vs 1.6 ± 1.6 ms; $P = 0.037$) and female atria (7.6 ± 1.0 ms vs 3.9 ± 0.9 ms; $P = 0.045$). A lower oestradiol concentration slowed CV in male (ΔCV, 1 nM oestradiol vs vehicle: -9.2 ± 1.8 cm s^{-1} vs -1.1 ± 2.7 cm s^{-1}; $P = 0.007$), but not female atria (ΔCV: -2.4 ± 2.0 cm s^{-1} vs 0.05 ± 3.2 cm s^{-1}; $P = 0.79$).

Slowed action potential propagation and prolonged repolarisation are two key mechanisms underlying reentrant and triggered arrhythmias, respectively. These rapid responses to acute oestrogen administration indicate non-genomic influences on cardiomyocyte electrophysiology and may be mediated by stimulation of oestrogen receptor signalling pathways.

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AF-Express Clinic in a Tertiary, Metropolitan Hospital Reduces Emergency Department Re-Admissions

K. Patching*, M. Perry, J. O'Brien,
M. Horrigan

Austin Health, Heidelberg, Australia

Background: The total number of Atrial Fibrillation (AF) hospitalisations in Australia continues to increase more than for any other cardiovascular condition.

Methods: The AF-Express clinic (AFX) uses hospital data systems to automatically identify patients who have presented to Emergency Department (ED) with AF. The nurse-led clinic aim is to make early review available in less than 5 working days.

We aim for 100% capture. Clinic care is targeted toward guaranteeing basic investigations and delivery of the AF care set.

Results: Data show an increase in AFX episodes, and significant downward trend in the number of ED episodes, explaining a preliminary finding of ~16% downward trend of all AF episodes. Supporting this evidence is the small number who re-present (1.3%) after being seen in AFX as opposed to 9.3% who re-present who have not previously been seen in AFX (see Table 1).

Table 1.

Episode	Re-admissions
ED	117 (21.2%)
Previously seen in AFX	1.3%
Not seen in AFX	9.3%
Not seen in AFX who re-present ≥2 and ≤6 times	2.5%

Conclusions: There are early signs that the AFX, by ensuring consistent delivery of care, can reduce ED re-admissions. Ongoing evaluation of this cohort including guideline and treatment gaps are needed to influence care delivery. Using informatics system developments, AFX will serve as a template for development of other informatics-based low cost, scalable, nurse-led healthcare delivery programs.

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An Elevated P Wave Terminal Force V1 is not Associated with Worsening Atrial Electroanatomic Substrate

M. MacPherson[1,*], J. Sajeev[1], G. Wong[2],
J. Kalman[2], H. Dewey[1], A. Koshy[3],
L. Roberts[1], J. Cooke[1], A. Teh[1]

[1] Eastern Health, Box Hill, Australia
[2] Royal Melbourne Hospital, Melbourne, Australia
[3] Austin Health, Heidelberg, Australia

Background: P wave terminal force in V_1 ($PTFV_1$) is an electrocardiographic (ECG) marker postulated to represent underlying adverse atrial remodelling. However, recent studies have questioned the clinical utility of $PTFV_1$. There is a paucity of evidence for the association between $PTFV_1$ and abnormal atrial electrical substrate.

Methods: We conducted a prospective study examining the relationship between an elevated $PTFV_1$ and atrial electroanatomic substrate. ECGs of 34 patients in sinus rhythm undergoing radiofrequency pulmonary vein isolation were analysed. 5 patients were excluded due to a lack of p wave morphology consistent with $PTFV_1$. An elevated $PTFV_1$, defined as the upper tertile of $PTFV_1$ values, were compared with the remaining patients. Left atrial electroanatomic substrate mapping was performed prior to ablation and indices of atrial substrate were compared between the groups.

Results: Median $PTFV_1$ in the control group and elevated $PTFV_1$ group was 4.60 mVms [Interquartile range (IQR) 3.48–5.72] and 9.52 mVms [IQR 8.81–11.28] respectively. There were no significant differences in age, gender and vascular risk factors between the groups. Atrial substrate indices were not significantly different between the control and $PTFV_1$ groups; global conduction velocity (41.7 ± 13 cm/s vs. 38.2 ± 11 cm/s), mean global bipolar voltages (1.9 ± 0.60 mV vs. 2.00 ± 0.55 mV), areas of low voltages (17.5% vs. 18.1%) and complex fractionations (3.8% vs. 3.1%).

Conclusion: An elevated $PTFV_1$ is not associated with electrophysiological indices of an abnormal left atrial substrate. These factors limit the utility of $PTFV_1$ as a clinical marker of underlying adverse atrial remodelling.

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Antibiotic Prophylaxis in Cardiac Implantable Electronic Device Procedures: A Tale of Two Western Australian Hospitals

A. Hort[1,*], T. Huston[2], M. Almonte[2],
S. Yee[2], R. Karimaei[2], J. Seet[3], Z. Nizich[3],
M. Rawlins[1], P. Czarniak[2], L. Chalmers[2]

[1] Fiona Stanley Hospital, Murdoch, Australia
[2] School of Pharmacy and Biomedical Sciences, Curtin University, Perth, Australia
[3] Sir Charles Gairdner Hospital, Nedlands, Australia

Australian guidelines recommend antibiotic prophylaxis (AP) for CIED procedures, however the level of adherence to these guidelines is currently unknown. This study aimed to investigate guideline adherence and the CIED infection rate in the two largest Western Australian public teaching hospitals.

In a retrospective, observational study, medical records of patients who underwent CIED procedures at the two hospitals from January to December 2017 were reviewed. Adherence to the AP guidelines was assessed with respect to drug, dose, timing, route and frequency. CIED infection was identified using patient follow-up documentation.

AP was administered in 589 (98.5%) of 598 procedures reviewed (Hospital A: $n = 400$, B: $n = 198$). Full guideline adherence was observed in 33.9% of procedures and differed significantly between the hospitals (A: 47.3% vs. B: 7.1%, $p < 0.001$). The most common reasons for non-adherence were timing of administration (A: 42.3% vs. B: 60.6% non-adherent, $p < 0.001$) and repeat dosing (A: 19.3% vs. B: 78.8% non-adherent, $p < 0.001$). Twenty infections were identified over 626.6 patient-years (PY) of follow-up (mean [SD] follow-up: 1.0 [0.3] years). The infection rate was 3.19 per 100 PY ($p = 0.99$ between the two hospitals). Two devices were removed; no patients died from CIED infection. There were no statistically significant associations between infection and any patient, procedure or AP-related factors. Infection occurred in 2.0% of AP guideline adherent and 4.1% of non-adherent cases ($p = 0.27$).

Although the rate of serious infection was low, there was evidence of suboptimal antibiotic use, and notably potential overuse of AP in CIED procedures. Practices varied significantly between hospitals.

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Assessment of Residual Aortic Stiffness in AF: Exploring the Role of Central Haemodynamics Response to Exercise

K. Khokhar [1,*], D. Lau [1], M. Stiles [2],
R. Mahajan [1], J. Bednarz [3], R. Misihima [1],
C. Gallagher [1], A. Thiyagarajah [1],
C. Verdicchio [1], D. Munawar [1], K. Kadhim [1],
P. Sanders [1]

[1] CHRD, Royal Adelaide Hospital, University of Adelaide and South Australian Health and Medical Research Institute, Adelaide, Australia
[2] Waikato Clinical School, Department of Health and Science, Auckland University, Hamilton, New Zealand
[3] Department of Statistics, School of Public Health, University of Adelaide, Adelaide, Australia

Background and Introduction: Increased arterial stiffness is a novel and independent predictor of atrial fibrillation (AF). The evaluation of central haemodynamic response to moderate exercise can help identify sub-clinical aortic stiffness in individuals with AF.

Objective: To study the response of central blood pressure indices to moderate exercise in patients with history of AF.

Method: The response of central blood pressure indices to moderate exercise was recorded in 46 consecutive patients with AF at our centre. Additionally, 31 subjects without any history of AF were recruited to act as controls. SphygmoCor XCEL (AtCor Medical, Australia) was used to characterise central and brachial blood pressure indices at rest and during early recovery after moderate exertion, quantified as achieving 80–85% target heat rate (HR) on Bruce protocol. The change in blood pressure indices were compared by linear regression model between the two groups. The analysis was further adjusted for age, gender, height, hypertension, left atrial volume, heart rate and medications.

Results: The characteristics of the study cohort are shown in Table 1. The resting central systolic BP (CSBP) was better controlled in patients with history of AF (123 ± 13 vs 131 ± 13 mmHg, $p = 0.02$). However, the mean change in CSBP during exercise was comparable between the two groups (24 ± 13 vs 21 ± 13 mmHg, $p =$ NS). Further, patients with history of AF have an exaggerated response of central augmentation pressure (6.6, 95% CI 9.1 to 4.1 vs -2.1 95% CI -3.5 to -0.7 mmHg, $p = 0.037$) to exercise with relatively blunt reflection index (-3.3 vs -12.8, $p = 0.013$) illustrating reduced central arterial compliance.

Conclusion: Assessment of central haemodynamics response to moderate exercise can help expose central arterial stiffness in patients with AF.

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Table 1. *Characteristics of Study Participants (n = 77).*

Characteristic	History of AF, $n = 46$	No history of AF, $n = 31$	P-value	All patients, $n = 77$
Age (years)	66.8 ± 8.2	54.4 ± 16.7	*<0.001**	61.8 ± 13.7
Male (n,%)	32 (69.6)	21 (67.7)	NS	53 (68.8)
BMI (kg/m^2)	27.3 ± 3.8	27.7 ± 4.5	NS	27.5 ± 4.1
Hypertension (n,%)	35 (76.1)	21 (67.7)	0.21	56 (72.7)
Diabetes Mellitus (n,%)	6 (13)	7 (22.6)	0.13	13 (17)
Central systolic BP (mmHg)	123 (13)	131(12)	*0.02**	124(13)
Brachial systolic BP (mmHg)	136(16)	146(15)	0.05	135(16)
Medications				
ACE-I/ARB (n,%)	37 (80)	24 (80)	NS	61 (80)
Beta-blockers (n,%)	24 (52)	6 (19)	*0.001**	30 (39)
CCB (n,%)	12 (26)	10 (32)	NS	22(28.6)
Left Atrial Volume mls/m^2	31.5 ± 6.9	30.5 ± 6.3	NS	31.1 ± 6.6
Resting Heart Rate (bpm)	67.3 ± 12.5	71.5 ± 12.5	NS	69 ± 12.6

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Atrial Fibrillation is Independently Associated with Both Syncope and the Risk of Falling in Older Adults: A Systematic Review and Meta-Analysis

V. Malik [1,*], C. Gallagher [1], D. Linz [1],
A. Elliott [1], M. Emami [1], K. Kadhim [1],
R. Mishima [1], J. Hendriks [1], R. Mahajan [1],
L. Arnolda [2], P. Sanders [1], D. Lau [1]

[1] Centre For Heart Rhythm Disorders, The University of Adelaide/Royal Adelaide Hospital, Adelaide, Australia
[2] Illawarra Health and Medical Research Institute, University of Wollongong, Wollongong, Australia

Aims: Recent observational data highlighted an association between atrial fibrillation (AF) and increased morbidity and all-cause mortality; not all attributable to cardiovascular causes. We hypothesise that falls and syncope contribute to increased morbidity and mortality in this population. Here, we undertook a systematic review and meta-analysis to examine the potential association of AF to syncope and falls.

Methods: CENTRAL, PubMed and EMBASE databases were searched from inception to January 2019 to retrieve relevant studies. Search terms consisted of mesh, tree headings and keywords relating 'AF', 'falls', 'syncope' and 'postural

hypotension' where possible; results were pooled using a random effects model.

Results: A total of ten studies were included with 7 studies (36,444 patients, mean age 72 ± 10 years) reporting an association between AF and falls and 3 studies (6769 patients, 65 ± 3 years) reporting an association between AF and syncope. Pooled analyses demonstrate that AF is independently associated with falls (OR 1.19; 95% CI 1.07–1.33: $P = 0.001$) and syncope (OR 1.88; 95% CI 1.20–2.94: $P = 0.006$). There was overall moderate bias and low-moderate heterogeneity ($I^2 = 37\%$; $P = 0.11$) for falls and moderate bias with low statistical heterogeneity (I^2 0%; $P = 0.44$) for syncope. Persistent AF, but not paroxysmal AF was associated with orthostatic intolerance in one study (4408 patients, mean age 66 ± 6 years).

Conclusion: AF is independently associated with syncope and falls in older adults. Further studies are needed to delineate mechanistic links and to guide management in order to improve outcomes in these patients. **(PROSPERO: CRD4201810721)**.

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Cardiac Ablation with Electroporation-Electrolysis (E2): Feasibility and Workflow Towards Dose Planning Using an In Vivo Model

L. Zhao [1,2,*], A. Rasko [2], C. Drescher [2], S. Maleki [1], M. Cejnar [2], A. McEwan [1]

[1] The University of Sydney, Camperdown, Australia
[2] Micropace Pty Ltd, Homebush West, Australia

The gold standard in atrial fibrillation ablation relies on thermal cell-kill, which carries limitations in efficacy, speed and risk. Electroporation is emerging in cardiac ablation as a fast, non-thermal and tissue-specific alternative. Successful irreversible electroporation (IRE) ablation in tumours has spurred similar use of kilovolt pulses in cardiac ablation. However, high voltages in the heart would compound clinical, technical and regulatory challenges.

A novel ablation technique, "E2", augments low-voltage electroporation with electrolytic cell-kill. A custom E2 ablation system was developed and tested on the in-vivo thigh muscle tissue model of cardiac ablation. E2 was applied on three sheep – anaesthetised and sedated but not paralysed – as either single or two consecutive monophasic pulses each lasting under 100 ms, with peak voltages 350 V to 490 V and peak currents 4.4A to 9.2A, resulting in total delivered energy of 22 J to 42 J. Electrode placement through a custom jig allowed consistent experimental conditions and accurate tissue extraction following sacrifice one hour after the final ablation.

H&E showed continuous lesions of at least 4 mm depth below the electrodes, extending radially. There was no inflammation or pathology away from the ablation site. With tolerable muscle contraction comparable to AICD testing and the absence of acute complications, these findings may be clinically relevant for pulmonary vein isolation. Lesions were mapped onto a numerical model, which can inform prototype development and treatment planning.

This study validates E2 ablation, preliminary prototyping and establishes a workflow for parametrising electroporation ablation towards endocardial dose optimisation.

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Cardiac Arrhythmia has a High Rate of Recurrence in the Thoroughbred Racehorse, a Naturally Occurring Animal Model for the Athlete's Heart

L. Nath [1,*], P. Curl [3], A. Elliott [2], A. La Gerche [4], S. Franklin [1]

[1] University of Adelaide, Roseworthy, Australia
[2] University of Adelaide, Adelaide, Australia
[3] Hong Kong Jockey Club, Hong Kong, Hong Kong
[4] Baker Heart and Diabetes Institute, Melbourne, Australia

Background: Cardiac arrhythmia is common in intensively trained human athletes. Rodent studies have demonstrated increased arrhythmia inducibility following a period of athletic conditioning. The Thoroughbred racehorse demonstrates cardiac adaptations to athletic training in a similar manner to human athletes and is a naturally occurring model for the Athlete's Heart.

Methods: Race records for Thoroughbred Horses racing in Hong Kong from 2007–2017 were reviewed. Horses with a below expectation race performance were examined with cardiac auscultation and electrocardiography. Arrhythmia incidence and recurrence were compared by Fishers exact test.

Results: There were 13,838 horses involved in 98,401 race starts during the study period. The overall incidence of arrhythmia was 1.9% of horses and 2.8 episodes per 1000 starts. The incidence of arrhythmia in horses after a previous episode (13.6 per 1000 starts) was higher than for horses with no previous episode (2.4 per 1000 starts, OR 5.6 (95% CI 4–7.8). Atrial fibrillation (AF) was the most commonly diagnosed arrhythmia (97% of episodes) with remaining episodes being sinus rhythm with ectopy. Atrial fibrillation was persistent in 4% of episodes. The rate of recurrence in horses treated for a persistent episode of AF was 50%, which was higher than the recurrence in horses with a paroxysmal episode of AF (17%), OR 4.8 (95% CI 1.1–21.2).

Conclusion: Amongst horses with a history of arrhythmias, recurrent episodes are more common. The individual factors that increase risk for arrhythmia in these animals require further investigation.

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Cardiac Electronic Implantable Devices in Elderly Australians: Results from GCOR

D. O'Donnell [1,*], S. Pavia [3], M. Swale [1],
T. Lin [1], S. Delacroix [2], M. Duong [2], S. Kim [2],
M. Santos [2], D. Eccleston [1], G. Young [2]

[1] *GenesisCare, Heidelberg, Australia*
[2] *GenesisCare, Adelaide, Australia*
[3] *GenesisCare, Brisbane, Australia*

Background: Elderly patients have traditionally had lower access to cardiac devices based partly on the perception that they experience more complications. They are underrepresented in clinical trials and limited data exist regarding the outcomes of elderly (>75 years) patients undergoing device implantation in Australia.

Methods: The Genesis Cardiovascular Outcomes Registry (GCOR-Device) prospectively collected data on 5000 patients from December 2015-December 2018). This analysis compared patient demographic and procedural data with outcomes by age at implantation ($\geq$75 years vs < 75 years).

Results: Elderly patients received more single chamber devices 19.6% vs 10.3%, received less implantable cardioverter defibrillators 11.1% vs 23.3% and less cardiac resynchronisation devices 7.9% vs 11.0%. Elderly patients were more likely to be implanted during an inpatient stay rather than electively. The complication rates and type did not differ significantly between older and younger patients.

Conclusion: Device implantation in elderly Australians produces complication rates comparable to those in younger patients.

Outcomes at 1 year %	>75 ($n = 2634$)	$\leq$75 ($n = 2199$)	p
Major complications	85 (3.1%)	92 (3.9%)	ns
All complications	152 (5.3%)	146 (5.5%)	ns
Cardiac Readmissions	117 (4.2%)	46 (2.0%)	<0.01
Death	125 (4.6%)	23 (1.0%)	<0.01

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This abstract has been withdrawn

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Cardiac Fibrosis as a Risk Factor for Atrial Fibrillation: A Meta-Analysis

T. Agbaedeng *, M. Emami, K. Kadhim,
D. Linz, R. Mahajan, D. Lau, P. Sanders

The University of Adelaide, Adelaide, Australia

Background: Fibrosis is a hallmark of atrial fibrillation (AF) substrate. Recent data suggest that fibrosis detected by late-gadolinium enhancement (LGE) cardiac MRI (CMR) can predict AF. However, this relationship is not well described.

Objective: To evaluate association of cardiac fibrosis with AF.

Methods: PubMed and Embase were searched through November 2018, using the keywords: LGE AND Fibrosis AND CMR AND AF. Included studies were pooled in a random effects meta-analysis and reported as: mean difference (MD); risk ratios (RR); and 95% confidence intervals (95% CI).

Results: After exclusions, we identified 9 studies (2,307 patients) conducted between 2003 and 2015 for LGE and AF. Fibrosis was present in 666 (35.1%) and detected by LV LGE in 7 (78%) and RV LGE in 2 (22%). The presence of AF was higher in patients positive for ventricular LGE than those negative, trending towards significance (RR: 1.51, 95% CI: 0.94–2.45, $p = 0.09$). Pooled LV fibrosis associated with AF progression (RR [NPAF vs. PAF]: 2.2, 95% CI: 1.22–3.94, $p = 0.009$). We identified 8 studies (2,041 patients) conducted between 2006 and 2016 reporting LGE and AF recurrence after catheter ablation, with fibrosis detected in 644 (31.6%) by LA LGE in 8 (88.9%, biased towards one centre). After 17.8 ± 14.2 follow-up years, atrial fibrosis was significantly greater in recurrent AF than controls (MD: 4.97%, 95% CI: 1.23–8.7, $p < 0.01$), and predicted 16% increased risk of AF recurrence (RR: 1.16, 95% CI: 1.07–1.26, $p < 0.05$).

Conclusion: Fibrosis detected by LGE associates with prevalence and progress of AF and is predictive of AF recurrence post ablation. This further supports the proarrhythmic role of fibrosis and selection of patients for ablation therapy based on LGE.

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Care Processes Affecting Door-to-Needle (DTN) and Door-in-Door-out (DIDO) Times at Non-PCI Hospitals

N. Chokshi [1,*], R. Amor [1], S. Burgess [1,2,3]

[1] *Department of Cardiology, Nepean Blue Mountains Local Health District, Sydney, Australia*
[2] *The University of New South Wales, Sydney, Australia*
[3] *Department of Cardiology, Liverpool Hospital, Sydney, Australia*

Background: Challenges to providing timely STEMI management at non-PCI hospitals exist. Reducing delays in administering thrombolysis, and transferring patients to PCI capable centres is critical in reducing total ischaemic time and mortality.

Aim: Identify factors affecting door-to-needle (DTN) and door-in-door-out (DIDO) times of STEMI patients presenting to non-PCI hospitals; evaluating guideline recommended DTN and DIDO times as our primary endpoint.

Method: This retrospective single centre pilot study evaluated DTN and DIDO times of STEMI patients at our non-PCI regional hospital from January 2017 to September 2018. Electronic and paper-based medical records were used to evaluate

outcomes. We screened 36 records, excluding 6 due to insufficient documentation, leaving 30 patients suitable for analysis.

Results: Of the 30 patients, 80% received thrombolysis, 17% underwent primary PCI, with 3% unsuitable for PCI due to multiple comorbidities. Median DTN time was 35 minutes (IQR 23–45), median DIDO time was 55 minutes (IQR 49–68), with DIDO times ranging from 42–120 minutes. 45.8% of DTN times and 0.0% of DIDO times met CSANZ guidelines. DTN delays were attributable to limited pre-hospital ECG analysis, diagnostic uncertainty, system delays, particularly delayed phone advice secondary to lack of a single call activation system. DIDO delays were primarily attributable to limited availability of transport, and delays in moving patients to and from the ambulance.

Conclusion: Guideline recommended DTN and DIDO times are frequently not met due to multiple factors. Further research extending this pilot study is required to enhance STEMI management in our regional network.

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Clinical Impact of Implantable Loop Recorder: A Tertiary Care Centre Perspective

H. El Jamaly *, C. Chow, S. Kumar, M. QingTao, M. Ali

Westmead Hospital, Westmead, Australia

Background: Implantable loop recorders (ILR) are long-term monitoring devices allowing symptom-rhythm correlation [1]. The diagnostic yield of ILR in Australian centres is not well established.

Methods: A retrospective study using electronic medical records of ILR implants between January 2008 and January 2018 at Westmead hospital. Information was collected on patient comorbidities; indication; diagnostic outcome and subsequent management.

Results: A total of 261 patients (58.6% female, age 49.1 ± 22.2 SD) were included. ILRs were implanted for evaluation of syncope in 151 (59.4%), pre-syncope in 27 (10.6%), unexplained palpitations in 49 (19.3%) and cryptogenic stroke in 18 (7.1%) of patients [Fig. 1] ILR monitoring yielded findings which changed management in 40 (15.3%) of patients over a mean follow up of 11.6 months $\pm$ 11.1 SD. Out of 37 (14.2%) patients with symptoms during the monitoring period, 20 (54.1%) had an arrhythmia [Fig. 2] ILR was helpful in ruling out an arrhythmic cause for symptoms in 17 (45.9%) patients. ILR results led to pacemaker implantation in 24 patients (9.2% overall, 15.9% of those with syncope) after a mean follow up of 6.5 months. A new diagnosis of AF was made in 15 (5.7%) patients. Overall ILR led to change in management in 16.1% patients with a number needed to implant of 6.2 to alter management. The results are likely to be more favourable for ILR, given many patients were either lost to follow up or were followed up in other centres.

Conclusion: ILR monitoring is effective in achieving long term symptom-rhythm correlation and diagnosing unexplained syncope [2]. Further studies are needed to assess cost efficacy and the optimal monitoring period.

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Clinical Significance of Focal Ventricular Tachycardias (VT) Remote or Adjacent to Scar in Patients with Structural Heart Disease: Procedural Characteristics and Clinical outcomes

R. Anderson [1,2,3,4,*], G. Lee [1,2], T. Watts [1], I. Trivic [3,4], J. Kalman [1,2], S. Kumar [3,4]

[1] *Department of Cardiology, Royal Melbourne Hospital, Melbourne, Australia*
[2] *Faculty of Medicine, Dentistry, and Health Science, University of Melbourne, Melbourne, Australia*
[3] *Department of Cardiology, Westmead Hospital, Sydney, Australia*
[4] *Westmead Applied Research Centre, University of Sydney, Sydney, Australia*

Background: Intra-myocardial re-entry is the predominant mechanism in scar-related ventricular tachycardia (VT). We investigated the presence of focal VTs found either remote or adjacent to scar borderzones in a cohort of patients with structural heart disease (SHD).

Methods and Results: Nineteen patients referred for catheter ablation were included (mean age, 67 ± 13 years; ejection fraction, $46\% \pm 14\%$; ICD, 17 patients (89%); cardiomyopathy, 15 patients (79%). A median of 3 VTs were inducible per patient (29 focal VTs and 34 reentrant VTs), 21% of patients with >1 focal VT (median 3.5) induced and 53% had both focal and re-entrant VT induced. The RVOT was the most common site (37%), followed by the RV moderator band (21%) lateral LV (16%) and papillary muscles (15%). Overall, in 12 patients the focal VT matched the clinical VT. Acute procedural success was observed in 11 patients (58%). After a median follow-up of 258 days, 11 patients (61%) remained arrhythmia-free. In those with recurrence, ICD therapies were significantly reduced from a median of 53 ATP episodes pre-ablation (with 69% of patients experiencing failed ATP reversions) to a median of 7 ATP episodes post catheter ablation. During follow-up, there was no focal VT recurrence.

Conclusion: Focal VTs commonly originate remote or adjacent to the scar border in regions of normal voltage. Revealing and treating focal VTs may result in improved outcomes as it commonly correlates to the clinical VT morphology and offers

a potential explanation for high rates of failed ICD therapies with ATP in this group.

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Clock Changes in the Type 2 Diabetic Sinoatrial Node

S. Parveen *, R. Lamberts, P. Jones

University of Otago, Dunedin, New Zealand

Diabetic patients have impaired heart rate control. In diabetic rats *ex vivo* heart rate was significantly decreased compared to non-diabetic animals. Why this is the case remains unknown.

Within sinoatrial nodal cardiomyocytes heart rate is determined by rhythmic oscillations in Ca^{2+} and other ions, the so called Ca^{2+} and membrane clocks. The Ca^{2+} clock primarily involves the intracellular Ca^{2+} store, the sarcoplasmic reticulum, and 'Ca^{2+}-handling' proteins such as the sarco/endoplasmic reticulum Ca^{2+}-ATPase (SERCA2a) and its regulator phospholamban (PLB). The membrane clock involves membrane ion transporters such as the hyperpolarisation-activated cyclic nucleotide-gated channel (HCN4) and Na^+-Ca^{2+} exchanger (NCX).

The aim of this research was to investigate whether the reduced intrinsic heart rate in diabetes is due to changes in the Ca^{2+} and/ or membrane clocks.

The sinoatrial node of non-diabetic and type 2 diabetic rats was isolated and protein expression was determined. A significant 1.6-fold increase in PLB expression was found in DM ($p < 0.05$), with no change to SERCA2a expression ($p > 0.05$). A significant 2.2-fold increase in NCX expression ($p < 0.05$) and a trend towards an increase in HCN4 ($p = 0.08$) in DM was found. The functional effects on heart rate were investigated by increasing external Ca^{2+} and ivabradine (HCN4 inhibitor) concentrations in isolated Langendorff hearts. Changes in external Ca^{2+} did not change intrinsic heart rate in both groups, however ivabradine reduced intrinsic heart rate in nDM, but not in DM.

We conclude the lower intrinsic heart rate in diabetic rats is, in part, a result of change in membrane clock proteins (non-functional HCN4).

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Comparison of Inducible and Spontaneous Ventricular Tachycardia in Defibrillator Recipients Following Myocardial Infarction

T. Deshmukh [1,*], S. Zaman [2], A. Narayan [1], S. Kumar [1], P. Kovoor [1]

[1] *Westmead Hospital, Sydney, Australia*
[2] *MonashHeart, Melbourne, Australia*

Background: We assessed the cycle length (CL) of ventricular tachycardia (VT) induced at electrophysiology study (EPS) early post-MI with spontaneous VT at follow up in implantable-cardioverter defibrillator (ICD) recipients.

Methods: Consecutive STEMI patients with left ventricular ejection fraction (LVEF) ≤40% underwent EPS as part of a study protocol targeting early (within 40 days) prevention of sudden cardiac death (SCD). The CL of induced VT at EPS was compared with first spontaneous VT and subsequent VT in ICD recipients at follow up. Secondary endpoints included mortality, sudden cardiac death (SCD) and cardiac arrest.

Results: EPS performed early post-MI in 403 patients was negative in 68.5% ($n = 276$) and positive in 31.5% ($n = 127$). In patients with a positive EPS, induced monomorphic VT had mean CL 229 ± 29 milliseconds. Primary prevention ICD was implanted in 120/127 patients with a positive EPS. In EPS positive patients with an ICD, 33% had an appropriate activation due to either VF ($n = 5$) or VT ($n = 35$) mean CL 308 ± 47 milliseconds at mean 3.4 ± 2.7 years post-STEMI. In individual patients the induced VT CL at EPS did not correlate with first spontaneous VT CL ($r = 0.09$, $p = 0.60$) but instead the VT CL lengthened with time post-MI ($r = 0.481$, $p < 0.001$). Total mortality occurred in 15.7% and 5.1% of EPS positive and negative patients, respectively ($p = 0.001$).

Conclusions: In patients post-MI with LVEF ≤40% and inducible VT at early EPS, the first episode of spontaneous VT at follow up in ICD recipients was significantly slower to what was induced. This is potentially related to the myocardial remodelling process post-MI.

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Comparison of Ventricular Tachyarrhythmia Characteristics in Patients with Non-Ischaemic vs. Ischaemic Cardiomyopathy with Defibrillators

S. Stolcman *, R. Tjong, M. McLean, M. McAlpin, R. Tan, W. Abhayaratna, M. Alasady, R. Pathak

The Canberra Hospital, Canberra, Australia

Introduction: The benefits of an implantable cardioverter-defibrillator (ICD) in significantly reducing sudden cardiac death in ischaemic (ICM) and non-ischaemic cardiomyopathy (NICM) patients has been well demonstrated. Our study investigated the characteristics of ventricular tachycardias (VT) between ICM and NICM patients who received ICD therapy.

Methods: Between August 2015 and August 2017, 58 patients (male = 50; age = 66 ± 16 years; ICM = 26, NICM = 32) presented with ICD device therapy (anti-tachycardia pacing (ATP) or shock). Cycle length of the tachyarrhythmia (TCL) and time from implant to first presentation were analysed, as were VT/VF occurrences and electrical storm events.

Results: 152 patients had ICD implanted (74 NICM, 78 ICM). Ejection fraction and duration of follow up in both groups was similar. 32 presented with therapy (17 ATP, 15 Shock) in NICM and 26 in ICM. 4 in ICM and 4 in NICM presented with VT storm. TCL was significantly faster in NICM patients versus ICM patients (272 ± 48 ms vs. 307 ± 47 ms; $p = 0.01$). There was no significant difference in time from implant to first presentation (27 ± 24 months vs. 25 ± 25 months; $p = 0.83$).

Conclusion: NICM and ICM patients had the same rate of ICD therapy for primary prevention of SCD. NICM patients had a faster TCL compared to ICM patients. There was no difference between groups in terms of time from implant to first presentation. These findings have implications for the approach to catheter ablation and appropriate programming of ICD therapies.

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Complication Rates of Cardiac Implantable Electrical Devices - Implanter Specific Predictors

D. O'Donnell[1,*], G. Young[3], I. Tan[4], M. Swale[1], P. Salkani[4], S. Delacroix[3], S. Kim[3], M. Duong[3], D. Eccleston[1], S. Pavia[2]

[1] GenesisCare, Heidelberg, Australia
[2] GenesisCare, Brisbane, Australia
[3] GenesisCare, Adelaide, Australia
[4] GenesisCare, Perth, Australia

Introduction: There is 30-fold variation in the reported complication rates of Cardiac implantable electrical device (CIED) implantation. Complication rates are multi factorial including patient, device and implanter factors. The annual procedural volume of the operator is the most commonly used predictor of outcomes, but other factors may be important. This analysis looked at the implanter specific predictors of complications.

Methods: This analysis prospectively collected data from December 2015–December 2018 in the Genesis Cardiovascular Outcomes Registry (GCOR-Device). This externally housed database contains demographic, procedural and 12 month follow up details on patients receiving a CIED. All complications following implantation are listed and independently assessed as major, minor or unrelated using standard criteria. This analysis assessed 30 day and 12 month complications and compared this with the implanters annual and lifetime experience as well as subspecialist training and institutional volume.

Results: 5000 patients and 19 implanters were included in the analysis. The overall 30-day complication rate was 5.5% and the major complication rate was 3.1%. The complica-

tion rates were lowest for implanters with total consultant practice >15 years compared with <15 years: major complications 0.9% vs 3.3%, all complications 2.3% vs 6.6%. The complication rates for those with >100 implants per year 5.4% was not different for those with <100 implants per year 5.7%. Institutional volume and subspecialist training as an electrophysiologist did not affect overall complication rates.

Conclusions: Implanter factors may predict CIED complication rates, however annual procedural volume is not sufficient to predict outcome.

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Contemporary Australian Experience with Cardiac Electronic Implantable Devices: Results from GCOR

D. O'Donnell[1,*], G. Young[3], M. Swale[1], T. Lin[1], P. Salkani[4], M. Santos[3], I. Tan[4], S. Delacroix[3], S. Kim[3], M. Duong[3], D. Eccleston[1], S. Pavia[2]

[1] GenesisCare, Heidelberg, Australia
[2] GenesisCare, Brisbane, Australia
[3] GenesisCare, Adelaide, Australia
[4] GenesisCare, Perth, Australia

Introduction: The reported complications rates following implantation of Cardiac Implantable Electrical Devices (CIED) are highly variable. International multicentre series have reported complication rates that exceed rates quoted by individual implanters. This is a multicentre series of consecutive device implants to provide a contemporary Australian analysis of device complications.

Methods: The Genesis Cardiovascular Outcomes Registry (GCOR-Device) prospectively collected data on all patients from December 2015–December 2018. The externally housed database contains demographic, procedural and 12 month follow up details on all patients receiving a CIED. All complications following implantation are listed and independently assessed as major or minor. Major complications were defined using updated criteria as any that required intervention, prolonged hospitalisation, intravenous drug therapy, resulted in device malfunction or programming that limited device function.

Results: 5000 patients were included in the analysis. The complication rates at 30 days were 3.1% major and 5.5% overall. 12 month mortality following CIED was 2.9%. The predictors of complications were an inpatient compared to an elective implant, a history of heart failure and implantation of a cardiac resynchronisation device. 420 (8.6%) patients had a readmission in the 12 months following device implantation. This was a cardiac readmission in 174 (3.4%) patients and device related in 21 patients.

Conclusions: In this multicentre, contemporary Australian device database the overall complication rates and readmission rates compare favourably with published series.

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Cost of Anticoagulation for Non-Valvular Atrial Fibrillation in Australia

D. Pol *, J. Yao, L. Dawson, M. Brooks

The Royal Melbourne Hospital, Parkville, Australia

Objectives: Since 2013, non-vitamin K antagonist oral anticoagulants (NOACs) have surpassed Warfarin to become the mainstay treatment of non-valvular atrial fibrillation (AF) in Australia. We examine the analogous change in cost of anticoagulation over the past 5 years.

Methods: Data were extrapolated from the Pharmaceutical Benefits Scheme (PBS) and Medicare Australia. We examined the total number of scripts and cost of Warfarin and all NOACs- Apixaban, Rivaroxaban, Dabigatran- that were available for non-valvular AF from September 2013 until October 2018. Month-to-month comparisons were made between the cost of all NOACs and Warfarin. INR testing cost was examined over the same period.

Results: NOAC prescription in Australia has continued to rise with a 3530% increase from September 2013 to October 2018 corresponding to a 42.8% decline in Warfarin use. Our study further demonstrates a 31.9% decrease in INR testing. Apixaban has now exceeded Rivaroxaban as the most commonly prescribed NOAC (48.2% vs. 40.4%) for non-valvular AF. With the increasing use of NOACs, cost has also increased proportionately by 3400% from $790,569 in September 2013 to $26,902,194 in October 2018. This has corresponded with a 21.9% decrease in cost of Warfarin and INR testing from $7,493,898 to $5,855,804.

Conclusions: NOACs have become the drugs of choice for stroke prevention in non-valvular AF in Australia. While use of NOACs has increased cost to the government, cost of Warfarin and INR testing has declined and costs are expected to decrease further when NOAC patents expire in 2020.

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This abstract has been withdrawn

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Decrement Evoked Potential Mapping (DEEP) for Atrial Fibrillation Ablation

J. Fitzgerald [1,*], A. May [1], M. McGee [1], J. Leitch [1], S. Haldar [2], A. Porta Sanchez [3], S. Gizurarson [4], K. Nanthakumar [5], N. Jackson [1]

[1] *John Hunter Hospital, Newcastle, Australia*
[2] *Royal Brompton and Harefield NHS Foundation Trust, United Kingdom*
[3] *Cardiólogo intervencionista del Hospital Universitario Quirónsalud de Madrid, Madrid, Spain*
[4] *Landspitali University Hospital, Iceland*
[5] *Peter Munk Cardiac Centre, University Health Network, Toronto, Canada*

Introduction: Giving an extra-stimulus to identify decrement evoked potentials (DEEPs) has been shown to identify targets for VT ablation. We sought to determine if this technique could be applied to AF ablation.

Methods: Patients undergoing AF ablation were prospectively enrolled. A voltage map of the left atrium was created in sinus rhythm and pulmonary vein isolation was performed. Following this a drive train and single extra-stimulus (at AERP+20 ms) were delivered from the proximal coronary sinus and left atrial appendage with the lasso at 8 left atrial and 5 right atrial positions. EGMs that delayed in timing on the lasso with the extra-stimulus were identified as DEEPs.

Results: 15 patients (11 M), 13 persistent AF, mean age 66 ± 9 years, mean LA size 28 ± 4 cm^2 were enrolled. Of 1340 EGMs examined, 13% were DEEPs (15% with CS pacing versus 10% LAA pacing, $p = 0.01$). The mean decrement seen was 26 ms. 85% of DEEPs were identified in sites with a normal EGM at baseline and 93% of DEEPs occurred in regions with normal voltage. There was no significant difference in the frequency of DEEPs at any particular site, however, 13.3% of DEEPs were seen in the RA and 21.3% in the LA ($p = 0.005$).

Conclusion: In this study, DEEPs were more common when pacing from the coronary sinus, more common within the left atrium and frequently occurred at regions with normal voltage. DEEPs may represent a novel target for atrial fibrillation ablation.

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Diagnostic and Prognostic Value of CMR and Cardiac PET Imaging in Patients with Cardiac Sarcoidosis

P. Kennewell [1,*], H. Marshall [1], K. Franke [1], H. Pham [1], T. Rattanakosit [1], N. Aboustate [1], P. Tully [1], R. Mahajan [1,2,3]

[1] *University of Adelaide, Adelaide, Australia*
[2] *SAHMRI, Adelaide, Australia*
[3] *Lyell Mcewin Hospital, Adelaide, Australia*

Background: Cardiac Magnetic Resonance (CMR) and Positron Emission Tomography (PET) are employed to diagnose Cardiac Sarcoidosis (CS). However, their role in prognosis and guiding treatment is not well established.

Objective: To discern the utility of CMR and PET in diagnosing and predicting adverse outcomes in CS.

Methods: "Cardiac Sarcoidosis*" AND "Magnetic Resonance Imaging" OR "Positron Emission Tomography" were searched on PubMED, EMBASE and SCOPUS on 21st of September 2018 yielding 1180 articles. After exclusions, 26 studies were included in the meta-analysis.

Results: 8 and 13 studies compared diagnostic value of CMR and PET, respectively against the diagnostic criteria of either the Japanese Ministry of Health or the Heart Rhythm Society. These showed a sensitivity of 75.7% [69.3–81.4] and 81.4% [76.7–85.4] for CMR and cardiac PET, respectively, to diagnose CS. The risk of ventricular arrhythmia was increased in patients with late gadolinium enhancement (LGE) on CMR (HR 3.32 [0.59–18.51], $I^2 = 58$; $N = 4$) or positive FDG uptake on cardiac PET (HR 2.91 [1.68–5.06]; $N = 3$). The LVEF in the group with and without LGE on CMR was 54 ± 9 and $57\pm7\%$, respectively. Absence of LGE on CMR predicted absence of ventricular arrhythmia (NPV = 96.7% [88.2%–99.1%]). LGE on CMR was also associated with increased risk of major adverse cardiac events (MACE) (HR: 8.20 [2.28–29.45], $I^2 = 81$; $N = 5$).

Conclusion: LGE on CMR and positive FDG uptake on cardiac PET are associated with high risk of ventricular arrhythmia. LGE on CMR imaging predicts high risk for MACE.

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Differences in Exercise Haemodynamic Parameters in Patients with AF-HFpEF Compared to Those Without HFpEF Undergoing Ablation: Implications in AF Management

H. Sugumar

Alfred Health/Rmh, Melbourne, Australia

Background: Atrial fibrillation (AF) and heart failure (HF) are modern cardiovascular epidemics with significantly increased morbidity and mortality. There is increased recognition of coexistent AF and HF with preserved ejection fraction (HFpEF). Invasive haemodynamics is considered to be the gold standard for diagnosis of HFpEF.

Objective: To determine the echocardiographic and exercise haemodynamic differences in patients undergoing AF ablation with or without HFpEF.

Methods: All patients underwent invasive haemodynamic testing with exercise right heart study, cardiac MRI, echocardiogram, and BNP testing. Only patients with EF >50% were included. Mann-Whitney U test was used for statistical analysis.

Results: Total of 70 people were suitable for the study and invited to participate, of which 41 (58.6%) participated in the study. Three were excluded due to decline in EF after enrolment. Total of 38 patients were included in the analysis. Detailed results are included in the table below. 60% of people undergoing AF ablation have undiagnosed HFpEF. 13/23 patients with HFpEF were in AF at the time of their exercise study. Total exercise time was lower in those with comorbid AF-HFpEF. Overall, patients with AF-HFpEF had lower exercise tolerance and decreased cardiac output at rest and with exercise.

Conclusion: Exercise capacity in patients with AF patients is markedly reduced if they have coexistent HFpEF. Rhythm control and maintenance of AV synchrony with catheter ablation may provide clinical benefit in this patient population. Future prospective studies are needed in this field.

Echo and Exercise haemodynamics in AF patients with or without HFpEF.

	AF-HFpEF	AF without HFpEF	P value
Total patients, %	23 (60.5)	15 (39.5)	NA
Total Exercise time mis, (n $\pm$ SD)	7.6 ± 2.9	11.2 ± 2.4	<0.001
Resting cardiac output L/min (n $\pm$ SD)	5.0 ± 1.0	6.7 ± 1.5	<0.001
Exercise cardiac output L/min (n $\pm$ SD)	8.9 ± 2.6	14.3 ± 3.7	<0.001
Resting wedge pressure mmHg (n $\pm$ SD)	12.7 ± 2.7	8.9 ± 3.1	<0.001
LA area o ECHO Cm2 (n $\pm$ SD)	26.4 ± 4.9	23.1 ± 3.3	0.05
Septs E/e' (n $\pm$ SD)	10.9 ± 3.3	7.4 ± 1.2	<0.001
MV deceleration time ms ((n $\pm$ SD)	200.9 ± 43.1	212.1 ± 51.9	NS
RVSP rest mmHg (n $\pm$ SD)	26.9 ± 7.6	26.6 ± 2.4	NS

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Differentiating Right- and Left-Sided Outflow Tract Ventricular Arrhythmias – A Review of "Classical" ECG Signatures and Prediction Algorithms

R. Anderson [1,2,3,4,*], S. Kumar [3,4],
R. Parameswaran [1,2], G. Wong [1,2],
A. Voskoboinik [1,2,5], H. Sugumar [1,2,5],
T. Watts [1], P. Sparks [1,2], J. Morton [1,2],
A. McLellan [1,2,5], P. Kistler [2,5], J. Kalman [1,2],
G. Lee [1,2]

[1] Department of Cardiology, Royal Melbourne Hospital, Melbourne, Australia
[2] Faculty of Medicine, Dentistry, and Health Science, University of Melbourne, Melbourne, Australia
[3] Department of Cardiology, Westmead Hospital, Sydney, Australia
[4] Westmead Applied Research Centre, University of Sydney, Sydney, Australia
[5] Baker IDI Heart and Diabetes Institute, Melbourne, Australia

Idiopathic ventricular arrhythmias (ventricular ectopics and ventricular tachycardia) commonly originate from the right ventricular (RV) and left ventricular (LV) outflow tracts (OT). The surface 12-lead electrocardiogram (ECG) is routinely used to localise the anatomical site of origin (SOO) prior to catheter ablation. However, the intimate and complex anatomy of the OT limits predictive value ECG criteria alone for localisation for these arrhythmias. Multiple ECG algorithms have been developed to assist pre-procedural localisation, and hence predict safety and efficacy of OT VAs. In this study, we systematically review all of the published the 12-lead ECG algorithms used to guide localisation of OT ventricular arrhythmias (Fig. 1, panels A-G).
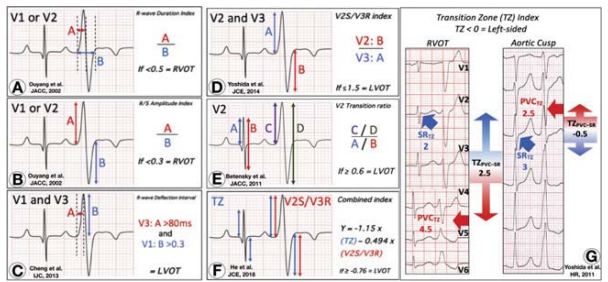

Fig. 1.

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Does Annual Implanter Procedure Volume Predict Complications of Cardiac Devices of Different Complexity?

D. O'Donnell [1,*], G. Young [3], I. Tan [4], T. Lin [1],
M. Swale [1], P. Salkani [4], S. Delecroix [3],
M. Duong [3], S. Kim [3], D. Eccleston [1],
S. Pavia [2]

[1] GenesisCare, Heidelberg, Australia
[2] GenesisCare, Brisbane, Australia
[3] GenesisCare, Adelaide, Australia
[4] GenesisCare, Perth, Australia

Introduction: The annual procedural volume of the operator is commonly used in guidelines assessing competence in implantation of cardiac devices. This analysis looked at complication rates in a national database and compared them with the annual implant volumes for pacemakers (PPM) defibrillators (ICD) and cardiac resynchronisation devices (CRT).

Methods: The Genesis Cardiovascular Outcomes Registry (GCOR-Device) prospectively collected data on 5000 patients from December 2015–December 2018. All complications are independently assessed as major or minor. This analysis compared 30-day complications with the operator's annual implant volume.

Results: 5000 patients and 19 implanters were included in the analysis. The complication rates for PPM did not differ with annual implant volume. The major complication rates for ICD and CRT were higher for implanters in the lowest quartile of annual device implants compared with the highest quartile.

Conclusions: Annual procedural volumes do not predict complications of PPM. Higher volume implanters of ICD and CRT have lower major complication rates.

		Overall	Highest Quartile	Lowest Quartile	p value
PPM	All	5.8	5.7	5.9	ns
	Major	3.1	2.9	3.1	ns
ICD	All	5.4	4.9	6.3	ns
	Major	3.1	2.3	3.5	<0.05
CRT	All	8.1	5.4	9.8	<0.05
	Major	4.4	3.1	5.8	<0.05

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Does Lead Abandonment Lead to Increased Risk of Long-Term Complications for Patients with CIEDs?

M. O'Connor[1,*], O. Carleton[1], P. Larsen[2], D. Hooks[1]

[1] Capital And Coast DHB, Wellington, New Zealand
[2] University of Otago, Wellington, New Zealand

Background: Cardiac Implantable Electronic Devices (CIEDs) leads may fail or require deactivation for other reasons. These leads can either be abandoned or extracted, but there is a paucity of long-term outcome data comparing these two management strategies. We present a cohort of patients who underwent either lead abandonment or extraction with long-term outcome data.

Methods: We conducted a retrospective review of all consecutive patients with an endocardial lead abandoned or extracted at Wellington Hospital between February 1992 and 2018. Clinical notes were reviewed for pre-defined outcomes including lead failure, endocarditis, inappropriate therapy, failure of therapy, venous complications and mortality.

Results: A total of 514 deactivated leads in 382 patients were identified; 326 were abandoned, 182 extracted and 6 partially extracted. Atrial leads abandoned due to permanent atrial fibrillation ($n = 122$) were excluded from the statistical analysis.

Patients who underwent lead extraction tended to be younger (58 ± 16 vs. 72 ± 13 years, $p < 0.01$) and have a lower incidence of hypertension (36% vs. 57%, $p < 0.01$), diabetes (11% vs. 19%, $p = 0.04$) and atrial fibrillation (38% vs. 53%, $p < 0.01$). Event rates were similar between abandoned and extracted lead management groups; endocarditis (0.6% vs. 0.9%, $p = 0.80$), venous thrombosis (3.0% vs. 0.7%, $p = 0.56$), compromised venous access (2.4% vs. 2.6%, $p = 0.92$), inappropriate therapy (1.2% vs. 2.6%, $p = 0.38$) or failure of therapy (0.6% vs. 2.6%, $p = 0.16$).

Conclusions: Patients with an indication for lead abandonment or extraction should be discussed at a CIED multi-disciplinary meeting to establish the optimal management strategy. Patients assessed in this fashion have similar long-term outcomes irrespective of management strategy.

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Duration of Inducible Ventricular Tachycardia Early After ST Elevation Myocardial Infarction and its Impact on Mortality and VT Recurrence

T. Deshmukh[1,*], S. Zaman[2], A. Narayan[1], P. Kovoor[1]

[1] Westmead Hospital, Sydney, Australia
[2] MonashHeart, Melbourne, Australia

Background: The aim of the present study was to assess the impact of the duration of inducible VT at the index electrophysiology study (EPS) on mortality and combined endpoints.

	Duration of induced VT		p-value
	0–10 seconds	>10 seconds	
Number	84	32	
Mean cycle length	230 ± 33	227 ± 22	0.867
Duration of VT (seconds) (median [LQ, UQ])	4 (2, 5)	20 (16, 26)	0.001
Total number of beats before termination (median, [LQ, UQ])	18 (9, 23)	90 (72, 117)	0.001
Mode of termination ATP (%)	27	38	0.091
DC shock (%)	61	62	
Spontaneous (%)	12	0	
All-cause mortality (%)	13	9	0.730
Cardiac mortality (%)	2	6	0.275
Cardiac mortality + VT recurrence (%)	34	25	0.476

Methods: Consecutive STEMI patients ($n = 119$) with Day 3–5 left ventricular ejection fraction ≤40% underwent EPS to determine need for an early primary prevention implantable cardiac defibrillator (ICD). A positive EPS was defined as sustained monomorphic VT with cycle length (CL) ≥200 ms. The induced VT was terminated by overdrive pacing or DC shock at 30 seconds or earlier if haemodynamic decompensation occurred. A negative EPS was defined as no arrhythmia induced or inducible ventricular fibrillation/flutter at CL <200 ms. All patients with inducible VT received primary prevention ICD, except for 6 patients, who declined.

Results: 116 patients were analysed. Data were not available for 3 patients. The mean age was 58.6 ± 11.2 years with 105 males and 14 females. The mean LVEF was $30.5 \pm 7\%$. Follow up was 4.9 ± 3.8 years. 8 patients were lost to follow up. Those with duration of induced VT of 0–10 seconds were compared to those with >10 seconds. VT recurrence rates 32% in the 0–10 seconds and 19% in the >10 seconds group.

Conclusion: This study is the first to show that median durations of inducible VT of 4 and 20 seconds at EPS early after STEMI have similar prognostic value. Furthermore, even inducible VT that lasted <10 seconds has predictive power for VT recurrence on follow up.

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Echocardiographic Findings in Critically Unwell Patients with New-Onset Atrial Fibrillation

D. Lancini [1,*], S. Prasad [1], R. Boots [2],
K. Guppy-Coles [1], J. Atherton [1], P. Martin [1]

[1] Cardiology Department, Royal Brisbane And Women's Hospital, Herston, Australia
[2] Burns, Trauma and Critical Care Research Centre, University of Queensland, Herston, Australia

Background: New-onset atrial fibrillation (NOAF) commonly occurs amongst critically unwell individuals and represents a management challenge. However, limited data exist regarding the role of structural cardiac abnormalities in NOAF.

Methods: All patients in a tertiary general ICU developing AF between Dec 2015 to Dec 2016 were identified by an automated alert system. Patients with a previous history of AF were excluded. Data on left atrial size (left atrial volume index, LAVI) and ejection fraction (LVEF) were collected on patients who underwent an echocardiogram during their admission.

Results: 111 patients developed NOAF during the study period, and 84 (75.7%) underwent echocardiography. The distribution of left atrial (LA) size and ejection fraction is shown in Figures 1 and 2 below. 26 patients (31%) had a normal LAVI, 63 patients (75%) had an LVEF > 50%, and 21 patients (25%) had both normal LA size and LVEF.

Conclusions: A substantial proportion of NOAF in the ICU population occurs in the presence of normal LA size and LV systolic function. These findings highlight the significance of extracardiac factors in driving NOAF in critically unwell individuals.

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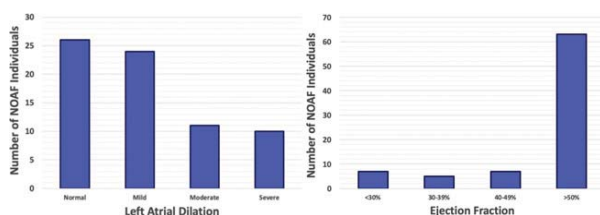
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Electrophysiologic Substrate of Ventricular Arrhythmias in Ventricular Noncompaction - A Systematic Review

A. Bhaskaran [1,*], T. Campbell [2], I. Trivic [2],
S. Virk [1], S. Kumar [1,2]

[1] Cardiology Department, Westmead Hospital, Westmead, Australia
[2] Westmead Applied Research Centre, Westmead Hospital, Westmead, Australia

Introduction: Ventricular noncompaction (VNC) is a form of structural cardiomyopathy that arises from prominent ventricular trabeculae and deep intratrabecular recesses with a predilection for ventricular arrhythmias (VAs).

Methods: a systematic review of case reports, case series and observational studies was conducted to characterise the electrophysiologic features of VA substrate in VNC. Studies were included if they described/included 12-lead ECG morphology of VAs and/or electrophysiology study.

Results: A total of 68 cases were included from 43 studies. Median age at presentation was 39. The most common areas of left ventricular noncompaction were the apex (50%) and lateral wall (43%). 10 patients had right ventricular noncompaction. Median left ventricular ejection fraction was 44%. Of the VAs, 19 were polymorphic and 49 were monomorphic with 29% (14/49) of these cases having 2 or more VT morphologies. 12-lead ECG morphologies were heterogenous, with 13% arising from the superolateral LV apex, 11% from the infero-basal RV septum and 9% from the RVOT. 21 patients had RV substrate on voltage/activation mapping, of which 67% did not have imaging evidence of RV noncompaction. 3 patients had pathogenic mutations (2/3 RYR2; 1/3 CASQ). There was no significant association between the degree of systolic impairment and the number of VAs ($p = 0.66$) or success of radiofrequency ablation ($p = 0.82$). 23/28 (82%) patients had successful elimination of their VA with radiofrequency ablation. Antiarrhythmics failed to control VT in 16 cases.

Conclusion: VA substrate appears more heterogenous than originally thought with a notable proportion of arrhythmias arising from structurally normal myocardium.

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Evaluating Patient Attitudes and Barriers towards Smart Technology for Cardiac Monitoring: Results from a Prospective Multi-Centre Study in an Elderly Population

J. Ko

Austin Health, Melbourne, Australia

Background: The incidence of atrial fibrillation (AF) is rising in the context of an ageing population. Remote assessment of heart rate and rhythm using smart technology (ST) holds promise in AF screening and monitoring. However, patient

engagement is paramount to the success of ST. We sought to survey the attitudes and potential barriers towards ST for arrhythmia monitoring in an elderly population.

Methods: Consecutive inpatients were recruited across three tertiary hospitals in Australia. Participants were administered a standardised survey regarding attitudes towards ST for arrhythmia detection. Survey responses were either binary (yes or no) or on a five-point Likert scale from "Strongly Disagree" (score 1) to "Strongly Agree" (score 5).

Results: Of the 363 participants, (mean age 66 ± 15 years, mean CHA_2DS_2VASC score 3 ± 2), 68.9% were interested in ST for cardiac monitoring. Those with AF ($n = 112$) were more likely to be interested (mean score 4.2 vs 3.5, $p < 0.001$). Cost (66.7%) and complexity (71.1%) of mobile devices were identified as major barriers to their adoption, particularly in older participants ($p = 0.02$). While only 52% of participants trusted ST accuracy, over 90% would seek medical attention based on aberrant readings.

Conclusion: We report a high level of interest among an older, high-risk patient cohort in utilising ST for cardiac monitoring. Despite a level of distrust, abnormal ST readings would still prompt the overwhelming majority of patients to seek medical attention. Clinicians and patients both need to be aware of the strengths and inherent limitations of this nascent technology for sustainable incorporation into clinical practice.

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Failure rate in Biotronik Linox/Sorin Vigila ICD leads

M. Alasti, E. Kotschet*, D. Adam, S. Healy, L. Bittinger, J. Krafchek, J. Alison

Monash Health, Clayton, Australia

Background: Failure of the Biotronik Linox/Sorin Vigila implantable cardioverter-defibrillator leads has been reported at rates above other ICD leads. The aim of this study was to assess failure rate in these leads implanted in our centre.

Methods: We performed a retrospective analysis of all implantations of Linox/Vigila leads over the last 12 years at our centre. All patients with a Linox family ICD Lead or Vigilla lead implanted at our center were identified and all clinical data and device interrogations including a new device check were considered.

Results: A total of 205 patients [169 (82.4%) men] had one of these leads (166 Linox family leads and 39 Vigila leads) implanted at our center between 2007 till 2015. 164 (80%) of implantations had been because of a secondary prevention indication and 140 (68.3%) leads had been implanted in right ventricular apex. Cephalic access had been used in 116 (56.9%) of patients.

Of these, 12 patients (5.9%) had lead failure. In four patients, lead fracture was the reason for lead failure, while noise and inappropriate shock was the issue in 4 patients and sensing/pacing problems in two patients.

Conclusion: In our patients with a Linox family or Sorin Vigila lead, the failure rate was 5.9%.

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Gender Difference in Clinical Outcomes after Percutaneous Left Atrial Appendage Closure in Patients with Atrial Fibrillation

S. Iwai[1,*], S. Worthley[2], P. Sanders[1], G. Young[1,2]

[1] *Centre for Heart Rhythm Disorders, South Australian Health and Medical Research Institute, University of Adelaide and Royal Adelaide Hospital, Adelaide, Australia*
[2] *Genesiscare, Sydney, Australia*

Background: Females with atrial fibrillation (AF) could have a greater risk for ischaemic stroke and systemic emboli compared with males. However, the incidence of these events by gender after percutaneous left atrial appendage (LAA) closure is not clear.

Objective: To compare gender differences in clinical outcomes after LAA closure.

Methods: The consecutive patients who underwent percutaneous LAA closure were studied. We examined gender differences in ischaemic stroke, haemorrhagic stroke, systemic emboli, device-related thrombus and procedure-related adverse events.

Results: The consecutive 124 pts (45 females and 79 males; age 75 ± 7) underwent LAA closure with Amplatzer in 68, Watchman in 37 and WaveCrest in 19. Females had higher CHA_2DS_2-VASc score (4.8 ± 0.8 vs 3.6 ± 1.3, $p < 0.0001$) and more prior stroke/transient ischaemic attack (15 [33%] vs 12 [15%], $p = 0.019$) compared with males. Seven procedure-related adverse events (cardiac tamponade: 1, device emboli: 1, haematoma: 5) occurred in 3 (6.7%) females and 4 (5.1%) males ($p = 0.71$). Device-related thrombus was observed in 1 (2.2%) females and 4 (5.1%) males ($p = 0.44$). During the mean follow-up (30 ± 18 vs 24 ± 17 month, $p = 0.08$), there was no significant difference in events rate between females and males; ischaemic stroke (5 [11.1%] vs 5 [6.3%], $p = 0.35$), haemorrhagic stroke (0 [0%] vs 2 [2.5%], $p = 0.29$) and systemic emboli (2 [4.4%] vs 2 [2.5%], $p = 0.56$).

Conclusion: Females had higher embolic event risk compared with males, but no gender difference was found in complications, all-cause stroke and systemic emboli after LAA closure.

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Gender Differences in Electrophysiology, Ventricular Tachyarrhythmia, Cardiac Arrest and Sudden Cardiac Death Following Acute Myocardial Infarction

A. Aslam [1,*], T. Deshmukh [2], C. Martin [1], P. Kovoor [3], S. Zaman [1,4]

[1] Monash University, Melbourne, Australia
[2] Department of Cardiology, Westmead Hospital, Sydney, Australia
[3] University of Sydney, Sydney, Australia
[4] Monash Cardiovascular Research Centre, Monash Heart, Melbourne, Australia

Introduction: Women experience less appropriate implantable cardioverter-defibrillator (ICD) interventions and are underrepresented in primary prevention ICD trials. Gender differences in inducible and spontaneous ventricular tachycardia/fibrillation (VT/VF), cardiac arrest and sudden cardiac death (SCD) early post-myocardial infarction (MI) require further study.

Methods and Results: Consecutive ST-elevation MI patients with left ventricular ejection fraction (LVEF) $\leq$40% underwent electrophysiology study (EPS) to target early prevention of SCD ($n = 403$, 16.9% female). An ICD was implanted for a positive (inducible monomorphic VT) but not a negative (no arrhythmia or inducible VF) EPS. The combined primary endpoint of VT/VF (spontaneous or ICD-treated), cardiac arrest or SCD was assessed using competing risk survival analysis in women versus men with adjustment for confounders. Logistic regression was used to determine independent predictors of inducible VT at EPS. Women were significantly older than men but with similar mean LVEF (31.5 ± 6.3 versus $31.6 \pm 6.4\%$, $P = 0.91$). EPS was positive for inducible VT in 22.1% and 33.4% ($P = 0.066$) and an ICD implanted in 25.0% and 33.4% ($P = 0.356$) of women versus men. Appropriate ICD activations (VT/VF) occurred in 5.9% and 36.6% of women versus men ($P = 0.012$). The adjusted cumulative primary endpoint incidence was significantly lower in women than men (1.6% versus 26.5%, $P = 0.03$). Female gender was not an independent predictor of inducible VT at EPS (HR 0.63, 95% CI 0.33–1.23, $P = 0.178$).

Conclusion: Women with early post-MI cardiomyopathy had significantly lower VT/VF, cardiac arrest and SCD, compared to men. In ICD recipients the rate of appropriate activations was 6-fold less in women compared to men.

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General Practitioners' (GPs') Awareness of the Australian Atrial Fibrillation (AF) Screening Guidelines and Their Practice of AF-Screening

K. Wong [1,2,3,*], C. Chow [1], S. Marschner [1], C. Kok [4], T. Usherwood [5]

[1] Westmead Applied Research Centre, University of Sydney, Westmead, Australia
[2] Bathurst Rural Clinical School, Western Sydney University, Bathurst, Australia
[3] School of Rural Health, University of Sydney, Orange, Australia
[4] Northern Clinical School, University of Sydney, Sydney, Australia
[5] Westmead Clinical School, University of Sydney, Westmead, Australia

Background: AF is often diagnosed and managed by GPs. In 2018 Australia's first guidelines for diagnosis and management of AF were published. Our aim was to investigate among GPs their awareness of the AF Guidelines and their approach to AF-screening.

Methods: The results from an online survey promoted through a variety of routes to GPs and GP registrars in Australia was analysed using SPSS. The survey included questions on knowledge of AF, AF-screening and use of ECG devices. Ethics approval was granted by University of Sydney.

Table 1. *AF screening among those aware and not aware of AF guidelines.*

Screening methods	Aware of guidelines ($n = 154$)	Not aware of guidelines ($n = 259$)	P
At least one AF-screening method	152 (99%)	199 (77%)	<0.001
Uses two or more methods of AF-screening	71 (46%)	59 (23%)	<0.001
Methods used:			
include pulse palpation	149 (97%)	196 (76%)	<0.001
include use of 12-lead ECG	67 (44%)	61 (24%)	<0.001
include use of mobile screening device	10 (7%)	4 (2%)	0.010[*]

[*] Fisher exact test.

Results: From October-2018 to January-2019, 413 participants completed the survey: 56% were from major cities across Australia, 71% were female, and 58% had <10 years of experience as GPs. 37% were aware of the new AF guidelines. Awareness rates were similar by location of practice (38% versus 37% for major cities and outside major cities, $p = 0.8$), and GP experience suggested a possible difference (34% versus 42% for <10 and ≥10 years, $p = 0.08$). However, female and male respondents significantly differed in awareness (34% versus 47%, respectively, $p = 0.01$).

Comparing those who were aware and unaware of the Guidelines, we found 99% versus 77% used at least one AF-screening method and 46% versus 23% used two or more methods. The main method used was pulse palpation, followed by 12-lead ECG. Use of mobile screening devices was limited in both groups (Table 1).

Conclusion: Respondents who were aware of the Guidelines were more likely to perform AF-screening on asymptomatic patients and used mainly pulse palpation or 12-lead ECG.

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Health Care Resource Utilisation in the AF population: The REVIEW AF Study

C. Gallagher [1,*], C. Wong [1], J. Hendriks [1], J. Bednarz [2], A. Elliott [1], D. Linz [1], M. Middeldorp [1], R. Mahajan [1], D. Lau [1], P. Sanders [1]

[1] *Centre For Heart Rhythm Disorders, South Australian Health and Medical Research Institute, University of Adelaide and Royal Adelaide Hospital, Adelaide, Australia*
[2] *School of Public Health, University of Adelaide, Adelaide, Australia*

Background: Hospitalisation is the main driver of health care resource utilisation in atrial fibrillation (AF). The aim of this study was to characterise reasons for repeat hospital admissions in a cohort of individuals with AF, and to examine the impact of age and gender on risk of re-presentation.

Methods: Individuals presenting to the emergency department of three hospitals in Adelaide, South Australia from March 2013 to March 2014 with a primary diagnosis of AF were enrolled. Based on coding and individual electronic medical record review all re-presentations over follow up were characterised as: (1) AF related; (2) cardiovascular related (excluding AF); or (3) all other causes. An age and gender adjusted model characterised risk of repeat presentations.

Results: The study cohort comprised 437 individuals with an AF related index presentation. Mean age was 69 ± 15 years and 49.9% were male. Individuals were followed for a mean of 3.7 ± 0.4 years. There were 2304 unplanned presentations over follow up. Of all repeat hospitalisations, AF accounted for 21%, cardiovascular causes accounted for 18.9% and all other causes accounted for 64.6%. Each 5-year decrease in age was associated with a 7% increase in the likelihood of an AF re-presentation (Odds Ratio [OR] 1.07, 95% confidence interval [CI] 1.03–1.11; $p < 0.0001$). Males were more likely than females to have an AF re-presentation (OR 1.29, 95% CI 1.03–1.60; $p = 0.03$).

Conclusions: A hospital presentation with a primary diagnosis of AF identifies individuals who pose significant health care burden with younger age and males identified as high-risk populations.

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High Density Mapping of the Crista Terminalis Demonstrates Transient Block and Rotational Activity: Implications for Persistent Atrial Fibrillation

C. Nalliah [1,*], G. Lee [1], T. Watts [1], G. Wong [1], R. Parameswaran [1], A. Voskoboinik [2], H. Sukumar [2], M. Larobina [1], M. O'Keefe [1], J. Goldblatt [1], A. Royse [1], A. McLellan [1], H. Ling [2], J. Morton [1], P. Kistler [2], P. Sanders [3], J. Kalman [1]

[1] *Royal Melbourne Hospital, Melbourne, Australia*
[2] *The Alfred, Melbourne, Australia*
[3] *Royal Adelaide Hospital, Adelaide, Australia*

Background: Anatomic and conduction heterogeneity at the crista terminalis (CT) may be important for maintaining persistent atrial fibrillation (AF).

Methods: This study comprised 18 patients without AF (Group 1, female 22%, age 64 ± 6) and 13 patients with persistent AF (Group 2, female 33%, age 66 ± 14). We performed intraoperative high density bipolar epicardial mapping at the CT and right atrial free wall (RAFW). In Group 1, both sites were mapped in sinus and paced rhythm (600 and 300 ms). In Group 2, 30 s of continuous AF from each site underwent phase transformation. Each plaque activation was manually characterised based on pre-defined criteria. The prevalence, frequency and stability of rotor events (≥2 revolutions) were compared across sites.

Results: In Group 1, the CT was characterised by longer plaque activation times, slower conduction velocity, greater conduction heterogeneity and more complex points, across all modes of activation. In group 2, 4,617 activations were manually classified. Activation patterns were highly heterogenous and transient. Rotor frequency (9.5 (3, 15.5) vs 2.0 (0, 5.5), $p = 0.005$), proportion of activations attributable to rotors (5.6 ± 4.2% vs 1.8 ± 1.8%, $p = 0.006$) and rates of rotor recurrence (3 (1.5, 6) vs 1 (0, 1.5), $p = 0.002$) were higher at the CT. Rotors frequently associated with transient lines of conduction delay/block at the CT (67% vs 17%, $p = 0.02$).

Conclusion: Slowed conduction and lines of block localise to the CT. Transient delay/block at the CT associate with rotational activity during AF. The CT may be important for maintaining persistent AF.

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His-Bundle Pacing – Medium-Term Safety and Feasibility

C. Chow [1,2,*], S. Nandal [1], V. Mutha [1], M. Obeyesekere [1], H. Lim [1], U. Mohamed [1,2]

[1] Northern Health, Epping, Australia
[2] University of Melbourne, Parkville, Australia

Background: His-Bundle Pacing (HBP) is associated with improved clinical outcomes, compared to conventional right ventricular (RV) pacing techniques. However, more safety and longer-term feasibility data are direly needed to convince wider uptake among electrophysiologists.

Methods: Between November 2017 and December 2019, all HBP pacemakers performed at the Northern Hospital were audited for safety and device stability.

Results: HBP was successfully performed in 72 out of 82 attempted cases (87.8%) by four electrophysiologists. Acute implant parameters were acceptable, with a mean threshold of $1.11V \pm 0.08$ @1.0 msec, sensing of 4.33 ± 0.54 mV and impedance of $608 \pm 15\Omega$. At 1-month, threshold values were stable at $1.03\,V \pm 0.10$ @1.0 msec. In this series, 40 of the 72 patients reached the 6-month timepoint, with two further medium-term device failures. One was extracted due to device-related infection, and another deceased of urosepsis. The 6-month threshold was stable at $1.19\,V \pm 0.17$ @1.0 msec.
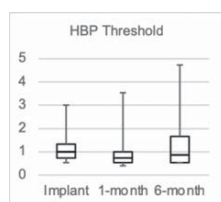
	Threshold (V)	Impedance (Ω)	Sensing (mV)
Implant	1.11 ± 0.08	608 ± 15	4.33 ± 0.54
1-month	1.01 ± 0.10	469 ± 7	5.07 ± 0.73
6-month	1.19 ± 0.17	482 ± 20	3.05 ± 0.69

Conclusion: HBP is safe and appears to achieve stable 6-month threshold values, amidst uncertainties around its follow-up stability. Longer-term data is still highly anticipated however, before this technique sees wider uptake among implanters.

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Human Vascularised Cardiac Organoids for Disease Modelling

J. Lees [1,*], A. Kong [1], G. Mitchell [1,2,3], S. Lim [1,2]

[1] O'Brien Institute Department, St Vincent's Institute of Medical Research, Melbourne, Australia
[2] Department of Surgery, University of Melbourne, Melbourne, Australia
[3] Faculty of Health Sciences, Australian Catholic University, Melbourne, Australia

Heart disease is the leading cause of death worldwide. There is a pressing need for accurate human disease models to improve our understanding of heart diseases and facilitate preclinical trials. Cardiac organoid models can recapitulate the 3D microenvironment and allow integration of different cell types found in native hearts. To create functional cardiac organoids, vascularisation is an essential structural component to maintain cell survival by facilitating the exchange of nutrients and oxygen, and removal of waste products. The intercellular cross-talk between endothelial cells and cardiomyocytes is also critical for cardiac development and mediating the onset and progression of cardiac disease.

We have generated a vascularised cardiac organoid derived entirely from human induced pluripotent stem cells (iPSCs). Purified iPSC-derived endothelial cells (iPSC-ECs) have a cobblestone morphology, express endothelial-specific protein markers, and can form tubular structures on Matrigel and a capillary-like network *in vivo*. Enriched human iPSC-derived cardiomyocytes express cardiac-specific markers, beat spontaneously in culture and are responsive to chronotropic agents. Using a novel proprietary method, we have constructed cardiac organoids with iPSC-cardiomyocytes and iPSC-ECs that exhibit spontaneous and synchronous contraction. After 3 weeks of maturation, the organoids are approximately 1.5 mm in diameter and CD31-positive vessel-like structures with lumens can be found interspersed throughout the cardiomyocytes.

The vascularised human cardiac organoids generated from iPSC-derivatives will allow us to achieve a better understanding of cardiac disease pathophysiology and development of new therapeutic interventions. This model can be scaled up for high-throughput screening of drug libraries that is not feasible in animal models.

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Impact of Contact Force Sensing Technology on the Safety and Efficacy of Atrial Fibrillation Ablation: a Meta-Analysis

S. Virk [1,*], J. Ariyaratnam [1], R. Bennett [2], S. Kumar [1,3]

[1] Department of Cardiology, Westmead Hospital, Australia
[2] Bristol Heart Institute, Bristol, United Kingdom
[3] Westmead Applied Research Centre, University of Sydney, Australia

Aims: Despite widespread adoption of contact force (CF) sensing technology in atrial fibrillation (AF) ablation, its impact on clinical outcomes remains unclear. We aimed to assess the safety and efficacy of CF-guided versus non CF-guided AF ablation.

Methods: Electronic databases were searched for randomised controlled trials (RCTs) and controlled observational studies (OS) comparing outcomes of AF ablation performed with vs without CF guidance. The primary efficacy endpoint was freedom from AF at follow-up. The primary safety endpoint was major peri-procedural complications. Secondary endpoints included procedural, fluoroscopy and ablation duration. Subgroup analyses were performed by AF type and study design.

Results: Nine RCTs ($n = 903$) and 26 OS ($n = 8919$) were included. Overall, CF guidance was associated with improved freedom from AF (relative risk [RR] 1.10; 95% confidence interval [CI], 1.02–1.18), and reduced total procedure duration (mean difference [MD] 15.33 minutes; 95% CI 6.98–23.68), ablation duration (MD 3.07 minutes; 95% CI, 0.29–5.84), and fluoroscopy duration (MD 5.72 minutes; 95% CI, 2.51–8.92). When restricted to RCTs, CF guidance neither improved freedom from AF (RR 0.95; 95% CI, −2.00 to 3.91), independent of AF type, nor did it reduce procedural, fluoroscopy or ablation duration. CF guidance did not reduce the incidence of major peri-procedural complications (RR 0.89; 95% CI, 0.64–1.24).

Conclusions: Meta-analysis of randomised data demonstrated that CF guidance does not improve the safety or efficacy of AF ablation, despite initial observational data showing dramatic improvement. Rigorous evaluation in randomised trials is needed before widespread adoption of new technologies.

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Investigation of Potential Pacing Lead Failure: An Australian Single-Centre Experience

R. Samuel [1,*], L. Segan [2], M. Perrin [2]

[1] St Vincent's Health, Fitzroy, Australia
[2] Barwon Health, Geelong, Australia

There is growing evidence to suggest an increased rate of pacemaker lead failure in St Jude Tendril leads. This has not been investigated in an Australian setting.

Data from a retrospective cohort of patients with St Jude Tendril 2088 leads implanted from 2010 was collected through our institution's PaceArt Optima database. Leads were eligible if they had at least one device check performed at the one month mark post implantation. A clinical review of each pacemaker check was performed to assess for the presence of 'noise', the most common manifestation of lead failure in these devices.

A total of 408 leads were eligible for inclusion in the study. Median follow up was 2.2 years. There were 10 cases of lead noise suggestive of lead failure, a failure rate of 2.45%. 81 leads were followed up for at least 4 years, of which 5 had failed after this time point, a failure rate of 6.17%. The Kaplan-Meier curve is shown in the figure below.

The rate of Tendril 2088 lead failure appears lower than that suggested by other retrospective studies performed overseas. Further research is required in the longer term to assess failure rate beyond 5–10 years.

Tendril 2088 Lead Survival
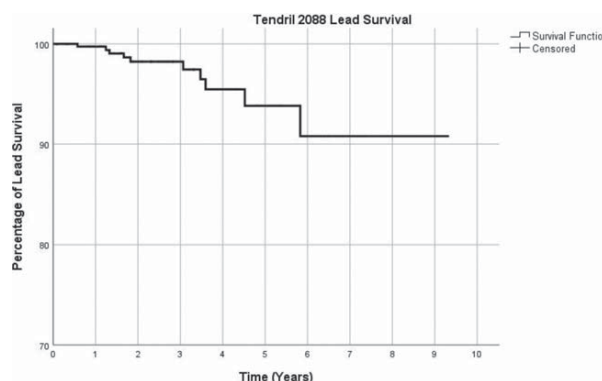
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Is Incorrect Anti-Coagulation Dosing Contributing to Ischaemic Stroke Burden? A Retrospective Single-Centre Study from Regional New South Wales, Australia

P. Bamford [1,3,*], M. Ray [2], S. Cheruvu [3], M. Parkinson [3], C. Said [3], J. Trappel [3], J. Rogers [3]

[1] University of Newcastle, Newcastle, Australia
[2] Royal North Shore Hospital, St Leonards, Australia
[3] Gosford Hospital, Gosford, Australia

Background: Atrial fibrillation (AF) contributes to 30% of ischaemic stroke presentations. Low doses of anti-coagulants are often prescribed to prevent stroke but ameliorate bleeding risk.

Objective: To determine whether incorrect dosing and clinician oversight contributes to ischaemic stroke in AF patients.

Method: A retrospective review was performed for patients with ischaemic stroke admitted to a regional centre between June 2017 and June 2018. These records were assessed for background of AF or newly diagnosed AF based on ECG or telemetry. Their CHA_2DS_2-VASc score, weight and anti-coagulant dose were recorded. Using the patient's age, weight, creatinine clearance and INR at time of presentation, the previously prescribed anti-coagulant was marked as either under-, correctly, or over-dosed.

Results: 298 patients presented with ischaemic stroke. 96 (32.2%) had atrial fibrillation with a mean CHA_2DS_2VASc score of 4.58. Of the 81 with pre-existing AF, 53 (65.4%) were anti-coagulated with the other 28 (34.6%) not anti-coagulated for reasons including previous serious bleeds (9 patients), high falls risk (7 patients), quality of life (3 patients), low risk as defined by CHA_2DS_2VASc <2 (2 patients) and apparent clinician oversight (7 patients).

43% of patients on DOACs were incorrectly dosed. 53.8% of patents on warfarin were sub-therapeutic on presentation.

Conclusion: 9.4% of all ischaemic stroke might have been prevented if anti-coagulants had been prescribed correctly. Under-dosing of anti-coagulants adds to the ischaemic CVA burden.

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Is There Seasonal Variation in the Incidence of Atrial Fibrillation?

L. Davis [1,*], L. Coverdale [2], M. Johnston [2], N. Prentice [2]

[1] *Westmead Hospital, Westmead, Australia*
[2] *Biotronik, Germany*

Cardiovascular events seem to follow a diurnal and seaonal pattern. The incidence of stroke based on hospital casualty presentations is also seasonal. To determine whether atrial fibrillation also follows a seasonal pattern we analysed the remote monitoring data of 53 of our patients with dual chamber pacemakers. Daily transmission data were examined for mode switching, AF burden, activity sensor rate and % V pacing between October 2017 to October 2018.
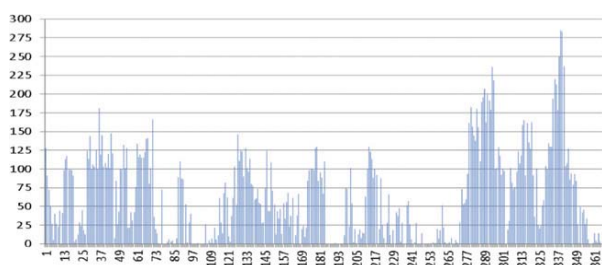
The frequency of atrial fibrillation varied in our patient cohort throughout the year with a peak in the August, September and October months. This is similar to the peak in the flu season of August September. The ventricular pacing percentage and activity sensor followed a stable pattern throughout the year.

Conclusion: Our data suggest that atrial fibrillation is more likely to occur in the late winter/early spring period perhaps associated with the increased incidence of respiratory illness. Further work needs to be performed to explore this.

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Learning Curve and Initial Experience of Implementing a HIS Bundle Pacing Program

L. Dawson [1,*], J. Cadden [1], D. Pol [1], I. Stephenson [1,2]

[1] *Royal Melbourne Hospital, Melbourne, Australia*
[2] *Melbourne Private Hospital, Melbourne, Australia*

Background: HIS Bundle Pacing (HBP) has emerged as a promising technology to avoid pacing complications associated with dyssynchrony in right ventricular (RV) pacing. There are limited Australian data on HBP and most international data are limited to experienced operators and centres.

Methods: Data were retrospectively collected on 45 consecutive HBP procedures at two Victorian centres from commencement of the program in March 2018 to February 2019. The cohort was divided into three groups (A: cases 1–15, B: cases 16–30, and C: cases 31–45) to determine changes over time in relation to operator experience.

Results: Mean age was 70.0 ± 18.4, 69% were male. Impaired LV function was present in 27%, 13% had a previous device, and 5% and 30% had a pre-existing right or left bundle branch block (BBB) respectively. HBP was successful in 82% of procedures, but was less likely to be successful if AV block was the indication (70% vs 100%, $p = 0.02$). QRSD increased by mean 9.8 ± 19.4 ms in patients without BBB and decreased by mean 20.9 ± 44.3 ms in patients with BBB. Rates of procedural success, QRSD improvement, and use of an RV backup lead were 80%, 50%, and 40%, respectively for group A, and 93%, 78% and 27%, respectively for group C. Procedural time and fluoroscopy time decreased over time across the three groups ($p = 0.05$ and $p < 0.001$ respectively).

Conclusions: HBP has a high success rate and is feasible in an Australian setting with improvements in procedural performance and outcomes seen with operator experience. AV block appears to affect procedural success.

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Meta-Analysis of Remote Magnetic Versus Manual Catheter Navigation for Atrial Fibrillation Ablation

S. Virk [1,*], S. Kumar [1,2]

[1] *Westmead Hospital, Sydney, Australia*
[2] *Westmead Applied Research Centre, University of Sydney, Australia*

Background: Catheter ablation of atrial fibrillation (AF) is a technically challenging procedure with sub-optimal success rates. In recent years, remote magnetic navigation (RMN) technologies have emerged in an effort to facilitate safer, more durable lesion formation during AF ablation. However, the impact of RMN on safety and efficacy of AF ablation is unclear.

Methods: Electronic databases were searched for controlled studies comparing outcomes of AF ablation performed using RMN versus manual catheter navigation (MCN). The primary efficacy endpoint was freedom from AF at ≥ 1 year follow-up. The primary safety endpoint was major peri-procedural complications. Secondary endpoint included fluoroscopy and procedure durations.

Results: Fifteen observational studies were included, involving a total of 3246 patients (RMN = 1475; MCN = 1771). Compared to MCN, RMN was associated with reduced major peri-procedural complications (relative risk [RR] 0.51; 95% CI, 0.29–0.91), but similar recurrence of AF at ≥ 1 year follow-up (RR 0.97; 95% CI, 0.89–1.05). Fluoroscopy times were significantly shorter with RMN (mean difference [MD] 13.3 minutes; 95% CI, 6.9–19.7) but total procedure (MD 51.3 minutes; 95% CI, 32.0–70.6) and ablation (MD 15.7 minutes; 95% CI, 8.2–23.2) durations were significantly longer.

Conclusions: RMN was associated with reduced peri-procedural complications and fluoroscopy exposure during AF ablation, albeit with longer procedure duration. However, freedom from AF at follow-up was not improved with the use

of RMN. Randomised controlled trials are warranted to confirm the potential benefits of RMN technologies and clarify their impact on long-term outcomes.

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Myocardial Fibrosis is Present in Thoroughbred Racehorses with Sudden Cardiac Death

L. Nath[1,*], T. Agbaedeng[2], S. Franklin[1], A. Saljic[2], A. Stent[3], A. La Gerche[4], A. Elliott[2]

[1] University of Adelaide, Roseworthy, Australia
[2] University of Adelaide, Adelaide, Australia
[3] University of Melbourne, Werribee, Australia
[4] Baker Heart and Diabetes Institute, Melbourne, Australia

Background: Sudden cardiac death (SCD) due to ventricular arrhythmia occurs in intensively trained human athletes. Horses undergo cardiac adaptations to training in a similar manner to human athletes and are a naturally occurring model for the Athlete's Heart. In rodent studies, athletic training induces myocardial fibrosis and this is a substrate for arrhythmia. The extent of myocardial fibrosis is yet to be quantified in other animal models such as the horse.

Methods: Cardiac tissues were harvested at post mortem from horses without structural heart disease that died from sudden unexplained cardiac death (SCD, $n = 8$ TBH), non-cardiac death (NC, $n = 8$ TBH), or healthy untrained horses (UT, $n = 10$ brumbies). Global and interstitial fibrosis was assessed in the right ventricular free wall (RVFW), left ventricular free wall (LVFW) and left ventricular papillary muscle (LVPM). Groups were compared by ANOVA and students t-test.

Results: At each site examined, mean global and interstitial fibrosis was highest in the SCD group. In LVPM, mean interstitial fibrosis was higher in SCD ($4.05 \pm 1.9\%$) than NC ($1.87 \pm 1.0\%$), $p = 0.002$, and UT ($1.73 \pm 0.4\%$), $p = 0.001$. In LVFW, mean interstitial fibrosis was higher in SCD ($5.00 \pm 3.5\%$) than UT ($2.41 \pm 0.6\%$), $p = 0.038$.

Conclusion: Myocardial fibrosis was greater in horses with SCD compared to similarly trained horses with death from a non-cardiac cause, or untrained horses. Myocardial fibrosis could be a substrate for arrhythmia and SCD in this species. These results may have application to intensively trained human athletes.

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New Atrial Fibrillation after Non-Cardiac Surgery Increases Risk of Stroke: Results From a Meta-Analysis

A. Koshy[1,*], V. Thijs[2], A. Teh[1], J. Sajeev[1], H. Lim[1], H. Han[1], L. Weinberg[1], P. Gow[1], O. Farouque[1]

[1] Department of Cardiology & University of Melbourne, Austin Health, Heidelberg, Australia
[2] Department of Neurology, Austin Health, Heidelberg, Australia

Introduction: New-onset post-operative atrial fibrillation (POAF) following non-cardiac surgery (NCS) has been associated with increased length of stay, morbidity and mortality. However, it is unclear whether POAF increases long-term risk of stroke, which may have implications for anticoagulation use in POAF.

Methods: Electronic databases (MEDLINE, PubMed) were systematically searched for studies of patients undergoing NCS that reported incidence of new POAF and stroke. Studies of patients with pre-existing AF were excluded. Event rates from individual studies were pooled using a Der-Simonian and Laird random-effects model.

Results: Sixteen studies of 3,664,390 patients undergoing NCS were included (mean age was 67 ± 3 years). Majority were observational cohort studies and follow-up ranged from 30-days to 3-years. Methods of cardiac rhythm monitoring varied between studies. 29,307 (0.80%) patients developed new POAF. On pooled analysis, POAF was associated with over a two-fold increased risk of stroke (Relative Risk 2.1 95%CI 1.9–2.3, $p < 0.001$) with low heterogeneity ($I^2 = 22\%$) between studies (Figure 1).
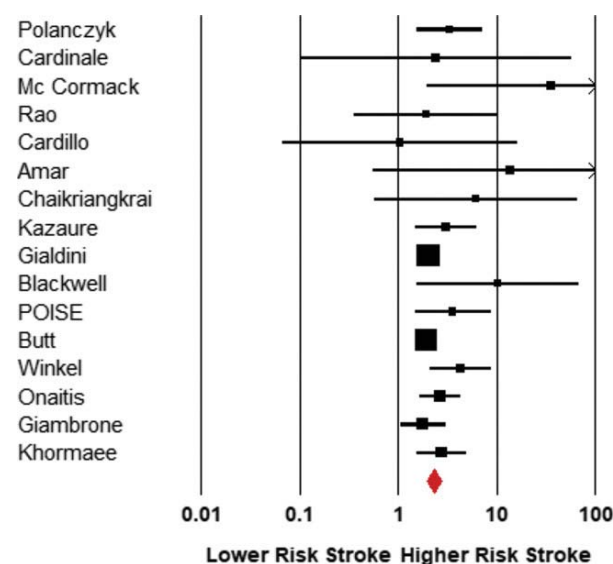

Figure 1.

Conclusion: New POAF after NCS is associated with a greater than two-fold increased risk of stroke. Future stud-

ies are needed to assess whether anticoagulation can reduce the risk of stroke in this cohort.

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New-Onset Atrial Fibrillation in the Critically Ill: Burden and Predictors

D. Lancini [1,*], S. Prasad [1], R. Boots [2], K. Guppy-Coles [1], J. Atherton [1], P. Martin [1]

[1] Cardiology Department, Royal Brisbane And Women's Hospital, Herston, Australia
[2] Burns, Trauma and Critical Care Research Centre, University of Queensland, Herston, Australia

Background: New-onset atrial fibrillation (NOAF) is a common complication of critical illness, ranging from isolated transient episodes to sustained arrhythmia. However, very limited data exist regarding the burden of AF episodes in the general ICU population, or the predictors of AF burden in this setting.

Methods: All patients in a tertiary general ICU developing AF between Dec 2015 to Dec 2016 were identified by an automated alert system. Patients with a previous history of AF were excluded. AF burden was extracted from hourly rhythm measures, and demographic and clinical data were obtained from ICU medical records. Student's T test was used to identify univariate predictors of NOAF burden across demographic, clinical and laboratory parameters.

Results: 218 patients developed AF during the study period, of which 111 (51%) were NOAF. The median AF burden was 5.8% of the total ICU stay, ranging from 0.08% to 100% (see Fig. 1). Statistically significant predictors of NOAF burden were creatinine ($p = 0.006$) and Mg^{2+} levels ($p = 0.04$). Past medical history was not significantly associated with AF burden.
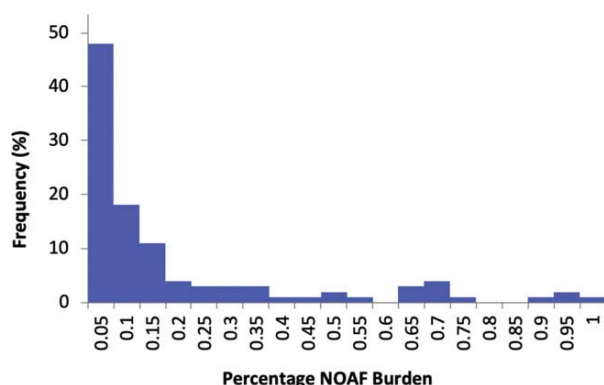

Fig. 1.

Conclusions: This analysis of a preliminary dataset provides evidence that NOAF episodes in the ICU population are frequently transient, and that biochemical parameters may be a significant driver of NOAF burden in this setting.

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No Difference in Success of Repeat Catheter Ablation for Patients with Recurrent Persistent AF in the Presence of PV Reconnection vs Enduring Pulmonary Vein Isolation

H. Sugumar

Alfred Health/Rmh, Melbourne, Australia

Background: Pulmonary vein isolation (PVI) remains the corner stone of AF ablation. Although the majority of AF recurrence is associated with PV reconnection (PVRECONN) a proportion have enduring isolation (PVISOL). We aimed to determine the long-term outcome of repeat ablation based on pulmonary vein reconnection status in patients with persistent AF.

Methods and Results: 172 of 706 (24.3%) patients with persistent AF underwent repeat catheter ablation (CA) for AF recurrence. Initial ablation involved PVI only in 73 (42.4%), PVI plus posterior wall isolation (PWI) in 60 (34.8%) and PVI + linear ablation in 39 (22.7%). At repeat procedure PV reconnection was present in 110 (64%) with a mean of 1.6 ± 1.5 PVs reconnected. PVISOL was present in 62 (36%). Additional ablation involved PWI in 19 (30.6%), mitral isthmus / Anterior line ablation in 23 (37.1%) and non PV triggers in 20 (32.3%). In PVRECONN group, 49 (44.5%) only had reisolation of their initial ablation strategy with 35 (31.8%) undergoing PWI and 26 (23.6%) underwent linear ablation. Arrhythmia free survival was documented with 24 hour holter monitor performed at least 12 month after the last CA. PVISOL group had 31 (50%) who remained arrhythmia free and was 62 (56.4%) in those with vein reconnection ($p = NS$) on or off anti arrhythmic therapy. Average follow up was 36.0 ± 27.0 months with an total of 2.2 ± 0.5 procedure performed on average.

Conclusion: In patients with enduring pulmonary vein isolation additional ablation/substrate modification resulted in similar arrhythmia free survival compared to those with PV reconnection and reisolation. Further prospective studies are required in patients with enduring pulmonary vein isolation.
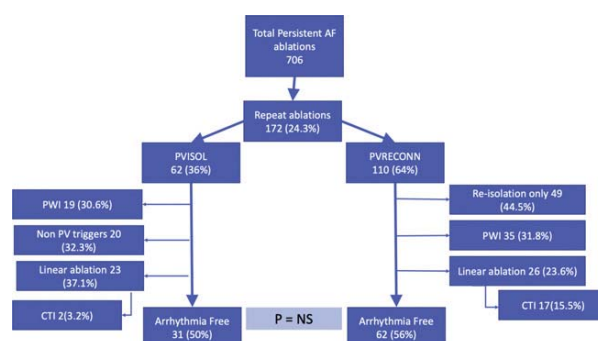
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NOAC's It's Time to Extenuate Patient Knowledge Gaps

L. Steel [1,*], A. Faint [2], M. Barras [2,3],
N. Cottrell [3], M. Parnell [3,4], B. Macey [3,5],
H. Yip [3,4]

[1] Royal Brisbane and Women's Hospital,
Brisbane, Australia
[2] Princess Alexandra Hospital, Woolloongabba,
Australia
[3] School of Pharmacy, University of Queensland,
Brisbane, Australia
[4] School of Pharmacy, University of Nottingham,
Nottingham, United Kingdom
[5] Department of Pharmacy and Pharmacology,
University of Bath, Bath, United Kingdom

Background: New oral anticoagulants (NOACs) are often perceived by clinicians as "easier" drugs to use than warfarin. We suspect a lack of quality patient education and subsequent knowledge of these medications.

Aim: To investigate gaps in patients' knowledge of their oral anticoagulants and compare differences in knowledge between patients taking warfarin and NOACs.

Method: A prospective cross-sectional survey was conducted in two tertiary hospitals by three international research students. Patients taking either warfarin or a NOAC were recruited. Patient knowledge was assessed using the Anticoagulation Knowledge Tool (AKT); [1] a tool that quantifies general anticoagulant and warfarin specific knowledge.

Results: 151 patients completed the AKT; 54 taking warfarin and 97 a NOAC. The total mean ($\pm$SD) percentage correct score on the AKT was 56.3% ($\pm$15.4). For all patients, significant gaps in knowledge were present for side effects ($n = 58$, 38%), concurrent NSAID use ($n = 62$, 41%) and safety of a missed dose ($n = 55$, 36%). Patients taking NOACS had a significantly lower mean percentage of correct answers compared to those taking warfarin for; side effects (30% vs 54%, $p = 0.02$); NSAID use (32% vs 57%, $p = 0.002$); and missing a dose (29% vs 50%, $p = 0.01$). For patients on warfarin, knowledge of current INR and dietary restrictions was limited.

Conclusion: Patients taking NOACs had significantly less anticoagulant knowledge than warfarin users, in particular; how to manage missed doses, interactions and side effects. We recommend NOAC education is patient specific with an emphasis on identifying and mitigating knowledge gaps.

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Nocturnal Hypoxemic Burden in Ambulatory Patients with Atrial Fibrillation: a Disease-Orientated Assessment of Sleep-Disordered Breathing Severity

C. Nalliah [1,*], M. Baumert [2], K. Kadhim [2,3,4],
M. Middeldorp [2,3,4], A. Elliott [2,3,4],
D. Lau [2,3,4], R. Mahajan [2,3,4], C. Wong [2,3,4],
D. McEvoy [5], J. Kalman [1], P. Sanders [2,3,4],
D. Linz [2,3,4]

[1] Royal Melbourne Hospital, Melbourne,
Australia
[2] Royal Adelaide Hospital, Adelaide, Australia
[3] Center for Heart Rhythm Disorders, Adelaide,
Australia
[4] South Australian Health and Medical Research
Institute, Adelaide, Australia
[5] Adelaide Institute for Sleep Health, College of
Medicine and Public Health, Flinders University,
and Sleep Health Service, Respiratory and Sleep
Services, Southern Adelaide Local Health
Network, Adelaide, Australia

Background: Studies exploring the relationship between sleep-disordered breathing (SDB) severity and atrial fibrillation (AF) have utilised the apnoea-hypopnoea index (AHI), which does not always reflect hypoxic burden.

Aim: (1) Characterise the composition of AHI and hypoxaemic burden (2) Define a disease-orientated metric for SDB-severity best associated with non-paroxysmal AF (nPAF).

Methods: 435 consecutive ambulatory AF patients underwent polysomnography to determine the composition of AHI (apnoeas vs. hypopnoeas), the number of acute episodic desaturations (oxygen desaturation index, ODI) and the composition of total time <90% oxygen saturation ($T90_{Total}$) attributed to acute desaturations ($T90_{Desaturation}$). Regression analysis was used to characterise the association with nPAF.

Results: 169 AF patients (38%) had nPAF and one third ($n = 149$) had moderate-severe SDB (AHI>15). 82% of the median total AHI (9.4 [3.6–20.1]) could be attributed to hypopnoeas. 29% of events were associated with episodic desaturations, which contributed to 96% ($T90_{Desaturation}$) of the variation in $T90_{Total}$. The high variability in durations and nadirs of distinct desaturation events can expose patients to long $T90_{Total}$, despite low AHI. Not AHI, but $T90_{Total}$ and ODI were associated with nPAF independent of gender and age. However, diabetes, hypertension and BMI contributed more significantly to the risk of nPAF.

Conclusions: Hypopnoeas constituted the majority of respiratory events during sleep. Patients with low AHI can have high nocturnal hypoxaemic burdens, due to accumulation of episodic desaturations. $T90_{Total}$ and ODI, but not AHI, are associated with nPAF independent of gender and age. However, concomitant risk factors make greater contributions to the risk of nPAF.

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Novel Wireless S Patch Device Improves AF Detection Post CVA

S. Lazarovska [1,*], H. Tie [1], A. Hopkins [1], H. Dimitri [1], U. Premwardhana [2], A. Mcdougall [3], S. Gopinath [4], J. Chow [5], R. Rajaratnam [1]

[1] Cardiology, Liverpool Hospital, Sydney, Australia
[2] Cardiology, Campbelltown Hospital, Sydney, Australia
[3] Neurology, Liverpool Hospital, Sydney, Australia
[4] Neurology, Campbelltown Hospital, Sydney, Australia
[5] SWSLHD Clinical Innovation & Business Unit, Sydney, Australia

Atrial fibrillation (AF) is the most common atrial arrhythmia leading to increased risk of thromboembolic events. It is often asymptomatic and paroxysmal in nature, making it difficult to detect using ward telemetry (WT) post cerebrovascular accident (CVA) leading to under utilisation of anticoagulation. This study compares conventional 2-day WT versus 4-day wireless S-patch monitoring to detect AF.

This first in Australia dual-centre study was a prospective comparison pilot of the S-Patch monitor against WT monitors in 51 patients admitted for stroke workup. The patients were fitted with both WT monitoring for 2 days versus S-patch monitoring for 4 days in the detection of AF. 76 hours of telemetry were assessed via data extractions and Cardiologist review. A matrix was used to measure nursing/patient satisfaction and setup/resource times were assessed.

84–94% of patients and 75–95% of nursing preferred the S-Patch. Non-parametric tests indicate significant time saving for removal of S-Patch versus WT [2.2 mins vs 5.1 mins ($p = 0.00$)]. Efficacy of S-Patch to detect AF following Cardiologist review was greater than WT, with 7 patients identified with AF by S-Patch versus 1 using WT. The S-patch had a false positive rate of 78%.

The S-patch had a higher detection rate of AF compared to WT. This allows patients to be anticoagulated appropriately for the prevention of future stroke. Patients and staff overwhelmingly prefer the S-Patch. The S-Patch is sensitive in the detection of AF, however it showed a high false positive rate where further refinement of the device would be beneficial.

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Nurse-Led Protocol-Based Atrial Fibrillation Clinic Associated with High Quality Care for Patients

N. Ariyarathna, J. Raman Srinivasan, C. Hastie, C. McCallum, M. McManus, V. Moosavi, Q. Yang *, B. Nkoane-Kelaeng, C. Olivia, A. Farshid

The Canberra Hospital, Garran, Australia

Background: Atrial fibrillation (AF) is the commonest arrhythmia that impairs quality of life, increases risk of stroke and hospitalisations. We report the results of an ongoing nurse-led protocol based AF clinic.

Methods: Patients newly diagnosed with AF were referred to our clinic and assessed by a registered nurse and cardiologist. Risk factors, HAS-BLED and CHA_2DS_2-VASC scores at initial clinic visit were recorded. Patients were treated according to established ESC guidelines. Outcomes including adverse events were recorded at follow-up.

Results: A total of 132 patients were seen with a mean age of 68.8 (57.6% males). AF was paroxysmal in 70%, persistent in 17% and permanent in 13%. Patients had a mean BMI of 31, mean CHA_2DS_2-VASC 2.6, mean HASBLED score of 1.1. Hypertension was present in 55% of patients, obesity in 49.6%, significant alcohol use in 20%, diabetes in 18% and OSA in 10%. Obese patients were more likely to have persistent/permanent AF (39% vs 22%, $p = 0.03$) with a trend towards a higher likelihood of AF at last follow-up (47% vs 34%, $p = 0.12$). In patients with a CHA_2DS_2-VASC score >1 in whom anticoagulation was indicated, rate of anticoagulation increased from 78% prior to clinic visit to 89% after clinic visit ($p = 0.0046$).

Conclusion: Hypertension, obesity, and alcohol use were prevalent within our AF cohort. Obesity was identified as a strong risk factor for persistent/permanent AF and these patients were less likely to be in sinus rhythm at last follow-up. Management of AF patients in a dedicated nurse-led clinic, however improved adherence to guidelines.

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Percutaneous Left Atrial Appendage Closure: Single Centre Experience using Three Different Devices

S. Iwai [1,*], S. Worthley [2], P. Sanders [1], G. Young [1,2]

[1] Centre for Heart Rhythm Disorders, South Australian Health and Medical Research Institute, University of Adelaide and Royal Adelaide Hospital, Adelaide, Australia
[2] GenesisCare, Sydney, Australia

Background: Percutaneous left atrial appendage (LAA) closure is an alternative option to anticoagulant therapy. However, the clinical outcomes using different devices in the real world are not clear.

Objective: To compare clinical outcomes among three different LAA closure devices.

Methods: The consecutive patients who underwent percutaneous LAA closure with Watchman, Amplatzer and WaveCrest were studied. Ischaemic stroke, haemorrhagic stroke, systemic emboli, device-related thrombus, peri-device leak and procedure-related adverse events were evaluated.

Results: The consecutive 124 pts (age 75 ± 7; 79 males; CHA2DS2-VASc 4.1 ± 1.4) underwent LAA closure. The closure devices were Amplatzer in 68, Watchman in 37 and WaveCrest in 19. During mean follow-up of 26 ± 18 months, ischaemic stroke occurred in 10 (3.7% per year), haemorrhagic stroke in 2 (0.7% per year) and systemic embolism in 4 (1.5% per year). There was no significant difference in all cause stroke (log-rank $p = 0.23$) and systemic embolism (log-rank $p = 0.22$) between the 3 devices. Procedure-related adverse events occurred in 7 (cardiac tamponade: 1, device emboli: 1, haematoma: 5). Device-related thrombus was observed in 4 (10.8%) with Watchman, 1 (5.3%) with WaveCrest and none with Amplatzer ($p = 0.026$). Peri-device leak >1 mm just after the procedure was detected in 5 (7.4%) with Amplazer, 1 (2.7%) with Watchman and 11 (57.9%) with WaveCrest ($p < 0.0001$).

Conclusion: In this single centre experience, while the incidence of peri-device leaks and device-related thrombus was different among device types, these differences are not associated with an increased risk of all-cause stroke and systemic embolism.

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Percutaneous Temporary Stellate Ganglion Block for Refractory VT Storm: A Case Series

D. Raja [1,*], U. Pandurangi [2], R. Pathak [3]

[1] *The Australian National University, Canberra, Australia*
[2] *The Madras Medical Mission, Chennai, India*
[3] *The Canberra Hospital and Health Services, Canberra, Australia*

Background: A ventricular tachycardia storm, at times, may not be responsive to anti-arrhythmic drug (AAD) therapy and even DC-shocks. An easily performable bedside USG-guided 'Stellate ganglion block (SGB)' may help in tiding over the VT storm before considering alternative options for such patients.

Methods: Characteristics of 6 patients, who underwent a bedside USG-guided left stellate ganglion block with a 'cocktail of lignocaine and bupivacaine' were analysed.

Results: All patients received at least two injectable AAD of different classes before the procedure. Coronary artery disease prevailed in 4 patients. One had ARVC. One patient was diagnosed to have cardiac sarcoidosis. An acute coronary syndrome precipitated the VT storm in one patient. One patient who had a polymorphic VT storm post-CABG day 2 underwent SGB as a stop-gap measure before being taken up for re-exploration for an acutely occluded graft. The mean age and LVEF were 52 ± 15.7 years and $36 \pm 6.9\%$,

respectively. All patients were free of VT/VF for a mean of 20 ± 5.6 hours after the procedure. The earliest time to recurrence of break-through VT post SGB was 14 hours. Three patients received a catheter ablation. One patient received immunosuppression therapy and one patient underwent re-exploration for occluded grafts. Two patients received an ICD in the follow-up. Two patients died of in-hospital complications: heart-failure and concomitant sepsis.

Conclusions: Stellate ganglion block is an effective means to tide-over an acute VT storm crisis before considering a catheter ablation or correcting the underlying aetiology.

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Periprocedural Use of Direct Oral Anticoagulants at the Time of Cardiac Implantable Electronic Device Insertion

J. Hawson*, R. Velusamy, I. Stevenson

Royal Melbourne Hospital, Parkville, Australia

Introduction: Direct oral anticoagulants (DOACs) have become first line therapy for patients with nonvalvular atrial fibrillation. However, the optimal usage of DOACs among patients undergoing insertion of a cardiac implantable electronic device (CIED) is not yet established. A large trial has previously demonstrated a nonsignificant trend towards increased bleeding when continuing DOAC compared with cessation of DOAC for 48 hours prior to procedure [1]. This study aimed to evaluate the novel approach of withholding DOACs for 24 hours prior to CIED insertion.

Methods: Consecutive patients undergoing insertion of CIED on therapeutic anticoagulation were retrospectively studied. Local protocol dictated that DOACs were withheld for 24 hours prior to CIED insertion, and that warfarin was continued. DOACs were restarted as early as possible at the discretion of the treating clinician. The medical record was then examined for both bleeding and thrombotic complications.

Results: A total of 771 patients were examined; 129 patients were on warfarin and 148 patients on DOACs. In the warfarin group, 53 patients had an INR of <2 on the day of procedure (range 1–3.4). Pocket haematoma was seen in 9 (1.8%) patients in the non-anticoagulated group, 4 (3.1%) patients in the warfarin group, and 4 (2.1%) patients in the DOAC group. There was no significant difference in haematoma between groups. There were no strokes in any group within 4 weeks of procedure.

Conclusion: Withholding DOACs 24 hours prior to CIED insertion is both a safe and efficacious perioperative approach.

Reference

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Pharmacological Cardioversion with 'Ibutilide' in Atrial Tachyarrhythmias: Safety and Efficacy

D. Raja [1,*], U. Pandurangi [3], R. Pathak [2]

[1] *PhD Student, Australian National University, Canberra, Australia*
[2] *The Canberra Hospital and Health Services, Canberra, Australia*
[3] *The Madras Medical Mission, Chennai, India*

Background: Ibutilide is being increasingly tried as an agent for achieving acute pharmacological cardioversion of atrial tachyarrhythmias (AT). However, there is dearth of real-world data about the safety and efficacy of this drug.

Methods: We performed a prospective observational study to characterise the patients undergoing successful cardioversion of AT with Ibutilide administered as per the institutional protocol.

Results: Out of 68 patients with ATs, cardioversion was attempted in 33. Successful cardioversion to sinus rhythm was achieved in 23 (69%) patients. The underlying cardiac rhythm was atrial flutter (AFL) in 13 (39%), atrial fibrillation (AF) in 18 (55%), focal AT in 2 (6%) patients. Diabetes, hypertension, rheumatic heart disease, congenital heart disease, ischaemic heart disease, post-operative, moderate/severe mitral regurgitation, LV dysfunction (LVEF <55%) was noted in 15 (42%), 15 (42%), 4 (12%), 2 (6%), 7 (21%), 11 (33%), 9 (27%), 25 (75%). The mean duration of AT was 5 ± 3 months. Paroxysmal and persistent AT were noted in 23 (66%) and 10 (30%) respectively. Successful cardioversion was achieved with the first bolus and second bolus in 18 (54%) and 5 (15%) respectively. Six patients developed frequent PVCs/NSVT which subsided over time with IV magnesium. TdP was observed in one patient which was successfully cardioverted with DC. No deaths were seen during the study. The predictors of success were non-valvular aetiology, presence of AFL, ongoing antiarrhythmics, lesser mean duration of AT.

Conclusions: Ibutilide can be safely administered for acute pharmacological cardioversion of ATs in a critical care setting.

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Predictors of Health Care Resource Utilisation in AF: The REVIEW AF Study

C. Gallagher [1,*], C. Wong [1], J. Hendriks [1],
J. Bednarz [2], A. Elliott [1], D. Linz [1],
M. Middeldorp [1], R. Mahajan [1], D. Lau [1],
P. Sanders [1]

[1] *Centre For Heart Rhythm Disorders, South Australian Health and Medical Research Institute, University of Adelaide and Royal Adelaide Hospital, Adelaide, Australia*
[2] *School of Public Health, University of Adelaide, Adelaide, Australia*

Background: Atrial fibrillation (AF) is a prevalent condition associated with significant morbidity and mortality. Hospitalisations are the main driver of health care resource utilisation in AF. The aim of this study is to characterise predictors of repeat emergency department (ED) presentations and hospital admissions in a cohort of individuals with AF.

Methods: Individuals presenting to the ED of three major tertiary centres in Adelaide, South Australia from March 2013 to March 2014 with a primary diagnosis of AF, were screened by electronic health record to identify predictors of repeat presentations.

Results: The study cohort comprised 437 individuals with an AF related index presentation. Mean age was 69 ± 15 years and 49.9% were male. Individuals were followed for a mean of 3.7 ± 0.4 years to determine reasons for re-presentation to hospital. There were 2304 repeat unplanned presentations during follow up. Multivariate analysis did not identify any demographic or clinical factors predictive of re-presentation to hospital. Individuals given non standardised advice to manage future AF episodes was associated with a significant increase in the risk of repeat ED presentations (Odds Ratio [OR] 6.7, 95% confidence interval [CI] 2.4–18.3; $p < 0.0001$), and hospital admissions for AF (OR 3.7, 95% CI 1.41–9.66; $p = 0.008$).

Conclusions: A hospital presentation with a primary diagnosis of AF identifies individuals who pose significant health care burden. Non standardised advice to manage future episodes of AF is associated with an increased risk of ED re-presentation and hospital admission for AF. Further research is required to understand this finding.

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Procedural Characteristics and Outcomes Following Implantation of Cardiac Electrical Devices of Increasing Complexity: Results from GCOR

D. O'Donnell [1,*], S. Pavia [2], T. Lin [1],
M. Swale [1], M. Santos [3], S. Delacroix [3],
S. Kim [3], M. Duong [3], D. Eccleston [1],
G. Young [3]

[1] *GenesisCare, Heidelberg, Australia*
[2] *GenesisCare, Brisbane, Australia*
[3] *GenesisCare, Adelaide, Australia*

Background: Most series have shown that the complication rates increase as the complexity of Cardiac Implantable Electrical devices (CIED) increases. There is little contemporary Australian data regarding this.

Methods: The Genesis Cardiovascular Outcomes Registry (GCOR-Device) prospectively enrolled patients from December 2015–December 2018. This analysis compared patient and procedural data and outcomes by type of CIED: single vs dual chamber, low power pacemakers (PPM) vs high power Implantable cardioverter defibrillators (ICD) and cardiac resynchronisation devices (CRT) vs non-CRT.

Results: Of 3831 new implants 57% were dual chamber PPM, 15% single chamber PPM, 5% single chamber ICD,10% dual chamber ICD, 5% CRTp and 8% CRTD. The procedural characteristics and complication rates were similar for single vs dual chamber and for PPM vs ICD. Complication rates were significantly higher for CRT.

Conclusions: For experienced implanters the complication rates do not differ significantly between single and dual chamber devices or between PPM and ICD. CRT remains a more complex procedure with a significantly higher complication rate.

	PPM	ICD	CRT	ICD vs PPM	CRT vs non-CRT
Procedure Time	35.25	36.94	69.44	ns	$p < 0.01$
Fluoroscopy Time	2.72	2.82	14.24	ns	$p < 0.01$
Major Complications	3.70%	3.20%	6.00%	ns	$p < 0.01$

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Prophylactic Radio-Frequency Ablation (RFA) before an Implantable Cardioverter Defibrillator (ICD): A Case Series

D. Raja [1,*], U. Pandurangi [2], R. Pathak [3]

[1] *The Australian National University, Canberra, Australia*
[2] *The Madras Medical Mission, Chennai, India*
[3] *The Canberra Hospital and Health Services, Canberra, Australia*

Background: We have limited data on concurrent catheter ablation in patients undergoing an ICD.

Methods: Retrospectively, we compared the number of patients receiving an ICD therapies- shock or ATPs or both after an ICD in patients who received an additional RFA (substrate homogenisation) before the procedure (Group A, $n = 43$) and the group which did not (Group B, $n = 64$).

Results: Baseline demographic variables were comparable. Group A had patients predominantly of ischaemic cardiomyopathy (high-risk substrate for SCD, 77% vs 55%, $p = 0.03$) and patients for secondary prevention (98% vs 58%, $p < 0.001$). Either group received comparable number of anti-arrhythmic drugs after the ICD implant.

Though the patients who received ICD shocks, ATPs or either of them were lesser in Group A the numbers could not reach statistical significance (24%, 19%, 30% vs 27%, 20%, 28%, $p = 0.8$). Similarly, the mean number of ICD shocks were considerably lower in Group A (0.37 ± 0.8 vs 1.2 ± 3, $p = 0.055$). An additional analysis of patients comprising only secondary prevention (42 vs 27) revealed statistically significant lesser number of ICD therapies in Group A (40% vs 74%, $p = 0.006$). A regression analysis in the whole cohort revealed that ARVC was the only predictor of a patient receiving an ICD shock.

Conclusions: Our data, though small, reveals significantly lesser number of ICD therapies (shocks or ATPs) post-implant in patients for a documented VA who also received a prophylactic RFA. The implications of this finding are numerous and must encourage multi-center RCTs in large numbers to address the research question.

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Prospective Evaluation of a Cardiologist-Narrated Audio-Visual Educational Module in Facilitating Shared Decision-Making during Cardiology Outpatient Consultation for Atrial Fibrillation

J. Kovoor[1,*], D. McIntyre[2], W. Chik[3], C. Chow[3], A. Thiagalingam[3]

[1] University of Adelaide, Adelaide, Australia
[2] University of Sydney, Sydney, Australia
[3] Department of Cardiology, Westmead Hospital, Sydney, Australia

Purpose: The role of audio-visual educational materials in facilitating shared decision-making (between doctors and patients) is relatively untested during waiting time prior to cardiology outpatient consultation. This could be of significant importance in atrial fibrillation (AF), the most common cardiac arrhythmia, which requires a number of complex management decisions. We conducted a cross-sectional observational study investigating the effectiveness of a cardiologist-narrated educational module in facilitating shared decision-making for AF.

Methodology: A web-based module comprising 4 educational videos on AF and questions gauging patient experience was delivered by iPad using Quick Response (QR) code scanning to 38 patients with AF in the waiting room prior to consultation. Videos ranged in length from 2 minutes 10 seconds to 5 minutes 30 seconds, and were viewed sequentially. Videos covered 4 topics: (1) What is AF? (2) AF Management (3) Stroke risk and anticoagulation (4) Lifestyle modification. Feedback was recorded on a 5-point Likert Scale or a 0–100 Visual Analogue Scale (VAS).

Results: Of the responders, 90.1% were "very satisfied" with the individual videos. There were no responses communicating patient dissatisfaction. The overall module had a beneficial effect on individual patient decision-making ability (median 90, range 50–100), on reducing peri-consultation anxiety (median 89.5, range 16–100), and on the likelihood of following treatment plans (median 93, range 52–100).

Conclusion: A cardiologist-narrated educational audio-visual AF module delivered prior to consultation benefitted both patient experience and shared decision-making ability for AF management. This could be a positive utilisation of patient waiting time prior to outpatient consultation.

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Radiofrequency Ablation (RFA) for Left Atrial Flutters in Rheumatic Heart Disease (RHD) Following Valve Replacement: A Case Series

D. Raja[1,*], U. Pandurangi[3], R. Pathak[2]

[1] PhD Student, The Australian National University, Canberra, Australia
[2] The Canberra Hospital and Health Services, Canberra, Australia
[3] The Madras Medical Mission, Chennai, India

Background: RHD patients with valve replacement surgeries and left atrial tachyarrythmias (ATs) pose higher risks for RFA wherein the data are limited.

Materials and Methodology: Retrospective data were collected from 19 patients of RHD with persistent atrial flutter after valve replacement surgeries who were considered for RFA.

Results: Of the 12 cases, 9 had mechanical and 3 had bio-prosthetic valves: 8 mitral, 3 double valve, 1 aortic replacement. The patterns of scar and reentry circuits were heterogeneous- defined in the mitral annular, posterior LA wall, LA roof, pulmonary vein ostia and dual loop (annulus dependent and LA roof) in 4, 2, 3, 2 and 1 patient, respectively.

Acute success was achieved in 9 patients (75%). Focal lesions could terminate flutters in 3 patients. RF lesions from the adjoining scar or the pulmonary veins to the mitral annulus or the LA roof could terminate the flutter in 6 patients. At a mean follow-up of 14 ± 4 months, 2 patients had recurrence and one underwent successful redo RFA. Difficulties in delivering effective RF energy due to enlarged atrium, multiple circuits, changing tachycardia cycle lengths and atrial activation sequences were found to be the reasons for failure in 3 patients.

Conclusion: RFA for left atrial flutter in RHD following valve replacement can be performed safely with modest acute and short-term outcomes despite challenges in management of anticoagulation, disease burden in LA and presence of in-situ valvular prosthesis.

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Radiofrequency Ablation for Ventricular Tachycardia at Wellington Regional Hospital

A. Kirby[*], J. Mau, D. Hooks, M. Webber

CCDHB, Wellington, New Zealand

Background: Ventricular tachycardia (VT) can be difficult to manage medically and radiofrequency ablation can improve symptoms, cardiac function and mortality. It can also reduce device therapy and reliance on potentially toxic anti-arrhythmic medications. It can be undertaken for both structural and idiopathic VT.

Method: We retrospectively reviewed all patients who underwent VT ablation at Wellington Regional Hospital over a three year period from December 2014.

Results: 63 procedures were performed on 51 patients. 38 (75%) male, with an average age of 60 years. 31 (61%) were structural and 20 (39%) idiopathic. 15 (29%) had severely impaired LV function and 22 (43%) had an ICD in situ. Symptoms consisted of palpitations 49 (96%), syncope 18 (35%) and cardiac arrest 13 (25%). Medications included beta-blockers 41 (80%), CCBs 9 (18%) and Class 1 AAD 10 (20%). 14 (27%) procedures were emergent/acute and 2 (4%) performed under GA.

The primary operator considered the procedure acutely successful for 45 patients (69%). 8 required multiple procedures to achieve this outcome. According to arrhythmia burden on holter monitor or implantable device at follow up, 18 (30%) had complete abolition and 18 (30%) partial improvement/modification. 38 patients (75%) reported symptomatic improvement and 8 were able to cease amiodarone. The LV EF improved in 4 patients.

There were very few complications with 2 femoral haematomas, 1 femoral pseudoaneurysm and 2 pericardial effusions. All patients were alive at 30 days.

Conclusion: Radiofrequency ablation for VT is a safe procedure with reasonably efficacy, providing a viable treatment option for many patients with difficult to manage arrhythmias.

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Rate of Appropriate and Inappropriate Therapy in Patients with Non-Ischaemic Cardiomyopathy, A Comparison between Primary and Secondary Prevention Implantable Cardioverter-Defibrillator Patients

R. Tjong, S. Stolcman *, M. McAlpin, M. McLean, R. Tan, W. Abhayaratna, M. Alasady, R. Pathak

The Canberra Hospital, Garran, Australia

Implantable cardioverter defibrillators (ICDs) have demonstrated favourable outcomes on survival in selected patients with cardiomyopathy. However, recent studies have questioned the protective role of ICD in Non-ischaemic Cardiomyopathy (NICM) for primary prevention.

Aim: To investigate the differences in ICD therapy in primary and secondary prevention ICD patients.

Between 2014–2017, 182 patients (male = 117; age = 63 ± 17 years, female = 65; age = 63 ± 17 years) had ICD for NICM. Patients were divided into primary prevention ($n = 97$) and secondary prevention groups ($n = 85$) based on implant indication. Patients' Left Ventricular Ejection Fractions (LVEF) were determined by transthoracic echocardiogram. ICD stored data of ICM and NICM patients were utilised. Cumulative first shock rate, type and appropriateness of therapy were determined.

There was no significant difference in clinical characteristics between the primary prevention group and secondary prevention group. Mean follow-up was 30 months after implantation. Overall ICD therapy rate was 19%. Cumulative probability of a first appropriate shock was higher in the secondary prevention group ($p = 0.03$). Overall, ICD therapy was significantly more frequent in the secondary prevention vs primary prevention group (25% vs 13%, $p = 0.02$). Inappropriate device therapy rate was insignificantly higher in primary prevention group (23% vs 19% $p = $ NS).

The rate of appropriate device therapy was significantly greater in secondary prevention group. Inappropriate device therapy was significantly high in both groups. Due to the inherent risks associated with ICD implantation, generator changes and inappropriate therapy, further risk stratification is required for risk of SCD.

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Recovery of Atrial Electrical and Structural Remodelling Following Successful Catheter Ablation for AF Mediated Cardiomyopathy: Long Term Follow Up from the CAMERA MRI Study

H. Sugumar

Alfred Health/Rmh, Melbourne, Australia

Background & Objective: Catheter ablation (CA) is successful in restoring ventricular function in patients with atrial fibrillation and cardiomyopathy as shown in the CAMERA-MRI study. We sought to determine if recovery of LV function with the restoration of sinus rhythm was associated with improvements in atrial electrical changes in a subgroup from the CAMERA-MRI study.

Methods: Detailed electroanatomic (EA) mapping of the right atrium (RA) using force sensing catheter during CS pacing was performed at the time of initial CA. An elective RA EA map was performed in willing participants a minimum of 12 months following successful CA. Bipolar voltage, fractionation and conduction velocity were collected in 4 segments (Anterior, Lateral, Posterior and Septal) together with echo and cardiac MRI.

Results: Fifteen patients (mean age 59.1 ± 6.8 yrs with an average AF burden of 0.6% (range 0–3%) post CA underwent detailed RA EA mapping at the index procedure and at 23.4 ± 11.9 months following successful CA. LVEF improved from $32.6 \pm 13.3\%$ to $56.6 \pm 7.8\%$ ($p < 0.001$), RA area decreased from 28.4 ± 7.2 cm^2 to 20.6 ± 4.3 cm^2 ($p < 0.001$) and LA area decreased from 32.9 ± 8.2 cm^2 to 26.8 ± 5.2 cm^2 ($p = 0.007$). On EA mapping, RA bipolar voltage increased from 1.6 ± 0.1 mV at CA to 1.9 ± 0.1 mV ($p = 0.04$). Atrial low voltage areas decreased from $19.7 \pm 11.8\%$ to $14.2 \pm 12.5\%$ ($p = 0.073$) with a significant decrease in fractionation from $21.7 \pm 13.7\%$ to $8.3 \pm 7.3\%$ ($p = 0.002$).

Conclusion: Recovery of atrial electrical and structural changes was observed following restoration of sinus rhythm and recovery of LV function in patients undergoing CA for persistent AF and LV systolic dysfunction.

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Safety and Efficacy of Same Day Discharge for Elective Implantation of Cardiac Resynchronisation Therapy or Implantable Cardioverter Defibrillator

K. Cheng [1,2,*], J. Lipton [1,2], R. MacFadyen [1,2], P. MacIntyre [1,2]

[1] Department of Cardiology, Royal Hobart Hospital, Hobart, Australia
[2] School of Medicine, University of Tasmania, Hobart, Australia

Background: In most Australian hospitals, elective implantation of cardiac implantable electronic devices (CIED) involves overnight admission. Same day discharge (SDD) after pacemaker implantation is safe, shows improved patient satisfaction and reduced costs compared to overnight admission. We evaluated the safety and effectiveness of SDD applied to more complex CIED [Implantable defibrillators (ICD) and resynchronisation therapy CRT)] in an Australian public hospital setting.

Methods: Retrospective audit of consecutive elective ICD or CRT implantations (de novo or upgrade). SDD group included cases between January 2017 and October 2018 and were compared to next day discharge (NDD) between January 2015 and December 2016. Patients were excluded from SDD if they had poor home support ($n = 1$), pacemaker dependent ($n = 1$), or required general anaesthesia ($n = 1$).

Results: 72 patients (66 ± 13 yrs, 21% female) were included in the SDD group; 66 patients (65 ± 11 yrs, 33% female) underwent NDD. The analysis included 37 ICD, 48 CRTP and 49 CRTD procedures, with similar distribution between the groups ($p = 0.33$). In the SDD group 18/69 (26%) were admitted overnight; 6/18 (33%) due to delayed start (>1300 hrs), 3/18 (17%) due to post-operative hypotension, and 2/18(11%) due to lead displacement. 90-day complication rate was 11% and did not differ between the groups ($p = 0.9$). SDD has saved 51 bed-days over 72 cases since its implementation. In our institution, this represents a saving of $124,644 over the 22-months period.

Conclusion: SDD for more complex CIED is safe, effective and reduces hospital stay with no significant difference in adverse events compared to NDD.

"Same day discharge protocol for elective implantation of ICD or CRT has successfully reduced hospital length of stay with no significant difference in adverse events compared to overnight admission."

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Smartwatch Based Arrhythmia Detection: Accuracy of Clinician Interpretation of Unclassified Tracings

K. Rajakariar [1,*], A. Koshy [2], J. Sajeev [1], S. Nair [3], L. Roberts [3], A. Teh [1]

[1] Eastern Health, Box Hill, Australia
[2] Austin Health, Heidelberg, Australia
[3] Eastern Health Clinical School, Monash University, Australia

Background: The AliveCor KardiaBand (KB) is an FDA approved smartwatch-based cardiac rhythm monitor that generates a single-lead ECG (iECG). An automated algorithm provides a diagnosis of atrial fibrillation, sinus rhythm, or unclassified for undetermined rhythms. We evaluated the accuracy of clinician interpretation of unclassified tracings.

Methods: Consecutive patients were prospectively recruited from three tertiary centres. The KB, paired with a smartwatch, was used to generate a single lead ECG and compared to a simultaneously recorded 12-lead ECG. Initial iECGs demonstrating an unclassified tracing were repeated. The 12-lead ECGs were analysed by a cardiologist to determine the underlying rhythm. Unclassified tracings were compiled for blinded clinician assessment by two electrophysiologists (EP) to determine the accuracy and agreement compared with the 12-lead ECG derived rhythm.

Results: A total of 239 iECGs were obtained from 200 patients (56.5% male, age 67 ± 16 years), of which 41 (17.2%) were given an unclassified reading. Manual clinician interpretation of these unclassified traces concurred with the baseline 12-lead ECG in 89% of traces (EP1: 87.8%, $\kappa = 0.80$, $p < 0.001$; EP2: 90.2%, $\kappa = 0.79$, $p < 0.001$) with a strong inter-observer agreement ($\kappa = 0.98$, $p < 0.001$).

Conclusion: Clinician interpretation of unclassified iECG diagnoses demonstrates a high level of accuracy with satisfactory clinician agreement. Limiting clinician analysis to unclassified iECGs may be an efficient and cost-effective solution for arrhythmia screening.

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S-Nitrosylation as a Post-Translational Modification of CaMKIIδ and its Effects on Cardiac Function

E. Asamudo*, J. Erickson

Department of Physiology, School of Biomedical Sciences, University of Otago, Dunedin, New Zealand

Nitric Oxide (NO) is a gaseous signalling molecule that plays a role in many biological processes especially in the heart. S-nitrosylation involves the covalent attachment of NO-related species to specific cysteine residues of a protein to form S-nitrosothiol, and this process is known to modify protein kinases, such as Calcium/Calmodulin- (Ca^{2+}/CaM) dependent protein kinase (CaMKII). The cardiac-specific

isoform, CaMKIIδ, is a key Ca^{2+}-handling kinase involved in excitation-contraction coupling in the heart. In pathophysiological conditions, CaMKIIδ can undergo autonomous activity and cause progression of arrhythmias, diabetes and heart failure. S-nitrosylation has been found to modify CaMKIIδ, however, it is unknown how this affects cardiac function in the whole heart and how inhibition of CaMKIIδ alters NO signaling in the heart. We hypothesised that S-Nitrosylation of CaMKIIδ will lead to impaired cardiac function in mice. Using Langendorff isolated heart perfusion technique, C57BL/6 wild-type (WT) and CaMKIIδ knock-out (KO) mice hearts were treated acutely with a nitric oxide donor, S-nitrosoglutathione (GSNO) at different concentrations. Prior to excision of the heart for Langendorff perfusion, echocardiography measurements were taken and results showed no changes in cardiac structure and function between WT and KO mice. Our data from Langendorff perfusion showed a trend towards increased left ventricular developed pressure in GSNO-treated KO hearts compared to GSNO-treated WT hearts. Notably, our data also showed that GSNO reduced arrhythmia frequency by 26% in KO hearts compared to WT hearts. These results suggest that NO may be contributing to whole heart impairment via a CaMKIIδ-mediated signalling pathway.

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T Wave Morphology Biomarkers in Congenital and Acquired Long QT Syndrome

D. Tardo [1,2,3,*], M. Peck [1,4], A. Hill [1,4], J. Vandenberg [1,4]

[1] Victor Chang Cardiac Research Institute, Sydney, Australia
[2] St Vincent's Hospital, Sydney, Australia
[3] University of Notre Dame Australia, Sydney, Australia
[4] University of New South Wales, Sydney, Australia

Introduction: Prolongation of the QTc is the key electrocardiogram (ECG) biomarker in the diagnosis and risk stratification of long QT syndrome (LQTS), however 25–50% of individuals with congenital LQTS (cLQTS) demonstrate a normal QTc at rest. The three common types of cLQTS can be differentiated by distinct changes in T wave morphology, although it remains unclear whether quantitative T wave analysis strengthens the diagnostic evaluation of the various forms of acquired LQTS (aLQTS).

Methods: Electronic database searches were performed with the keywords and terms 'LQTS', long QT syndrome', 'QTc prolongation', 'prolonged QT', and 'T wave', 'T wave morphology' 'T wave pattern', 'T wave biomarkers'. Peer-reviewed, whole-text articles assessing T wave morphology, independent of QTc, for both cLQTS and aLQTS were included.

Results: 15 studies met the criteria for review. Automated digital analysis of T wave architecture, using varied means of computational programming, was applied to both cLQTS and aLQTS cohorts. Leads I, II, aVF, V2, V5 and V6 attained discrimination rates ranging between 83–90% in cLQTS. Lead V5 distinguished aLQTS from cLQTS (77% accuracy), with lead I differentiating aLQTS from healthy controls (90% accuracy). Median beat analysis, derived from leads I, II, V1 to V6, also demonstrated accuracy for aLQTS in healthy individuals, partaking in multichannel pharmacological profile studies.

Conclusion: T wave assessment using automated algorithms plays a developing role in determining torsadogenic risk in both cLQTS and aLQTS. Diversity in programming design and limited models for aLQTS provide challenges in developing a unified, clinically applicable model for LQTS risk stratification.

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The Accuracy of Smartwatches Compared to Holter Monitors for Heart Rate Monitoring in Atrial Fibrillation: A Pilot Study

L. Toner [*], A. Al-Kaisey, A. Koshy, F. Ha, R. Spencer, J. Sajeev, A. Teh, O. Farouque, H. Lim

Austin Health Department of Cardiology, Melbourne, Australia

Introduction: Smartwatches (SW) with photoplethysmographic heart rate (HR) monitoring capability are increasingly popular. We present a pilot study to assess the accuracy of two SW (Fitbit Charge HR [FB] and Apple Watch Series 3 [AW]) compared with Holter monitoring in ambulatory patients in atrial fibrillation (AF).

Methods: Patients with persistent AF referred for 24-hour Holter monitoring were prospectively recruited. Six patients with sinus rhythm (SR) were recruited as a comparator. The Holter monitor was the criterion measure. Each patient was then allocated to wear either a FB or AW with their Holter for 24 hours.

Statistical analysis: Pearson (r) correlation coefficients and Bland-Altman comparison with 95% limits of agreement (LoA) were evaluated to assess agreement between SW and Holter HR. Bias was then calculated as the mean difference between the SW and Holter HR. A ± 10-beat difference between Holter-HR and SW-HR was used as the metric for accuracy of SW derived HR.

Results: Over 53,000 heart rate values were recorded from 32 patients. Both SW performed well in SR (Bias <1 beat, LoA -11 to 11 beats, $r = 0.87$, $p \leq 0.001$) with accuracy 92 - 95%. However, in AF, both devices underestimated HR with wide LoA (bias -9 beats, LoA -41 to 23 beats, $r = 0.60$, $p < 0.001$). The degree of underestimation was more pronounced when HR >80. In AF, accuracy was reduced: 77% for AW and 56% for FB.

Conclusion: In ambulatory patients, smartwatches accurately measure HR in SR. However, they have reduced accuracy and underestimate HR in AF.

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The Effect of his Bundle Pacing on QRS Duration in an Initial Patient Cohort

S. Stolcman *, R. Tjong, M. McAlpin, M. McLean, R. Tan, W. Abhayaratna, R. Pathak

The Canberra Hospital, Canberra, Australia

Introduction: Increased QRS duration from right ventricular (RV) pacing causes dyssynchrony and has significant effects on ventricular function. His bundle pacing (HBP) is a physiological alternative to RV pacing. Our study compared QRS duration in an initial cohort of patients with HBP.

Methods: 52 patients (male = 36; age 69 ± 12 years; sinus node disease = 33, atrioventricular block = 19) presented for permanent pacemaker. A Medtronic® 69 cm 3830 pacing lead was positioned at the His bundle substituting the RV lead. Device interrogation was performed at implant, post-operatively, 1 week and 6 weeks.

Results: HBP was acutely successful in all cases. 3 patients required extraction due to increased pacing threshold after 6 weeks. Lead parameters are displayed (Table 1). No

Table 1.

	Impedance (Ω)	Threshold (V)	Sensing (mV)	Intrinsic QRS (ms)	Paced QRS (ms)
Implant	632 ± 158	1 ± 0.6	6 ± 4	124 ± 38	121 ± 31
Post-Op	527 ± 88	0.9 ± 0.6	6 ± 5	127 ± 36	122 ± 29
1 week	504 ± 65	0.9 ± 0.5	6 ± 5	119 ± 35	115 ± 24
6 weeks	501 ± 75	1.3 ± 1.2	6 ± 5	127 ± 35	127 ± 25

significant difference was observed between intrinsic QRS and paced QRS duration ($p = 0.27$). Mean follow up was 251 ± 157 days.

Conclusion: HBP is an alternative to RV pacing in this initial cohort. By not significantly increasing the ventricular paced QRS duration, long term deleterious effects of RV pacing can be avoided.

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The Evolution of Symptomatic or Asymptomatic Atrial Fibrillation Following Treatment of Surgical Mitral Valve Disease by Repair or Bioprosthetic Replacement

F. Khan [1,*], E. Sivaraj [1], A. Black [1,3,4], A. Hardikar [2,3], K. Bhattarai [2], J. Leong [2], R. Macfadyen [1,3,4]

[1] *Cardiology Department, Royal Hobart Hospital, Hobart, Australia*
[2] *Cardiothoracic Surgery Department, Royal Hobart Hospital, Hobart, Australia*
[3] *Royal Hobart Hospital and UTAS School of Medicine, Hobart, Australia*
[4] *Menzies Institute for Medical Research, Hobart, Australia*

Background: Surgical mitral valve disease is characterised by ECG atrial fibrillation (AF) before or after operation and may be treated surgically. Detection can be symptomatic or asymptomatic ECG. Frequency of asymptomatic AF following mitral valve repair (MVr) or bioprosthetic replacement (MVR) is unknown.

Method: Audit of mitral surgery (2009–2015) to define re-presentation with AF provided 198 cases with MVr or MVR (68.9 ± 10.4 yr, 61%♀). 19 patients were lost of follow up. Comparison by χ^2 testing.

Results: From 1085 procedures we extracted 198 mitral valve cases (206 combined operations excluded). Pre-operative demographics of MVr ($n = 40$; 63.5 ± 12.7 yrs, 97.5% Caucasian; CHA_2DS_2-VASc; 2.05 ± 1.15) and MVR ($n = 138$; 70 ± 9.4 yrs, 98.6% Caucasian, CHA_2DS_2-VASc 2.75 ± 1.24) gave pre-operative prevalence of AF for MVr, 17.9% cf MVR, 39.9% ($p = 0.011$). Post operation showed reduced prevalence of AF (MVr, 12.5% cf MVR, 37.7%, $p = 0.22$, NS) in the context of 17.5% MAZE procedures in MVr; and 9.4% in MVR ($p = 0.22$, NS). Excluding 16 deaths (MVR = 4, MVR = 12), following MVr AF recurred in 9 cases at 30.2 ± 12.1 mths cf 78 cases at 23.8 ± 13.3 mths after MVR. AF was asymptomatic in 97.5% cases of MVr and 81.9% of MVR. The burden of AF in MVr or MVR was not predicted by association to peri operative CHA_2DS_2-VASc score or by $CHADS_2VAS_2C$ at AF recognition.

Conclusions: MVr and MVR shows differing patterns of largely asymptomatic AF during follow up. This should lead to a reconsideration of anti-thrombotic therapy following surgical mitral valve treatment and whether long term/permanent thromboprophylaxis is appropriate regardless of rhythm on discharge.

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The Incidence of Fatal Arrhythmia Among Patients with Early Onset Acute Coronary Syndrome and Familial Hypercholesterolaemia

S. Mirzaee[1,*], A. Lin[1], M. Isa[2], J. Cameron[1], J. Alison[1], S. Zaman[1], S. Nicholls[1]

[1] *Monash Health, Clayton, Australia*
[2] *Monash University, Monash School of Medicine, Melbourne, Australia*

Background: Familial hypercholesterolaemia (FH) is a common inherited disease which causes premature acute coronary syndrome (ACS). Fatal ventricular arrhythmias are the leading cause of mortality in ACS patients worldwide. However, there are limited data on the association of FH and cardiac arrhythmias.

Objective: This study aimed to examine the association of cardiac arrhythmia profile and FH in the setting of ACS.

Methods: We included 231 patients with early onset ACS out of 997 total admissions to coronary care unit in a large tertiary centre between January-December 2015. FH was diagnosed using the Dutch Lipid Clinic Network Criteria. Fatal ventricular arrhythmias (FVA), defined as primary ventricular fibrillation (VF) or sustained ventricular tachycardia (VT), were confirmed by reviewing rhythm strips and 12-lead electrocardiograms.

Results: Among all subjects with premature ACS incidence of fatal arrhythmia was 4.7%. 26 patients (11.2%) with early-onset ACS had probable/definite FH, with mean age 46.8 ± 7.4 years and mean low density lipoprotein-cholesterol 5.6 ± 1.9 mmol/L. There was no significant difference in the prevalence of diabetes (25.9% vs 24.7% vs 23.0%, $p = 0.94$), hypertension (46.1% vs 49.5% vs 50.0%, $p = 0.87$) or smoking (69.2% vs 61.3% vs 76.9%, $p = 0.24$) among all groups [Unlikely ($n = 104$), Possible ($n = 101$), Probable/Definite ($n = 26$)]. When compared to patients with no FH, patients with FH had significantly lower rates of FVA (4.3%, 0.9%, 0%, $p = 0.007$). Left ventricular ejection fraction (LVEF) was not significantly different between the groups ($p = 0.11$). On multivariable analysis, FH was independently associated with lower frequency of FVA, adjusted for age, LVEF <40% and type of ACS ($p = 0.04$).

Conclusion: This study suggests FH is associated with lower incidence of FVA in the setting of ACS. Further investigation via multicentre prospective studies with larger populations is warranted.

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The role of Holter Monitor in the Detection of Atrial Fibrillation in Transient Ischaemic Attack and Acute Ischaemic Stroke

Q. Tran[1,*], A. O'Loughlin[1,2,3]

[1] *Campbelltown Hospital, Sydney, Australia*
[2] *Liverpool Hospital, Sydney, Australia*
[3] *University of Western Sydney Campbelltown, Sydney, Australia*

Background: Ischaemic stroke of cardioembolic origin is associated with profound morbidity and mortality, of which atrial fibrillation (AF) accounts for a significant proportion. Holter monitoring remains the first line investigation in identifying patients with underlying AF in stroke patients.

Methods: We conducted a retrospective review of all patients undergoing Holter monitoring between August 2017 and February 2019 at an urban teaching hospital, to identify incidence of AF (defined as episodes lasting longer than 30 seconds) in patients presenting with transient ischaemic attack (TIA) or confirmed acute ischaemic stroke (AIS).

Results: 193 eligible patients, 15 excluded due to known history of AF. Remaining 178 patients had mean 23.5 hours of Holter monitoring. Baseline demographics data: mean age 64.1 years, male gender 55.6%. TIA accounted for 41.6%, and AIS accounted for the remaining 58.4% of cases. AF was detected in 5 patients (2.8%). An additional 6 patients had AF identified on ward telemetry, which was not detected during Holter monitoring. Nine of these 11 patients were commenced on anticoagulation. A further 7 patients were commenced on anticoagulation due to suspected cardioembolic source based on cerebral imaging in the absence of confirmed AF. In a separate analysis of patients excluded for known AF, 8 of the15 patients had AF detected during Holter monitoring (53.3%).

Discussion: Holter monitor alone is an insensitive method for detecting atrial fibrillation. Longer duration of monitoring should be considered in patients with cryptogenic stroke as suggested by recent trials with detection rate of 30% at 36 months.

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Transvenous Lead Extraction in Nonagenarians

S. Montalto*, L. Dawson, G. Wynn, N. Strathmore

Royal Melbourne Hospital, Parkville, Australia

Introduction: The ageing population, coupled with the rising number of pacemaker and defibrillator insertions in Australia, is resulting in an increasing number of elderly patients being referred for transvenous lead extraction (TLE). There is an inherent bias against referral of the very elderly for invasive procedures, particularly those that are perceived to carry a high morbidity/mortality risk. To date, there are no published outcome data for TLE in nonagenarians.

Methods: Data were collected from medical records and dedicated TLE database, on all patients who underwent TLE in Victoria between 2008 and 2017.

Results: Out of a total TLE cohort of 499 patients, 12 were aged ≥ 90. Mean age in the ≥ 90 cohort was 92.5 (vs 65.2 overall). Average lead duration was longer in the ≥ 90 group; 7.5 years vs 6.9 years ($p < 0.01$). Indications for extraction (≥ 90 group vs overall) were local infection (83% vs 61%), endocarditis (17% vs 21%), lead problem (0% vs 15%) and 'other' (0% vs 3%). There was no significant difference in laser use (44% vs 52%, $p = 0.42$), success rate (100% vs 93%, $p = 0.16$) or complication rate (0% vs 1.4% major/4% minor, $p = 0.26$). Amongst the nonagenarian cohort, mortality was 0% at 30 days and 11% at 3 months.

Conclusion: TLE is safe and effective in all age groups, when undertaken by an experienced operator. With careful patient selection, even very elderly patients can be confident of a success rate comparable to the general population, without increased risk of complications.

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Treating Atrial Fibrillation with the Second Generation Cryoballoon: Outcomes and Complications

E. Mahmoodi*, A. Davis, J. Leitch,
N. Jackson, B. Wilsmore, M. Barlow

Department of Cardiovascular Medicine, John Hunter Hospital, Newcastle, Australia

Background: Pulmonary vein isolation using cryoballoon ablation is an accepted method for the treatment of symptomatic atrial fibrillation (AF). The second-generation cryoballoon has been used in Australia since 2013.

Aims: To describe the outcomes using the second generation cryoballoon in treating AF in terms of freedom from symptomatic recurrence and complications.

Methods: We reviewed all patient records and correspondence for the first 200 consecutive patients who underwent AF ablation with the second generation cryoballoon at two local centres between 1/1/2013 and 1/6/2016.

Results: All of the patients had symptomatic AF (68.4% paroxysmal, 31.6% persistent AF) and had failed at least one antiarrhythmic drug previously. The median duration of symptoms pre-ablation was 36 months**.** 97.5% of the procedures achieved complete vein isolation. The average procedure time was 101 minutes and the average fluoroscopy time was 21.5 minutes. Antiarrhythmic medication was ceased in the first three months following the procedure in asymptomatic patients and 37% of patients were still on medication at a median follow up of 28 months (21% sotalol, 3% amiodarone and 13% flecanide). At 12 and 24 months, freedom from symptomatic AF was 78.6% and 72.6%, respectively. Transient phrenic nerve injury was the most common complication (7.4%), and they all improved by the end of the procedure. There were 3 major complications: a small perforation of the left atrium, a left occipital stroke and a transient gastroparesis.

Conclusion: Pulmonary vein isolation with the second-generation cryoballoon is an effective treatment in reducing recurrence of symptomatic AF.

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Trends in the Use of Permanent Pacemakers in Australia: A Nationwide Study from 2008–2017

S. Westaway, E. Nye*, C. Gallagher,
B. Pitman, D. Lau, R. Mahajan, P. Sanders,
C. Wong

Centre for Heart Rhythm Disorders, University of Adelaide and Royal Adelaide Hospital, Adelaide, Australia

Background: There is an increasingly ageing and comorbid population in Australia. Although prior studies have demonstrated that permanent pacemaker (PPM) insertions were rising in this context, there is a lack of contemporary data.

Methods: Data from the Australian Institute of Health and Welfare were analysed to determine the annual nationwide number of PPM generator and electrode insertions, plus replacement, removal and adjustment procedures between 2008–2017. Rates were calculated using the mid-year estimated population from the Australian Bureau of Statistics.

Results: PPM generator insertions increased from 12,153 in 2008–09 to 17,862 in 2016–17. As a percentage of all cardiovascular procedures, generator insertion increased from 2.14% to 2.99%. Generator insertion rates increased from 55.3 to 72.6 per 100,000 with rises seen in all age groups. In contrast, generator replacements decreased from 20.5 to 18.3 per 100,000. The highest proportion of generator insertions was in the 80+ age group (46.6%) and in males (58.4%). Although the rate of generator insertions increased in all age groups and both genders, the proportion of insertions appeared stable across age groups and gender, with the greatest absolute increase seen in the 80+ age group.

Conclusions: The rate and number of PPMs increased in Australia between 2008–2017, while the rate of PPM generator replacements decreased. This increasing demand for pacing services is in large part driven by an ageing population, in addition to rising insertion rates across all age groups. Our evidence supports a continued increase in future pacing demand and has significant implications for healthcare planning.

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Trends in the Use of Warfarin and Novel Oral Anticoagulants in Australia, 2013 to 2017

A. Dina*, T. Akindele

Princess Alexandra Hospital, Annerley, Australia

Background: In 2013, novel oral anticoagulants (NOACs) were added to the PBS as alternatives to warfarin for stroke prevention in atrial fibrillation (AF). Aim of this study is to examine changes in the use of oral anticoagulants (OACs) since the introduction of NOACs.

Methods: Number of prescription per capita (prescription per 100,000 people) from Medicare database between Jan 2013–Dec 2017 was analysed. The use of OACs was compared according to years and states.

Results: Between 2013–2017, the prevalence of NOAC increased by 1900% per capita, while for the same period, prevalence of warfarin decreased by 38% per capita. Queensland (1008 per capita) and Tasmania (1073 per capita) had the highest prevalence of NOAC use in 2013 which was nearly 10 times that of Northern territory (102 per capita). South Australia remained the state with the highest prevalence of warfarin use throughout this time period (3117 to 1753 per capita).

The use of warfarin was steady until 2015 when the average annual decline was 19.6% per capita over the next 2 years. The prevalent use of all OACs (NOAC and warfarin) has increased by 400% per capita from 2013 to 2017.

Conclusion: Australia-wide usage of all NOACs has increased rapidly since listed by PBS while the use of warfarin has declined. The overall increase in use on anticoagulants over the years may be due to increase in incidence and/or prevalence of AF in Australia during the study period.

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Usefulness of Implantable Loop Recorder (ILR) Beyond Electrophysiology Study (EPS) in the Evaluation of Syncope of Unknown Etiology

H. El Jamaly*, C. Chow, S. Kumar, M. QingTao, M. Ali

Westmead Hospital, Auburn, Australia

Background: Syncope is a common condition accounting to about 1% of emergency department visits and a 1-year-recurrence of 31–43% [1]. Little is known about the local clinical yield of ILR devices in patients with syncope and a negative electrophysiology study.

Methods: Retrospective analysis of the electronic medical records at Westmead hospital between January 2008 and January 2018 of patients presenting with syncope who underwent EPS and ILR testing. The yield of both modalities was compared.

Results: A total of 78 (51.6%) patients had an EPS to investigate syncope. There was 0 (0%) incidence of induced VT, 7 (8.9%) induced VF, 9 (11.5%) induced AF, 4 (5.1%) other induced supraventricular tachycardia, 2 (2.6%) incidence of sinus node dysfunction and 1 (1.3%) of AV nodal dysfunction [Fig. 1]. There were 3 (3.8%) patients with a cardiac conduction abnormality and 13 (16.7%) with a supraventricular tachycardia. In contrast, ILR monitoring (mean follow-up of 12.7 ± 10.5 months) showed 6 (7.7%) patients had positive findings for syncope of whom 5 (83.3%) had PPM insertion for brady-arrhythmia and 1 (16.7%) had ablation for VT [Fig. 2]. Of the 5 patients with PPM insertion, 4 (80%) were symptomatic, and on EPS all had normal AV nodal conduction and 4 (80%) patients had normal sinus node recovery times (SNRT). The mean monitoring time to PPM insertion was 10.8 months. ILR also diagnosed 4 (5.1%) patients with a supraventricular tachycardia.

Conclusion: ILR allow extended cardiac rhythm monitoring and symptom-rhythm correlation [2] which yielded further indications for ablation or PPM device insertion in our cohort. Further studies are needed to elucidate the ideal monitoring period for ILR with long term cost/benefit analysis.

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3D Guided CT Assessment to Identify the Right Pulmonary Vein on Standard Apical 4-Chamber View

X. Chan*, O. Mehta, P. Mottram, I. Tsay, J. Teng

Monash Heart, Clayton, Australia

Introduction: Pulmonary vein (PV) assessment is an integral component of the transthoracic echocardiogram (TTE) examination; typically assessed in the apical four-chamber view (A4Ch). There is disagreement in current textbooks and literature regarding which specific right pulmonary vein is visualised on A4Ch; as either the right superior (RSPV) or right inferior PV (RIPV).

Given the high reliability of cardiac CT for PV assessment, we aimed to characterise right PV anatomy on A4Ch by uti-

lising multi-modality comparison of echocardiography and 3D-guided A4Ch on CT.

Methods: Retrospective analysis was performed on consecutive patients with TTE demonstrating PV flow (by colour or pulse-wave Doppler) and cardiac CT within 30 days; studies not meeting image quality criteria were excluded. To simulate the A4Ch on CT, multi-planar reconstruction was used to create an image plane including right PV ostia and LV apex. This image was rotated along the long-axis to achieve an A4Ch with both ventricles and atria, tricuspid and mitral valves in view without LVOT or aorta. This was attempted for right superior, inferior and middle (RMPV, if present) PVs.

Results: 50 patients were analysed: mean age 66 yrs, 48% female, mean LA volume (indexed) 43.5 ml/m^2. A4Ch was feasible in 100% ($n = 50$) of CT simulations using the RIPV, only 24% ($n = 12$) were feasible using RSPV with all excluded cases due to LVOT/aorta persistently in view. RMPV was present in 6 cases with feasible A4ch in 67%.

Conclusion: This study demonstrates that the right PV on A4Ch is highly likely to be the RIPV due to the RSPV being anatomically impossible in the significant majority of cases.

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A Genetic Test Identifies High Risk Hypertensive Patients who have Nonobstructive Coronary Artery Disease on CCTA

N. Gahungu[1,*], D. Newby[2], M. Williams[2], P. Adamson[2,3], J. Rankin[5], G. Morahan[4], G. Dwivedi[4,5]

[1] *Royal Perth Hospital, Perth, Australia*
[2] *University of Edinburgh/British Heart Foundation Centre for Cardiovascular Science, Edinburgh, United Kingdom*
[3] *Christchurch Heart Institute, University of Otago, New Zealand*
[4] *Harry Perkins Institute of Medical Research, The University of Western Australia, Nedlands, Australia*
[5] *Fiona Stanley Hospital, Murdoch, Australia*

Introduction: High-risk plaque characteristics (HRP) on Coronary Computed Tomography Angiography (CCTA) are associated with an increased risk of adverse cardiovascular events but their long-term prognostic value in patients with nonobstructive coronary artery disease (CAD) is unclear. We aimed to evaluate whether adding genetic testing improves the prognostic value of CCTA in patients with nonobstructive CAD (i.e. ≤70% stenosis).

Methods: 132 hypertensive patients with nonobstructive CAD who underwent CCTA in the SCOT-HEART Trial were tested for genetic variants we previously identified and were assigned a genetic risk score (high vs low). Associations between nonfatal MI, nonfatal stroke, or all-cause mortality and genetic risk or HRPs (positive remodelling, low attenuation plaque, napkin ring, and spotty calcification) were assessed in 5 years of follow-up.

Results: Adverse events occurred more frequently in patients with a high genetic risk compared to low genetic risk (17.4% vs 3.7%; $p = 0.01$). Proximal artery/Left main Low attenuation Plaque (LAP) emerged as the most sensitive marker of poor outcomes (33.3% vs 5.4% for LAP vs no LAP, respectively; $p = 0.046$). Those who had both a high genetic risk and LAP were eighteen times more likely to experience adverse events compared to patients with either or none (RR 18.71 [95% 9.10 to 38.48]; $p < 0.0001$).

Conclusion: In patients with nonobstructive coronary artery disease, high genetic risk and CCTA-derived LAP strongly predicted adverse events. Our test could be used to identify patients who may best benefit from intensive secondary preventative strategies.

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A Systematic Review on the Cost-Effectiveness of Cardiovascular Magnetic Resonance

C. Autore[1,*], F. Pathan[2], R. Kozor[3]

[1] *The University of Sydney, Sydney, Australia*
[2] *Nepean Hospital, Kingswood, Australia*
[3] *Royal North Shore Hospital, St Leonards, Australia*

Introduction: Cardiovascular Magnetic Resonance (CMR) is a powerful diagnostic tool in cardiology, however, due to barriers of cost, access and availability, uptake has been variable. This systematic review aimed to collect and synthesise all health economic evaluations on CMR.

Methods: Seven databases (biomedical/health economic) were searched in accordance with PRISMA guidelines to identify relevant articles highlighting cost-effectiveness of CMR. Following screening, studies that reported health economic outcomes (e.g. QALY, ICER) were included

Results: Our search yielded 3,192 articles. Following duplicate removal ($n = 1301$) and title exclusion/abstract exclusion ($n = 1891$), 18 full text articles were analysed. 9 articles informed the systematic review.

Of these, all but 1 article focused on the diagnosis of ischaemia/coronary artery disease (CAD). Health economic models used to determine cost-effectiveness included: Markov (2 articles), Bayes mathematical (2 articles), decision analytical model (2 articles), cost benefit analysis (1 model) and health care payer analysis (1 model). Comparatives strategies ranged from nuclear imaging, stress echocardiography and invasive angiography. CMR was the economically dominant, more cost-effective strategy as demonstrated by: ICER (£7778.81–47,800), QALY difference (1.13–11.17), per patient cost saving (€424, £497, Swiss Frank 1,160, US\$647–1446) and finally health care payer cost saving (US\$ 287–935). Given the focus on CAD, results cannot be extrapolated to multiple other indications for CMR.

Conclusion: This systematic review argues that CMR is a cost-effective strategy from a societal perspective, a health care payer perspective and on cost per patient analysis in CAD.

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Accuracy of Highly Limited Echocardiographic Screening Images for Diagnosis of Heart Disease; The Quick-Six Study

K. Tiver [1,*], M. Horsfall [1], A. Swan [1],
C. De Pasquale [1,2], E. Horsfall [2],
D. Chew [1,2,3], C. De Pasquale [1,2]

[1] *Department of Cardiology, Flinders Medical Centre, Adelaide, Australia*
[2] *College of Medicine & Public Health, Flinders University, Adelaide, Australia*
[3] *South Australian Health and Medical Research Institute (SAHMRI), Adelaide, Australia*

Introduction: Experienced echocardiographers can quickly glean diagnostic information from limited echocardiographic views and the use of limited cardiac ultrasound, particularly as a screening tool, is increasing. The availability of portable ultrasound machines contributes to this rise. Moreover, proposed changes to the Medicare Benefits Schedule, for the first time, support limited studies. However, the sensitivity and negative predictive value of a "screening" echocardiogram is uncertain.

Aim/Method: We examined the accuracy of limited echocardiography in 204 consecutive, de novo studies. We used 6 images; parasternal long axis, with colour over the mitral valve, and aortic valve, and apical 4-chamber, with colour over the mitral valve, and tricuspid valve. We compared the interpretation of 8 subjects with the final echocardiogram report (gold standard). The subjects comprised 4 echocardiography-specialised cardiologists and 4 senior cardiac sonographers. Studies were graded as; [1] normal or [2] needs full study (due to inadequate images or abnormality detected). Sensitivity, negative predictive value (NPV) and accuracy are reported.

Results: Forty-one percent of studies were normal by gold standard. Overall, a screening echocardiogram was 76% sensitive, 65% accurate with an NPV of 60%. When inadequate images were excluded, accuracy was identical at 65%. Analysis of subgroups showed sonographer sensitivity 80%, NPV 63%, accuracy 63%, compared to cardiologist sensitivity of 68%, NPV 61%, and accuracy 67%.

Conclusions: Highly limited cardiac ultrasound as a screening tool for abnormalities had a sensitivity of only 76%, raising safety questions. Caution is recommended in extrapolating its use for specific indications, and in non-specialised settings.

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Alterations in Multiplanar Strain in Bone Marrow Transplant Patients Previously Treated with Anthracyclines

T. Deshmukh [*], L. Geraghty, D. Emmerig,
S. Sivapathan, M. Hogg, S. Panicker,
P. Brown, M. Altman, D. Gottlieb, L. Thomas

Westmead Hospital, Sydney, Australia

Background: Echocardiographic strain analysis can identify subclinical LV dysfunction in patients who have received chemotherapy and bone marrow transplant (BMT).

Methods: 50 BMT patients, with previous anthracycline exposure, who underwent a transthoracic echocardiogram (TTE) [Nov 2016–Oct 2017] were compared to 50 age and gender matched controls (departmental database). Standard parameters of LV function (LVEF) and offline strain analysis were performed (GE Echopac).

Results: Time from BMT to TTE was 7 ± 6 years. Based on current recommendations [1], a normal LVEF cutoff >53% was used. 40 BMT patients had an LVEF > 53%. Global longitudinal strain (GLS) was significantly lower versus controls (18.4 ± 3 vs $20.5 \pm 2\%$; $p = 0.001$), as was global circumferential strain (GCS) (15.9 ± 4 vs $19.3 \pm 4\%$; $p = 0.002$). 29 BMT patients and 48 controls had "normal" LV function (LVEF > 53% and GLS > 17). Even in this subgroup, GCS was significantly lower in the BMT group (16.9 ± 4 vs $19.1 \pm 4\%$, $p = 0.04$) and suggests that it could be an additional marker to detect pre-clinical stage B heart failure.
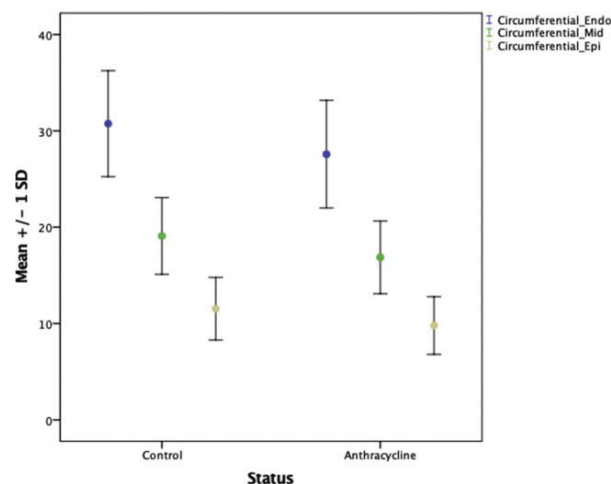
Limitations: This is a single centre cross-sectional study with a limited sample size; lack of serial measurements preclude evaluation of within patient changes over time.

Conclusions: Our results provide new insights for the use of multiplanar strain imaging for detection of sub-clinical cardiac dysfunction that may be present in patients after a BMT despite preserved LVEF. Their prognostic value to identify adverse events require further evaluation.

Reference

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An Assessment of Type II Cancer Therapeutics Related Cardiac Dysfunction Echo Surveillance

A. Scannell*, K. Johnson

Nelson Marlborough District Health Board, Nelson, New Zealand

Background: The efficacy of Trastuzumab against cancer ensures its longevity in clinical practice despite its undeniably dangerous cardio-toxic side effect profile. Our goal was to assess whether we are currently achieving internationally recognised standards of echo surveillance in Trastuzumab treated patients and to identify any subsequent data trends which could help us with risk-stratification and ongoing surveillance planning.

Method: All the files of any patients who received Trastuzumab therapy between 01/01/16–01/01/19 within our District Health Board were retrospectively analysed with a view to comparing the standard of care with those set out by the internationally recognised American Society of Echocardiography –this included systematic review of 216 echocardiograms.

Results: 3 patients had baseline Troponin and BNP blood tests. 216 CTRCD Surveillance Echoes were performed on 45 patients over a 3 year period. 14.28% were missed/delayed beyond the recommended interval. 26.85% did not measure GLS. All measured EF: 42.59% used Simpsons Biplane Method and 0.46% utilised the 3D EF measurement. No Contrast Echoes were performed, however 2 patients received additional blood tests, earlier echoes, commencement of cardiac meds and/or early cessation of therapy as per guidelines.

Conclusion: Our District Health Board is a small centre and as such, has limited clinical resources which negatively impacts our adherence to the guidelines. However by identifying our areas of critical weakness and continuing to audit ourselves we can amend our practice to ensure better future care.

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Ascending Aortic Compliance in Patients with Bicuspid Aortic Valves; a Cardiac MRI Study

L. Holmes [1,2,*], R. Cordina [1,2], G. Black [2], M. Dennis [1,2], D. Celermajer [1,2], R. Puranik [1,2]

[1] *Royal Prince Alfred Hospital, Camperdown, Australia*
[2] *The University of Sydney, Camperdown, Australia*

Background: Patients with bicuspid aortic valve (BAV) are more likely to develop ascending aortic dilatation and rupture. It is unclear whether this is primarily due to altered aortic flow with a maladaptive response of the vessel wall, or pathology of the aortic wall itself. Cardiac MRI (CMRI) presents the opportunity to evaluate regional aortic compliance in BAV patients.

Methods: 30 patients (19 BAV and 11 age- and sex- matched patients with tri-leaflet aortic valves) were studied. BAV patients were then divided into two groups – dilated (diameter > 36 mm; $n = 12$) and non-dilated ($n = 7$). Aortic compliance was calculated in the ascending and descending aorta.

Results: Patients in the control, non-dilated BAV and dilated BAV groups were similar in terms of age (37 ± 13, 33 ± 12 and 42 ± 12 years respectively, $p = 0.31$) and sex (36%, 71%, and 66% males respectively, $p = 0.228$). Mean ascending aortic diameter was 30 ± 4.9 mm in controls, 30.4 ± 3.6 mm in non-dilated BAV, and 41.7 ± 5.8 in dilated BAV, $p < 0.05$. The mean diameter at the descending aorta was 18.6 ± 3.7 mm, 17.7 ± 2.9 mm, and 21.3 ± 1.7 mm for controls, non-dilated BAV, and dilated BAV respectively, $p = 0.03$. Pulse pressure was not significantly different between groups at 53 ± 9 mmHg, 50 ± 20 mmHg, and 59 ± 13 mmHg respectively, $p = 0.274$. Ascending aortic compliance was similar in dilated BAV (1.75 ± 0.95 mm^2 mmHg^{-1}) compared to non-dilated BAV (2.7 ± 1.27 mm^2 mmHg^{-1}) and controls (2.25 ± 1.49 mm^2 mmHg^{-1}), $p = 0.28$.

Conclusions: Preserved aortic compliance in patients with BAV and aortic dilatation suggests that there is a flow related pathogenesis for dilatation rather than an intrinsic wall abnormality.

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Assessment of Pulmonary Pressures by Transthoracic Echocardiographic (TTE) and Invasive Right Heart Catheterization (RHC) in a Real-World Pulmonary Hypertension Population – Does Tricuspid Regurgitation (TR) Severity Make a Meaningful Difference?

R. Reyaldeen[*], M. Mallouhi, A. Kennington, K. Nath, A. Chong, S. Wahi

Queensland Health, Brisbane, Australia

Background: Non-invasive TTE evaluation of pulmonary hypertension requires accurate assessment of the TR spectral Doppler signal (For estimation of the right ventricular (RV) systolic pressure (RVSP) as a surrogate for pulmonary artery systolic pressure (PASP)) and RV systolic function. However, TR severity may also influence RVSP calculations, where severe TR can result in an underestimation due to rapid RV-right atrial pressure (RAP) equalisation, and unreliable determinations of RAP by the conventional TTE approach.

Purpose: To characterise the impact of TR severity on TTE assessment of RVSP in comparison to RHC measurements.

Methods: Patients undergoing TTE and RHC for assessment of pulmonary hypertension were included. Calculated RVSP ($4 \times TR_{velocity}^2 + RAP$), TTE indices of RV systolic function, and RHC haemodynamic data were retrospectively recorded from patients with varying TR severity.

Results: 102 patients were included (66 ± 14 years; 60% Female; Mean pulmonary artery pressure 38 ± 13 mmHg). There was moderate overall correlation between TTE-RVSP and RHC-PASP ($r = 0.76$, $p < 0.001$) which remained preserved across the varying grades of TR (Mild: $r = 0.65$, $p < 0.001$; Moderate: $r = 0.85$, $p < 0.001$; Severe: $r = 0.75$, $p < 0.001$). There was a significant association between TTE- and RHC-derived RAP in the mild TR group. This was not seen in the groups with moderate or severe TR (mild $p = 0.006$, moderate $p = 0.398$ and severe $p = 0.780$).

Conclusion: TTE-RVSP appears to have reasonable correlation with RHC-PASP independent of TR severity. TTE-RAP remains the "Achilles heel" in the overall equation where significant TR can result in false estimations of the RAP and misleading fluctuations in RVSP values.

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Association between 18F-Sodium Fluoride Positron Emission Tomography Uptake and High-Risk Plaque Features on Optical Coherence Tomography in Patients with Acute Coronary Syndrome

K. Majeed [1,2], J. Bellinge [1,3,*], R. Alcock [3], J. Spiro [3], G. Hillis [3], D. Newby [4], T. Mori [1], R. Francis [1], C. Schultz [1,3]

[1] *University of Western Australia, Perth, Australia*
[2] *University of Ottawa Heart Institute, Ottawa, Canada*
[3] *Royal Perth Hospital, Perth, Canada*
[4] *University of Edinburgh, Edinburgh, United Kingdom*

Background: 18-F Sodium Fluoride Positron Emission Tomography (18F-NaF PET) is a non-invasive molecular imaging technique which identifies early microcalcification, a high-risk feature of coronary atherosclerotic plaques. We aimed to study the association between coronary 18F-NaF uptake and high-risk plaque features on optical coherence tomography (OCT) and evaluate the potential application to patient level risk stratification.

Methods: Prospectively recruited patients with ACS underwent multi-vessel OCT at the time of coronary angiography/angioplasty and 18F-NaF PET post-hospital discharge. The maximum tissue to background ratio (TBR) on 18F-NaF PET scans and various high-risk plaque features on multi-vessel OCT were measured by standard methods in individual coronary segments. For the patient level analysis three groups were defined, based on microcalcification activity (zero, one or two and more coronary segments with elevated 18F-NaF uptake).

Results: In 62 patients (mean age 61 ± 9 years, 86% male) there were 286 coronary segments with OCT data. Elevated 18F-NaF uptake was associated with higher lipid arc ($74°$ [$35°$–$117°$] versus $48°$ [$15°$–$83°$], $p = 0.021$), higher prevalence of macrophages (61% versus 39%, $p = 0.008$) and lower plaque free wall (PFW) ($50°$ [$7°$–$110°$] versus $94°$ [$34°$–$180°$], $p = 0.027$). At patient level decreasing PFW, greater calcification and increasing macrophages were seen as the number of coronary lesions positive for microcalcification activity increased ($p < 0.001$, $p = 0.006$ and $p = 0.028$, respectively).

Conclusion: 18F-NaF uptake is associated with multiple high-risk plaque features measured on OCT in both per segment and per patient analyses. This suggests that 18F-NaF PET has the potential to refine the risk assessment of patients with ACS.

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Association between Left Ventricular Strain and Health Related Quality of Life and Functional Capacity in Stage A and B Heart Failure

K. Haji[1,*], C. Wong[1], C. Neil[1], T. Marwick[2]

[1] *Western Health, Melbourne, Australia*
[2] *Baker Heart and Diabetes Institute, Melbourne, Australia*

Background: Patients with stage A and B heart failure can have a significant burden of fatigue and poor quality of life despite having normal left ventricular (LV) ejection fraction (EF). Global longitudinal strain (GLS) can detect early changes in LV function. This study evaluates the relationship between LV function with functional capacity and quality of life (QOL) measures in stage A and B heart failure.

Methods: A cross-sectional study of patients with stage A and B heart failure ($n = 431$) to show the relation of echocardiographic parameters with functional capacity and quality of life measures. Functional capacity (6-min walk test (6MWT), quality of life (short form-12 (SF-12) and international measure for physical activity (IPAQ)) were measured. Echocardiogram was used to assess global longitudinal strain (GLS), Ejection fraction (EF), left ventricular mass index (LVMI), left atrial volume index (LAVI), left ventricular end diastolic volume (LVEDV) and E/e'.

Results: The mean age was 65 ± 11 years, 72% were men. Mean GLS was $-18.1 \pm 3\%$. Univariate analysis showed age (-4.2 (-5.4, -3.1) $P < 0.01$) GLS (5.8 (1.5, 9.9) $P = 0.01$), LAVI (-1.5 (-2.9, -0.2) $P = 0.03$), and Ee' (-7.1 (-9.7, -1.1) $P < 0.01$) were associated with distance walked in 6 MWT. EF (0.2 (0.1, 0.3) $P = 0.01$) and GLS (0.5 (0.1, 0.9) $P = 0.01$) were both associated with higher SF 12 score. And no cardiac parameter was associated with IPAQ score.

Conclusion: GLS was associated with measures of functional capacity and one in two measures of QOL in patients stage A and B heart failure.

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Association of Global Longitudinal Strain with the Development of Adverse Left Ventricular Remodelling: A Systematic Review and Meta-Analysis

P. Thein*, M. Isa, E. Wong, A. Brown, J. Cameron, A. Nasis

MonashHeart and Monash Cardiovascular Research Centre, Monash Health and Monash University, Melbourne, Australia

Background: Global longitudinal strain (GLS) is associated with major adverse cardiovascular outcomes independent of LVEF. However, the association of GLS with the development of adverse left ventricular remodelling (LVR) is not well established.

Aim: To study the relationship between abnormal GLS (>-16%) and LVR in patients with normal resting LVEF.

Methods: Embase, Medline and Cochrane databases were systematically searched to identify studies utilising GLS and LVEF in predicting LVR. The primary outcome was mean difference in GLS in patients who develop LVR compared to those who do not develop LVR at ≥ 3 months. The reviewers followed PRISMA protocol.

Results: Eleven studies were included in the final quantitative analysis of 700 patients (mean age 59.5 ± 11.9, Male = 68%). When patients who developed LVR were compared with those without LVR, mean baseline LVEF was: 56.1% (95%CI = 54.9–57.3, $P < 0.0001$) vs. 61.6% (60.6–62.6, $P < 0.0001$) and mean baseline GLS was: -15.7% (-16.5 to -15.1, $P < 0.0001$) vs. -19.5% (-20 to -18.9, $P < 0.0001$) whereas, mean differences of baseline GLS and EF in LVR group were statistically significant: 3.8% (3.0–4.6, $P < 0.0001$) and -5.5% (-7.0 to -3.9, $P < 0.0001$) respectively. When baseline and follow-up LVEF and GLS are compared in LVR group, mean LVEF difference was 3.62 (2.06 to 5.18, $I^2 = 38\%$, $P < 0.0001$) and mean GLS difference was -2.17 (-3.21 to -1.13, $I^2 = 71\%$, $P < 0.0001$) (Fig. 1) whilst in those without
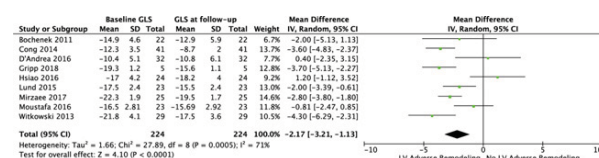

Fig. 1. *Comparison of baseline and follow-up GLS values in patients who develop adverse left ventricular remodelling.*

LVR, mean LVEF and GLS difference were 2.71 (-4.92 to -0.50, $I^2 = 75\%$, $P = 0.02$) and 0.64 (-0.74 to 2.03, $I^2 = 84\%$, $P = 0.36$).

Conclusion: Abnormal GLS at baseline and further worsening at follow-up is associated with the development of adverse LVR. Therefore, patients with abnormal resting GLS may benefit from closer surveillance and earlier therapy.

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Can Non-Invasive Global Myocardial Work Index Calculation Improve Exercise Stress Echocardiography?

A. Borrie*, C. Goggin, W. Robinson, A. Sasse

CCDHB, Wellington, New Zealand

Background: Myocardial work index (MWI) is derived from echocardiographic strain assessment in combination with estimated non-invasive pressure-volume loops. It has been characterised to describe global and regional myocardial work. Aim of the presented study is to evaluate the effect of exercise and ischaemia on global MWI.

Method: Patients were retrospectively enrolled from an existing database of exercise stress echocardiography. Inclusion criteria were a clinical indication of possible ischaemia and technical suitability to calculate MWI. Exclusion criteria

were abnormal baseline LV function (relevant cardiomyopathy, LVEF <50%, baseline wall motion abnormalities) or poor image quality. Percentage change in global MWI from rest to peak exercise was calculated. Echocardiograms positive for ischaemia were defined by independent visual assessment with matching angiographic findings.

Results: 152 patients met inclusion criteria, 17 were excluded for poor image quality and 85 for LV function. 40 normal and 9 positive tests remained for analysis. Mean change in MWI was +54% in normal patients, −4% in ischaemic patients respectively ($p = 0.001$). ROC curve comparing normal and ischaemic echocardiograms had an AUC of 0.95. The optimal cut off point for a normal test (by index of union method) was a greater than 22% increase in myocardial work (sensitivity 89%, specificity 90%).

Conclusion: This pilot study examining global MWI response to exercise shows promising discrimination between ischaemic and normal myocardial responses. This is limited by image quality. Further prospective research with a larger sample is needed.

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Changes in Left Ventricular Structure and Function with Increasing Body Mass Index

H. Chen[*], B. Chiang, A. Bhat, S. Khanna, T. Kayes, G. Gan, T. Tan

Blacktown Hospital, Blacktown, Australia

Background: Obesity has been proposed to be associated with cardiac remodelling. We previously reported findings demonstrating positive correlation between increases in body mass index (BMI) with left atrial (LA) volumes. In this study, we aim to characterise subclinical changes in LV size and systolic function as a function of BMI.

Methods: 60 patients (without hypertension, cardiovascular disease, diabetes mellitus, structural heart disease, heart failure, tachy/brady-arrythmias or renal failure) were separated into three equal groups based on BMI (Controls: 18.5–$25\,kg/m^2$, Intermediate BMI Group 1:30–$35\,kg/m^2$, High BMI Group 2:35–$40\,kg/m^2$). Standard echocardiographic parameters of LV structure and function were measured. In addition, mean global longitudinal strain (LVGLS) was measured offline using vendor-independent software (TomTec Arena, Germany v4.6) and comparisons made between each group. Differences between groups were assessed using one-way ANOVA. Equality of means was assessed using the Welch method and post hoc analysis was performed using Tukey or Games-Howell analysis.

Results: Of the patients analysed (mean age 37.2 ± 11 years; 43% male), there was a significant difference in LV wall thickness, LV mass indexed ($p = 0.004$) and LVGLS ($p = 0.001$). Post hoc analysis revealed a significant increase in LV mass between controls vs intermediate ($p = 0.019$) and high ($p = 0.011$) BMI groups. However, LVGLS was only significantly different between controls and high BMI group ($p = 0.002$).

Conclusions: Our results suggest that cardiac structural changes i.e. LV remodeling as defined by LV mass increase

occurs with intermediate elevation in BMI prior to subclinical cardiac dysfunction as defined by LV strain decrease in greater elevation in BMI.

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Changes in Pericardial Fat Composition after Radiotherapy: Implications for Coronary Artery Disease?

M. Malaty[1,2,*], S. Tang[2,3,5], E. Koh[3,5], S. May[6], G. Delaney[4,5], L. Holloway[3,5], R. Rai[3], G. Liney[3,5], J. Otton[1,2]

[1] *Department of Cardiology, Liverpool, Australia*
[2] *UNSW, Sydney, Australia*
[3] *Cancer Therapy Centre, Liverpool Hospital, Liverpool, Australia*
[4] *South Western Sydney Clinical School, UNSW, Liverpool, Australia*
[5] *Ingham Institute of Applied Medical Research, Liverpool Hospital, Liverpool, Australia*
[6] *University of Sydney, Sydney, Australia*

Introduction: Radiotherapy (RT) including the heart within the treatment field is associated with increased long term rate of coronary disease. Recent studies have demonstrated that certain characteristics of the perivascular adipose tissue (PVAT) are associated with both vascular inflammation and event.

Methods: We studied 24 patients undergoing left sided tangential radiotherapy for breast cancer at baseline, 6 weeks and 12 months. Cardiac MRI scans were performed at 3 Tesla (Siemens, Skyra) including MOLLI sequences to generate a T1 map indicating the T1 time of each voxel at the cardiac base, midzone and apex. Regionrs of interest were drawn at the PVAT surrounding the LAD artery.

Results: The mean heart dose was 2.3 Gy. The mean LV dose was xxx Gy. XXGy at the Base xx MidZone and xxx at the apex. No significant change in PVAT T1 time was found at 6 weeks post commencement of radiotherapy. At 12 months there was a significant increase in PVAT T1 time at the apex (pre RT 264 ms post RT 284 ms TTest $p < 0.05$), receiving the highest radiotherapy dose, with a numerical increase in T1 at the midzone (pre RT 272 ms post 289 ms $p < 0.08$) with no significant change at basal.

Conclusion: PVAT T1 signal intensity appears to increase after left sided tangential breast radiotherapy. We speculate that changes in PVAT T1 correlate with recognised histological changes related to inflammatory infiltrate and adipocyte composition. These changes merit further study to assess the potential for causal influence on coronary events post radiotherapy.

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Characterisation of Left Ventricular Shape Change as Defined by Sphericity Index in Patients with Acute Phase Takotsubo Cardiomyopathy and Anterior STEMI Patients

S. Khanna *, G. Gan, K. Gupta, W. Khan, W. Tan, H. Chen, A. Bhat, T. Tan

Blacktown Hospital, Blacktown, Australia

Background: Left ventricle (LV) shape changes have been proposed to be predictive of cardiovascular outcomes. Extreme sphericity has been shown to be a strong predictor of heart failure and atrial fibrillation. Sphericity index (SI) is a measure that may be used to quantify LV shape changes. The aim of our study was to characterise LV shape changes using SI between patients with acute phase Takotsubo's cardiomyopathy (TTC) and acute anterior transmural infarction (AMI).

Methods: Consecutive TTC ($n = 49$) and AMI ($n = 51$) patients with a comprehensive transthoracic echocardiogram during index admission were examined. Standard measures of LV size and systolic function were compared between groups. Mean SI was calculated as an average of the ratio of the short-axis length to the long-axis length in 4- and 2-chamber apical views in both end-diastole (ED) and end-systole (ES). Both groups were also compared to healthy controls ($n = 50$) and dilated cardiomyopathy (DCM) controls ($n = 39$).

Results: TTC and AMI patients had significantly worse LVEF and greater SI compared to normal controls suggesting LV shape change but not to the degree of DCM patients. Interestingly, there was no significant difference in LVEF between TTC ($51 \pm 12\%$) and AMI ($53 \pm 13\%$) [$p = 0.52$] but there was a significant difference in mean SI for TTC (0.60 ± 0.06) vs AMI (0.52 ± 0.07) [$p < 0.0005$] reflecting a more spherical shaped ventricle in the TTC group.

Conclusions: Our results demonstrate differences in LV shape between different cardiac pathologies. Characterisation of these LV geometric changes may provide mechanistic insights into these underlying cardiac pathologies and guide management strategies.

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Characterisation of Right Heart Function in Patients with Non-Ischaemic Cardiomyopathy

H. Chen *, A. Bhat, D. Makarious, C. Ng, S. Khanna, G. Gan, T. Tan

Blacktown Hospital, Blacktown, Australia

Background: Left and right ventricular (RV) function aressss proposed to be intimately linked, with the presence of RV impairment in patients with LV systolic dysfunction portending a poor prognosis. Our aim was to determine the prevalence of RV systolic impairment in patients with non-ischaemic cardiomyopathy (NICM) and to characterise the relationship between LV and RV systolic function using echocardiographic parameters.

Methods: Consecutive patients with HFrEF secondary to NICM stabilised on guideline recommended therapy were recruited. Patients with significant valvular, congenital, and pulmonary disease were excluded. All patients underwent comprehensive echocardiography and were stratified based on LVEF (mild 40–49%, moderate 30–39%, severe <30%). RV function was characterised using standard and novel measures. Two-dimensional RV free wall peak systolic strain (RV-FWS) was measured offline using vendor independent software (TomTec Arena, Germany v4.6).

Results: 86 patients (58 ± 17 y, 36% men) were assessed. In the mild ($n = 31$), moderate ($n = 28$) and severe ($n = 27$) groups: mean TAPSE (cm) was 2.1 ± 0.4, 1.9 ± 0.5, 1.7 ± 0.6; mean RVS' (cm/s) was 11 ± 3, 11 ± 3, 9 ± 3; mean FAC (%) was 44 ± 10, 29 ± 10, 17 ± 7; and mean RV-FWS (%) was -27.4 ± 7, -17.2 ± 6, -7.9 ± 3 respectively. One-way ANOVA comparing the three groups showed greatest significance with FAC ($p < 0.001$), and RV-FWS ($p < 0.001$) but not TAPSE or RVS'.

Conclusion: Not all patients with LV dysfunction had concurrent RV dysfunction. The severity of RV dysfunction paralleled LV dysfunction and was best detected using FAC and RV-FWS. Routine screening of RV function in these patients may help identify those who may benefit with more intensive follow up and preventative treatment.

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Characterisation of Right Ventricular Size and Systolic Function in a Cohort of Myocarditis Patients with Normal LVEF

S. Khanna *, G. Gan, K. Gupta, W. Khan, A. Bhat, H. Chen, T. Tan

Blacktown Hospital, Blacktown, Australia

Background: Myocarditis is believed to affect both left and right ventricles through an inflammatory process. Subclinical left ventricular (LV) dysfunction has been demonstrated in patients with acute myocarditis despite normal LV ejection fraction (LVEF). However, indices of right ventricular (RV) function in these patients have not been well characterised and are the aim of our study.

Methods: Patients admitted to our institution with myocarditis (2013–2017) and with a comprehensive transthoracic echocardiogram were included. Patients with pre-existent cardiac disease or impaired LVEF were excluded. Echocardiographic indices of left and right heart function were compared to healthy controls. Strain analysis of ventricular function was performed using vendor independent software (TomTec Arena, Germany v4.6).

Results: 100 patients (50 myocarditis, 50 controls) were examined. Patients with myocarditis had a mean Troponin-I level of 6190 ± 8452 ng/L. There were no significant differences in the baseline characteristics between groups. However, patients with myocarditis had significantly larger LV volumes ($p < 0.01$), higher indexed LV mass ($p = 0.01$) and lower LV global longitudinal strain (GLS; $p < 0.01$) compared

to controls. Myocarditis patients also had larger RV basal diameter (cm) (3.7 ± 0.6 vs 3.2 ± 0.8, $p < 0.01$), lower RV fractional area change % (40 ± 6 vs 54 ± 8, $p < 0.01$) and lower RV free wall GLS % (-22.6 ± 5.1 vs -32.6 ± 3.4, $p < 0.01$).

Conclusions: Our results demonstrate the presence of significant subclinical LV and RV dysfunction in a cohort of patients with myocarditis despite normal LVEF. In these patients, assessment of the right heart should routinely be performed as these measures can be of prognostic relevance and early preventative therapies may benefit.

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Characterisation of Subclinical Myocardial Dysfunction in Rheumatoid Arthritis Patients with Normal LVEF

J. Newman *, S. Khanna, A. Bhat, H. Chen, G. Gan, T. Tan

Blacktown Hospital, Sydney, Australia

Background: Rheumatoid arthritis (RA) is a chronic systemic inflammatory condition modulated by pro-inflammatory cytokines. These are believed to have negative inotropic effects at the level of the myocyte. We hypothesise that chronically elevated pro-inflammatory cytokine levels in RA result in subclinical myocardial dysfunction. Myocardial deformation indices are proposed to be a more sensitive marker of cardiac dysfunction compared to left ventricular ejection fraction (LVEF). We aimed to detect subclinical cardiac dysfunction in a cohort of RA patients with normal LVEF.

Methods: Consecutive stable RA patients (>1 year disease activity) admitted to our institution and without known cardiovascular disease were compared to age- and gender-matched controls. Patients without comprehensive transthoracic echocardiography (TTE), congenital heart disease, pulmonary disease, valvular heart disease or poor quality images were excluded. Left ventricular size and systolic function were measured according to ASE guidelines. LV mean global longitudinal strain (GLS) was measured offline using vendor-independent software (TomTec Arena, Germany v4.6).

Results: Of the 118 RA patients identified, 82 had a comprehensive TTE. 47 were excluded, leaving a cohort of 35 patients (mean age 71.8 ± 15.9, 77% female). There was no significant difference in baseline clinical characteristics or measures of left ventricular size and systolic function between controls and RA patients. However, LV mean GLS (%) was significantly lower in RA patients ($-17.18 \pm 1.7\%$) compared with controls ($-19.1 \pm 2.5\%$) ($p = 0.02$).

Conclusions: Our results suggest patients with RA have subclinical cardiac dysfunction despite normal LVEF measurements. These patients may benefit from regular cardiac follow-up and early commencement of cardioprotective agents.

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Clinical Value of Routine Echocardiography Prior to Coronary Angiography in Patients in Non ST-Elevation Myocardial Infarction

N. Sowden *, D. Lancini, T. Basso, K. Guppy-Coles, S. Hayman, G. Malhotra, J. Atherton, S. Prasad

Royal Brisbane and Women's Hospital, St Lucia, Australia

Background: The value of routine pre-angiography echocardiography in patients with Non ST-elevation myocardial infarction (NSTEMI) has not been well studied. This study aimed to quantify the clinical value of routine echocardiography prior to coronary angiography in four areas: (i) accuracy of regional wall motion abnormalities (RWMAs) for identifying culprit lesions, (ii) estimation of left ventricular end diastolic pressure (LVEDP), (iii) identification of significant (moderate+) mitral or aortic valve disease, and (iv) prognostic value.

Methods: Retrospective review of 330 patients with a first-ever NSTEMI undergoing echocardiography prior to coronary angiography at a single tertiary referral centre. Echocardiographic and cardiac catheterisation data obtained from prospectively maintained echocardiography and cardiac catheterisation laboratory databases. Outcomes data obtained from national death registry.

Results: (i) In patients with identifiable RWMAs, the concordance with angiographic culprit lesions was moderately high (Cohen's Kappa 0.061, $p < 0.001$). (ii) In 90 patients with same-day echocardiography and cardiac catheterisation, septal E/e' >15 identified LVEDP >15 mmHg with a high specificity (74%) and positive predictive value (77%). (iii) Significant aortic or mitral valve disease was identified in 40 patients (12%). (iv) At a median follow-up of 24 months, left ventricular ejection fraction (LVEF) and septal E/e' ratio were independent predictors of all-cause mortality when evaluated alongside significant clinical (age, diabetes, chronic kidney disease) and angiographic (extent of coronary disease and post-PCI TIMI flow) variables.

Conclusions: Routine echocardiography prior to coronary angiography in patients with NSTEMI provides clinically meaningful information that influences management and stratifies long-term prognosis.

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Comparison of Echocardiographic Parameters of Left Atrial and Ventricular Function between Young Stroke vs Lone Atrial Fibrillation vs Healthy Controls

A. Bhat [1,*], S. Khanna [1], H. Chen [1], G. Gan [1], R. MacIntyre [2], T. Tan [1]

[1] Department of Cardiology, Blacktown Hospital, Sydney, Australia
[2] University of New South Wales, Sydney, Australia

Background: Stroke is one of Australia's leading causes of morbidity and mortality with a significant percentage classified as cryptogenic. The nature and aetiology of cryptogenic stroke remains elusive, with a proportion believed to be cardio-embolic secondary to subclinical paroxysmal atrial fibrillation (AF). We aim to gain mechanistic insights into the pathophysiology of cryptogenic stroke in the young by comparing cardiac structural and functional differences in patients with young stroke, lone AF and healthy controls.

Methods: Patients aged ≤ 60 years with diagnosed ischaemic stroke admitted to our institution (2014–2018) without traditional cardiovascular risk factors were compared to age-matched patients admitted with a diagnosis of paroxysmal lone AF. Both groups were compared to cardiovascular disease-free controls. 30 patients in each cohort were recruited. Echocardiographic parameters were analysed; LV and LA strain assessment was performed offline using vendor-independent software (TomTec Arena, Germany v4.6).

Results: There were no significant differences in LV parameters (LVEF, LV endoGLS) between groups. When comparing lone AF with young stroke patients, indexed LAmax was significantly smaller in stroke patients (26 ± 7 vs 22 ± 7; $p = 0.024$). LA strain was significantly lower in AF patients compared to stroke patients (21.6 ± 5.4 vs 30.7 ± 4.9; $p < 0.0005$). Interestingly, LA strain in stroke patients was significantly lower compared to the healthy cohort (30.7 ± 4.9 vs 34.9 ± 6.2; $p < 0.005$).

Conclusions: A stepwise reduction in LA strain was appreciated between controls, young stroke and lone AF. This may indicate dynamic LA remodelling occurring in the young stroke population and suggest a shared causal mechanism for stroke development in this group.

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Computed Tomographic Coronary Angiography and Coronary Artery Calcium Score as a Risk Stratification Tool Prior to Non-Cardiac Surgery: A Meta-Analysis

A. Koshy [1,*], F. Ha [1], P. Gow [2], H. Han [1], F. Amirul-Islam [1], B. Cailes [1], H. Lim [1], A. Teh [1], O. Farouque [1]

[1] Department of Cardiology, Austin Health and University of Melbourne, Heidelberg, Australia
[2] Victorian Liver Transplant Unit, Austin Health, Heidelberg, Australia

Background: Current CSANZ guidelines are unclear about the role of computed tomographic coronary angiography (CTA) and coronary artery calcium score (CACS) in risk stratification prior to non-cardiac surgery (NCS). We performed a systematic review and meta-analysis evaluating perioperative risk prediction using these modalities in NCS.

Methods: Electronic databases were used to identify studies of preoperative CTA and CACS reporting 30-day perioperative major adverse cardiovascular events (MACE). Summary odds ratios (OR) for degree of coronary artery disease (CAD) and MACE were pooled using a random-effects method.

Results: Eleven studies were included. 246 (7.1%) MACE occurred in 3480 patients. Risk of perioperative MACE rose with the severity and extent of CAD on CTA ($p < 0.001$; Fig. 1 top). Multivessel disease (≥ 2 vessels, >50% stenosis) demonstrated the greatest risk (OR 8.8 95% CI 5.1–15.3, $p < 0.001$;
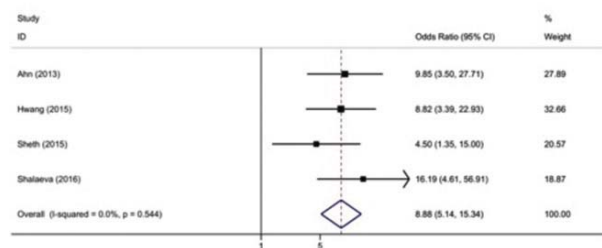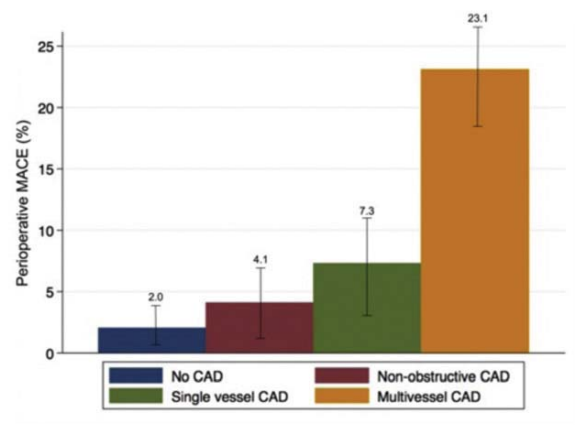

Fig. 1.

Fig. 1 bottom). Increasing CACS was also associated with higher perioperative MACE (CACS: ≥ 100 OR 5.1, $p < 0.01$). In a cohort deemed high risk by established clinical indices, absence of multivessel disease on CTA demonstrated a negative predictive value of 96% (95% CI 92.8–98.4) for predicting freedom from MACE.

Conclusion: Severity and extent of CAD on CTA conferred incremental risk for perioperative MACE post noncardiac surgery. The 'rule-out' capability of CTA is comparable to other non-invasive modalities and may be a viable alternative in perioperative risk stratification.

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Computed Tomography Coronary Angiography (CTCA) Detected High Risk Plaques are a Predictor of Future Coronary Events – Insights from a Propensity Matched Study of Patients who have Undergone Invasive Coronary Angiography, Fractional Flow Reserve and CTCA

D. Scherer [1,*], K. Fernandes [2], N. Nerlekar [2], C. Jiang [2], J. Abdelmalak [2], A. Lin [2], K. Munnur [2], P. Psaltis [1], J. Cameron [2], S. Senevirantne [2], S. Nicholls [2], D. Wong [2]

[1] *SAHMRI, Adelaide, Australia*
[2] *MonashHeart, Clayton, Australia*

Background: High risk plaque (HRP) features, such as low attenuation plaque, positive remodelling and spotty calcification, identified on coronary computed tomography angiography (CCTA) have been shown to associate with fractional flow reserved (FFR) and acute plaque ruptures. No studies have compared the predictive value of HRP, quantitative plaque measures and FFR in predicting future major adverse cardiac events (MACE).

Methods: Patients from MonashHeart who had undergone CTCA and FFR between 2009–2017 were reviewed. Patients with MACE (cardiovascular death, myocardial infarction, stroke, hospitalisation for unstable angina, or coronary revascularisation >90 days following CCTA) were propensity matched to patients without MACE.

Results: 265 patients were reviewed with 17 (6.4%) having documented MACE over a median follow up of 5.4 years. MACE events included 2 STEMIs, 2 NSTEMIs, and 13 unstable anginas. Of the 34 propensity matched patients (mean age 60.5 ± 9.5 years, 74% men), 22 (65%) had FFR significant (defined as FFR <0.8) lesions and 12 (35%) had FFR non-significant lesions. MACE occurred in 10 FFR significant and 7 FFR non-significant patients. The mean interval between CCTA and MACE was 523 days. High risk plaques with ≥ 2 HRP features (hazard ratio 4.09, 1.37 to 12.18, $p = 0.01$) was the only predictor of future MACE. Total plaque burden ($p = 0.82$), minimal luminal area ($p = 0.39$) and FFR significance were not predictors of MACE ($p = 0.55$).

Conclusions: In patients who have undergone both CTCA and FFR, the presence of high risk plaques (≥ 2 HRP features) is the only predictor of future MACE.

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Computed Tomography Coronary Angiography Derived High Risk Plaques Predict Physiological Significance of Coronary Artery Stenoses as Assessed with Invasive Fractional Flow Reserve

D. Scherer [1,*], C. Jiang [2], N. Nerlekar [2], K. Fernandes [2], J. Abdelmalak [2], A. Lin [2], K. Munnur [2], P. Psaltis [1], J. Cameron [2], S. Senevirantne [2], S. Nicholls [2], D. Wong [2]

[1] *SAHMRI, Adelaide, Australia*
[2] *MonashHeart, Clayton, Australia*

Background: High-risk plaque (HRP) characteristics such as low attenuation plaque (LAP), positive remodelling and spotty calcification are feasibly identified on computed tomography coronary angiography (CTCA). The presence of ≥ 2HRP are considered very high-risk with a strong independent association with prognosis. Fractional Flow Reserve (FFR) however, remains the reference standard for lesion-level coronary intervention in stable patients.

Purpose: We investigated the relationship between qualitative HRP (non-invasive anatomical assessment) and FFR (invasive functional assessment).

Methods: Consecutive stable coronary artery disease patients who underwent CTCA and invasive FFR at Monash-Heart between 2009–2017 were reviewed. Patients with significant FFR (<0.8) were propensity-matched for age, sex and cardiovascular risk factors to patients with non-significant FFR resulting in 55 patients per group. Logistic regression analysis was applied to define predictors of FFR significance. Odds ratios (OR) with respective 95% confidence intervals are reported.

Results: The presence of a single HRP feature in a lesion was similar between FFR significant vs non-significant (78% vs 72%, $p = 0.66$). The presence of ≥ 2 HRP features in a lesion was greater in FFR significant vessels (51% vs 25%, $p = 0.01$). Univariable predictors of FFR-significance included increasing total plaque burden ($p = 0.002$), increasing minimal luminal area ($p = 0.002$), ≥ 2HRP features ($p = 0.007$), and presence of LAP ($p = 0.05$). On multivariable assessment, total plaque burden (Odds Ratio (OR 1.06 (1.01–1.11), $p = 0.01$), decreasing minimal luminal area (OR 0.54 (0.41–0.81), $p = 0.001$), and ≥ 2HRP (OR 3.91 (1.43–10.71), $p = 0.008$) remained independent predictors of significant invasive FFR.

Conclusions: The presence of ≥ 2 HRP features within a coronary lesion non-invasively identified on CTCA independently predict FFR significance.

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Contrasting Utility of Echocardiography in Suspected Endocarditis Caused by Staphylococcus aureus (SAB) and Non-HACEK Gram Negative Bacteria (GNB) at Waitemata District Health Board (WDHB)

M. Ali[1], S. Cicovic[1,*], M. Broom[2], N. Amir[1], H. Bhally[2]

[1] Department of Cardiology, Waitemata District Health Board, Auckland, New Zealand
[2] Department of Infectious Diseases, Waitemata District Health Board, Auckland, New Zealand

Background: Use of Echocardiography in suspected endocarditis is well established in SAB. On the contrary, GNB endocarditis is rare (1–2%) but echocardiography requests are not uncommon suggesting a potential knowledge gap in its optimal utilisation for endocarditis.

Study objectives:

1. To determine the appropriate use of transthoracic (TTE) and transoesophageal (TOE) echocardiography as a best practice recommendation in SAB.

2. To analyse echocardiogram requests and its utility for suspected endocarditis in patients with GNB.

Method: A retrospective analysis involving all adult patients with SAB and GNB admitted at WDHB between Sept '16 until Aug '17, excluding cardiothoracic surgery or non-renal solid organ transplant population. Echocardiography requests at the time of bacteremia were reviewed with relevant clinical information through electronic medical system (EMS).

Results: Of the 1099 positive blood cultures from 888 patients, 102 patients had SAB and 591 had GNB. Seventy-five (73.5%) SAB patients had echocardiography performed, with 9 (12%) suggestive of endocarditis. This included 4 positive TOEs only, and 3 'false positive' TTE with negative TOE.

In contrast, 56 (9.5%) GNB patients had TTE performed for indications including endocarditis. Septic shock was present in 53%, and only 5–10% had significant immunosuppression or long-term devices. All echocardiography results (including 2 TOEs) were negative for endocarditis. GNB patients with ≥2 positive blood cultures (93% vs 5.3%, $p < 0.001$) and *Klebsiella* bacteremia (15.2% vs 8.6%, $p < 0.09$) were more likely to have echocardiography.

Conclusion: In our non-specialised tertiary care setting, echocardiography yield for endocarditis in GNB is very low and therefore not recommended. For SAB, yield can be increased with TOE use.

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Coronary Artery Disease and Pericoronary Adipose Tissue Attenuation by Computed Tomography in Familial Hypercholesterolemia

S. Mirzaee[1,2,*], A. Lin[1,2], M. Isa[2], U. Thakur[1], N. Nerlekar[1,2], J. Cameron[1,2], A. Nasis[1,2], S. Nicholls[1,2], D. Wong[1,2]

[1] Monash Health, Clayton, Australia
[2] Monash University, Monash School of Medicine, Melbourne, Australia

Introduction: Familial hypercholesterolaemia (FH) is a common hereditary lipid disorder which causes premature coronary artery disease. Pericoronary adipose tissue (PCAT) attenuation is a novel computed tomography coronary angiography (CTCA) biomarker of coronary inflammation with prognostic validation. We sought to compare PCAT attenuation in FH patients with and without significant coronary artery disease (CAD).

Methods: Patients with probable/definite FH as per Dutch Lipid Clinical Network Criteria who underwent 320-detector CTCA were included in this cross-sectional study. More than 50% coronary stenoses in CTCA were defined as significant CAD. Using semi-automated software (Autoplaque version 2.0), PCAT attenuation was measured around the proximal 10–50 mm of the right coronary artery (RCA). In patients with significant CAD, PCAT attenuation was measured around the lesion with highest-grade stenosis.

Results: Sixty patients with phenotypic FH (40 with significant CAD and 20 with no CAD) were included. Median low-density lipoprotein cholesterol (LDL-C) was higher in patients without CAD compared to those with significant CAD (5.3 [IQR 3.85–6.7] vs. 3.3 [2.65–4.55] mmol/L, $p < 0.001$). PCAT attenuation was significantly higher in patients with significant CAD compared to those without CAD (-80.9 ± 12.2 vs. -90.6 ± 7.6 HU, $p = 0.004$). PCAT attenuation around the proximal RCA was not statistically significant between the two groups (-85.3 ± 11.9 vs. -90.6 ± 7.6, $p = 0.09$). PCAT attenuation did not correlate with plasma LDL-C levels.

Conclusion: FH patients with significant CAD had a higher PCAT attenuation than those without CAD, perhaps reflecting a greater degree of coronary inflammation. Future studies are required to assess whether PCAT attenuation can enhance risk stratification and guide therapy in FH patients.

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Coronary Artery Shape as a New Biomarker - Anatomical Features Linked to Adverse Haemodynamics

S. Beier[1,*], J. Ormiston[2], M. Webster[2], P. Medrano[3], S. Masoud-Ansari[3], B. Cowan[3]

[1] *Unsw, Sydney, Australia*
[2] *Auckland City Hospital, Auckland, New Zealand*
[3] *University of Auckland, Auckland, New Zealand*

Coronary vessel geometry can create disturbed blood flow that is associated with adverse haemodynamics and atherosclerotic risk. Patient-specific haemodynamic assessments have led to some insights, however population assessments of adverse shape characteristics are lacking.

Twenty patient-specific left main geometries (15 females, 5 males, 55 ± 9 years) were analysed for shape features and compared to haemodynamic simulations. Significant shape variation was present (angle A $129.9° \pm 20.7°$; inflow angle $15.9° \pm 24.3°$; angle B $75.3° \pm 21.3°$; radii 1.74 ± 0.64 mm, 1.42 ± 1.07 mm, 1.59 ± 0.46 mm, and tortuosity 1.09 ± 0.13, 1.02 ± 0.06 and 1.46 ± 0.68 for LM, LAD and LCx, respectively). A principal component analysis (PCA) showed that the bifurcations varied primarily in size, and secondly in curvature and angle. Geometric differences of larger radii and higher LAD tortuosity were found in patients with hypertension, and variations in LM shape were also evident across age groups. Interestingly, we found that an obtuse angle B is only unfavourable in combination with an acute LM inflow angle, which was shown to be a more dominant factor in local haemodynamics. An acute angle B ($<60°$) was also found adverse. Similarly, both radii and tortuosity appeared to have an optimal range with adverse haemodynamic effects outside that range.

This demonstrates the potential of shape feature analysis combined with haemodynamic assessment and highlights the value of vessel shape as a clinical biomarker for adverse haemodynamics and atherosclerotic risk.

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Coronary CT Angiography for Allocation of Lipid Lowering Therapy: A Tertiary Centre Experience

B. Jaltotage[1,*], A. Gupta[2], U. Ali[1], R. Parsons[3], J. Rankin[1], G. Dwivedi[1]

[1] *Department of Cardiology, Fiona Stanley Hospital, Perth, Australia*
[2] *Department of Radiology, Fiona Stanley Hospital, Perth, Australia*
[3] *School of Occupational Therapy, Social Work and Speech Pathology, Curtin University, Perth, Australia*

Background: The need for lipid lowering therapy has traditionally been guided by clinical cardiovascular risk scores such as the Framingham Risk Score (FRS).

This study investigates the incorporation of Cardiac CT angiography (CTCA) in accurately allocating patients to lipid lowering therapy. A pristine CTCA is defined as normal, and the presence of trace plaque renders the CTCA abnormal. Coronary artery calcium score (CAC) does not detect soft plaque, which is more vulnerable, and for this reason the CAC score has not been used for reclassification.

Methods: 273 patients had an assessment of their clinical risk and a CTCA between 2015 and 2018. Clinical risk and clinical allocation of lipid lowering therapy has been calculated on the basis of the FRS and the Canadian Cardiovascular Society guidelines. Patients with a high clinical risk and a normal CTCA were reclassified down, and those with a low clinical risk and an abnormal CTCA were reclassified up.

Results: Of the 273 patients, 100 (37%) patients were reclassified. 25 patients (9%) were classified down and 75 patients (28%) were classified up. Of the patients who were classified up, 25 had severe coronary disease, and four patients required revascularisation.

Conclusions: In patients with low to intermediate risk chest pain presenting to a public tertiary hospital, CTCA reclassified 37% of patients, a quarter of who were reclassified down and three quarters reclassified up. 25 patients with low clinical risk had severe coronary disease with four of these patients requiring revascularisation.

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Determinants of LA Strain: Independent Effects of LA Volume and LV Global Longitudinal Strain

G. Gan [1,2,3,4,*], A. Bhat [1,3,4], K. Gu [4], F. Fernandez [1,4], S. Eshoo [1,4], L. Thomas [2,3]

[1] Department of Cardiology Blacktown Hospital, Sydney, Australia
[2] Department of Cardiology Westmead Hospital, Sydney, Australia
[3] University of New South Wales, Sydney, Australia
[4] Western Sydney University, Sydney, Australia

Background: Left atrial (LA) global longitudinal strain (GLS) by 2D echocardiography has demonstrated prognostic value. LA GLS has been linked to left ventricular (LV) function but the impact of altered LA volume has not been well studied. We sought to examine the relationship between LA GLS, LA volume and LV GLS.

Method: Patients without previous cardiac disease referred for exercise stress echocardiography were prospectively recruited. All participants underwent comprehensive transthoracic echocardiography (TTE) prior to exercise stress echocardiogram. Only patients with no evidence of ischaemia on stress echocardiogram, normal LV ejection fraction (LVEF) and left ventricular mass indexed (LVMI) were included.

Results: 260 patients (57% male, mean age 59 ± 14 yrs) with normal LVEF and LVMI were included. 182 (70%) patients had hypertension (HTN), 86 (33%) patients had diabetes mellitus (DM) and 81 (31%) patients had HTN and DM. On linear regression analysis, both LV GLS ($p < 0.01$) and indexed LA volume (LAVI) ($p < 0.01$) were independent determinants of LA GLS. For further evaluation, we examined LA GLS and LV GLS as tertiles based on tertiles of LAVI. At the lower tertiles of LAVI, a linear relationship was observed between LA GLS and LV GLS. At higher tertiles of LAVI, reduction in LA GLS relative to worsening LV GLS was non-linear and exponential.

Conclusion: Out findings suggest that in the presence of normal LAVI, LA GLS had a linear relationship to LV GLS. LA remodelling reflected by larger LAVI had an incremental negative association with LA GLS independent of LV GLS.

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Effects of Breast Radiotherapy on Right Ventricular Systolic Function

G. Femia [1,6,*], P. Pender [6], S. Tang [2,3,4], E. Koh [2,4], G. Delaney [1,2], L. Thomas [1,3], L. Holloway [2,4], R. Rai [2,4], G. Liney [2,4], J. Otton [3,6,5]

[1] University of Sydney, Sydney, Australia
[2] Ingham Institute of Applied Medical Research, Liverpool, Australia
[3] University of New South Wales, Liverpool, Australia
[4] Cancer Therapy Centre, Liverpool Hospital, Liverpool, Australia
[5] South Western Sydney Clinical School, UNSW, Liverpool, Australia
[6] Department of Cardiology, Liverpool Hospital, Australia

Background: Modern radiotherapy techniques for breast cancer attempt to minimise cardiac radiation doses as previous regimes have been shown to impact cardiac function and increase the risk of cardiovascular events. Using cardiac MRI and strain analysis, we aimed to assess the effect of modern radiotherapy techniques on right ventricular (RV) function.

Methods: We performed cardiac MRI using a 3T scanner on 20 patients at baseline, 6 weeks and 12-months post tangential left breast free breathing radiotherapy. A full dataset was available for 17 patients. Right ventricular strain was measured using prototype RV strain software (CVI42 v5.6). Standard volumetric assessment of the right ventricle was also performed.

Results: The mean heart dose was 2.3 Gy. The mean RV dose was 2.5 Gy. A differential dose was seen over the RV, with the apical segments receiving greatest doses. At 6 weeks there was trend towards reduced absolute strain in global, mid RV and apical measurements ($p = 0.06$). At 12-months, absolute global longitudinal RV function was significantly reduced (baseline −15.1% vs. 12-months −13.9%; $p < 0.05$). There was no significant reduction in basal strain and a non-significant reduction in mid RV strain. RV strain reduction was driven by reduction in apical strain (baseline −17.7 vs. 12-months −14.5%; $p < 0.01$), the region receiving the highest radiation dose.

Discussion: This preliminary data indicate a reduction in RV strain after left breast tangential radiotherapy. If confirmed, these results may inform future decisions regarding radiotherapy planning and delivery. The reduction in absolute strain appeared to correlate with radiotherapy dose.

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Efficacy of Exercise Stress Echocardiography in Elderly Patients

A. Andrews

Princess Alexandra Hospital, Woolloongabba, Australia

Introduction: An exercise stress echocardiogram (ESE) is routinely used to exclude coronary artery disease. A diagnostic ESE requires the patient to reach target heart rate (85% of age predicted heart rate maximum). The purpose of this review was to determine if patient age affects the likelihood of a diagnostic ESE.

Method: A retrospective analysis of ESEs performed at a tertiary referral centre between January 2016–June 2017 was undertaken. Results were retrieved from the McKesson Cardiology reporting system. Patient age, exercise duration and maximum heart rate were reviewed. Patients were divided into 4 groups based on age- <70 years, 70–74 years, 74–79 years and 80+ years.

Results: A total of 880 ESEs were reviewed. Patients aged <70 years ($n = 741$) mean exercise time was 8 minutes 11 seconds, 15% ($n = 112$) of tests did not achieve target heart rate. Patients aged 70–74 years ($n = 82$) mean exercise time was 6 minutes 30 seconds, 17% ($n = 14$) of tests did not achieve target heart rate. Patients aged <75–79 years ($n = 38$) mean exercise time was 5 minutes 19 seconds, 31% ($n = 12$) of tests did not achieve target heart rate. Patients aged >80 years ($n = 19$) mean exercise time was 3 minutes 46 seconds, 47% ($n = 9$) of tests did not achieve target heart rate.

Conclusion: As patient age increased the mean exercise time and likelihood of obtaining a diagnostic ESE decreased. There was a substantial difference in exercise time and percentage of diagnostic tests in patients aged 75–79 and 80+ years when compared to patients aged <65 years.

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Epicardial Adipose Tissue in Indigenous and Non-Indigenous Australians: Implications for Cardiometabolic Diseases

D. Sun[1], N. Kangaharan[2], B. Costello[3], S. Nicholls[4], C. Emdin[5], R. Tse[6], C. Gallagher[1], A. Kaur[2], K. Roberts-Thomson[1], P. Sanders[1], C. Wong[1,*]

[1] *Centre For Heart Rhythm Disorders, University of Adelaide and Royal Adelaide Hospital, Adelaide, Australia*
[2] *Departments of Cardiology, Royal Darwin and Alice Springs Hospital, Australia*
[3] *Baker Institute and Alfred Hospital, Australia*
[4] *MonashHEART, Australia*
[5] *Harvard Medical School, Boston, USA*
[6] *Auckland City Hospital, Auckland, New Zealand*

Background: Obesity is prevalent in Indigenous Australians whom exhibit significant differences in body composition and preferential central obesity. While excess regional adiposity can be partially inferred from clinical measurements, noninvasive imaging allows for direct quantification of specific fat depots. Epicardial fat has been strongly associated with cardiometabolic disease in other populations. However, this ectopic fat depot has yet to be characterised in Indigenous Australians.

Methods: We studied 100 individuals matched for ethnicity (Indigenous and Caucasian descent), age, gender, and body mass index. Epicardial fat volumes and subcutaneous adipose tissue was quantified with computed tomography. Associations of Indigenous ethnicity and adiposity measures were assessed using multivariate linear regression models.

Results: Indigenous Australians had significantly greater epicardial fat volumes compared to non-Indigenous Australians (95.8 ± 37.5 vs 54.1 ± 27.6 cm^3, $p < 0.001$). In contrast, subcutaneous adipose tissue volumes were comparable in Indigenous compared to non-Indigenous individuals (22.1 ± 15.1 vs 20.3 ± 13.5 cm^3, $p = 0.54$). In multivariable models, sequential adjustment for age, gender, clinical comorbidities, biochemical parameters, and medication use did not attenuate the association between Indigenous ethnicity and greater epicardial fat volume ($B = 43.0$, $p < 0.001$). Furthermore, this association did not materially change with the inclusion of various adipose measures, such as body mass index, subcutaneous adipose tissue, or weight.

Conclusions: Indigenous Australians have significantly greater epicardial adipose tissue compared to non-Indigenous Australians. This finding extends previous observations on body fat composition differences in these individuals, and supports the possibility that epicardial fat and other visceral adipose depots may be contributing to the greater burden of cardiovascular disease in Indigenous Australians.

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Evaluating the Revised 2010 Cardiac Magnetic Resonance Criteria for Arrhythmogenic Right Ventricular Cardiomyopathy

G. Femia *, C. Semsarian, M. McGuire, R. Sy, R. Puranik

University of Sydney, Sydney, Australia

Background: Making a clinical diagnosis of arrhythmogenic right ventricular cardiomyopathy (ARVC) is difficult and dependent on complex criteria. We previously showed that the revised cardiac magnetic resonance (CMR) criteria created a group of patients with isolated right ventricular (RV) dilation or dyskinesia that satisfied the original but not the revised criteria.

Methods: We re-assessed 55 patients with clinical suspicion of ARVC and either isolated RV dilation ($n = 23$) or RV dyskinesia ($n = 32$). Mean follow up time was 69 ± 25 months. Serial CMR was performed on 50 patients; 5 were excluded due to an implanted cardiac defibrillator (ICD).

Results: There was improvement in indexed RV end diastolic volume, indexed RV end systolic volume and

RVEF irrespective of body surface area; $-11.7\pm15.2\,\mathrm{mls/m^2}$, $-6.4\pm10.5\,\mathrm{mls/m^2}$ and $+3.3\pm7.9\%$ (p values = 0.004, 0.017 and 0.031). Of note in follow up, 29 (59%) patients had normalised RV parameters, 19 (39%) maintained the same degree of abnormality and 2 (4%) progressed to satisfy the major ARVC criteria. The negative predictive value of the revised CMR criteria is 96%. All five patients excluded with ICD recorded no shocks and clinically did not evolve into ARVC.

Conclusion: These data support the accuracy of the revised CMR criteria for ARVC and its potential use as a 'rule out' test owing to its high negative predictive value. Serial CMR imaging recommended for those with high-risk features but not diagnostic RV abnormalities for ARVC.

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Evolution of Clinical Quality Activities within a National Echocardiography Database: Seven-Year Trends from the GenesisCare Outcomes Registry

D. Eccleston [1,2,*], D. Cehic [2], D. Cross [2], L. Kearney [2], C. Morgan [2], G. Scalia [2], P. Disney [2], P. Srivastava [2]

[1] *University of Melbourne, Parkville, Australia*
[2] *GenesisCare, Sydney, Australia*

Introduction: Despite rapid technologic advances and growth, less attention has been focused on quality in imaging than in other areas of cardiovascular medicine. Therefore the ACC proposed additional areas of effort such as data standardisation, structured reporting identifying key data elements and imaging registries. We explored these changes within a large multi-centre Australian registry.

Methods: From 2010–2014 we introduced direct online entry of echocardiographic studies into an electronic database, selection and auditing of key data elements and quality improvement pathways to maximise completeness of data acquisition and reporting across 4 states. We compared data completeness (AV peak velocity, EF, E/E'', LA area, rhythm, RVSP) by time and state using de-identified data.
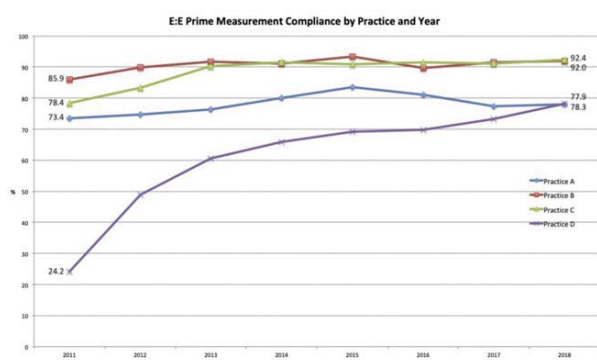
Results: 464,688 echocardiographic procedures were captured from 2011 to 2018. Data completeness improved significantly from 2011–2018 (72.0 ± 26.8 vs $88.2\pm13.5\%$ $p=0.02$). while Inter-practice variability fell for both EF and E/E' ($p<0.002$).

Conclusion Identification, systematic capture and auditing of key echo data elements can significantly improve the quality and reduce inter-practice variability of echo data. Developing a national database allows rapid adoption of local quality improvements.

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Feasibility and Accuracy of Assessing Left Ventricular Systolic Function by Measuring Mitral Annular Excursion using a Hand-Held Echocardiography Device with an Automated Atrioventricular-Plane Tracking Algorithm

K. Guppy-Coles, S. Prasad, A. Lo [*], K. Smith, T. Truloff, P. Beard, J. Armstrong, J. Atherton

Royal Brisbane and Women's Hospital, Brisbane, Australia

Background: Hand-carried ultrasound (HCU) and automated echocardiographic (echo) software may allow point-of-care, focussed assessment of left ventricular systolic function (LVSF). This could potentially allow for assessment and monitoring by non-specialised staff to reduce the global burden of heart failure.

Aim: Determine accuracy and feasibility of assessing LVSF via mitral annular excursion (MAE) using HCU with integrated first-in-man, automated atrio-ventricular (AV) plane tracking software (AutoMAE).

Methods: Forty-five consecutive patients in sinus rhythm undergoing clinical echo (including MAE via Motion-Mode 'M-MAE', and left ventricular ejection fraction (LVEF) measurements; Vivid E9), also had AutoMAE performed (AV plane App on Vscan Extend[TM]) within 24 hours. AutoMAE (mean from septal and lateral annular measures from an apical four chamber view) was compared to M-MAE using mean difference (absolute and relative) and Bland-Altman, as well as to LVEF using receiver operating characteristic (ROC; $\leq55\%$ LVEF). AutoMAE reproducibility was also assessed.

Results: The 45 patients (56% male) were 45 ± 14 yrs with LVEF $59\pm7\%$. AutoMAE had 91% feasibility. Intra ($n=39$) and inter-observer ($n=11$) comparisons: 0.9 ± 0.8 mm; 1.0 ± 1.0 mm absolute and $9\pm7\%$; $10\pm9\%$ relative mean differences respectively. AutoMAE was comparable to M-MAE, although with systematic underestimation: 3.0 ± 1.7 mm absolute and $25\pm14\%$ relative mean differences; Bland-Altman -2.6 (-7.0, $+1.8$) mm. AutoMAE ROC found an AUC of 0.77 at ≤14.1 mm (Sensitivity 80%; Specificity 68%).

Conclusion: MAE measurement using automated software is highly feasible. While there was consistent underestimation of AutoMAE compared with M-MAE, ROC analysis suggests this may allow reliable detection of a reduced LVEF. Further investigations are required into AutoMAE accuracy when used by non-specialised staff.

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Feasibility of Oxygen Sensitive Cardiac Magnetic Resonance in Demonstrating Right Ventricular Myocardial Ischaemia in Patients with Pulmonary Arterial Hypertension

K. Sree Raman [1,2,3,*], M. Stokes [4],
R. Shah [1,2,3], A. Walls [3], P. Steele [4],
C. Burdeniuk [2], C. De Pasquale [1,2],
D. Celermajer [5], J. Selvanayagam [1,2,3]

[1] *Flinders University, Adelaide, Australia*
[2] *Flinders Medical Centre, Adelaide, Australia*
[3] *South Australian Health and Medical Research Institute (SAHMRI), Adelaide, Australia*
[4] *Royal Adelaide Hospital, Adelaide, Australia*
[5] *University of Sydney and Royal Prince Alfred Hospital, Sydney, Australia*

Background: Progressive right ventricular (RV) dysfunction in pulmonary arterial hypertension (PAH) which is contributed by RV ischaemia leads to adverse clinical outcomes. Oxygen-sensitive (OS) cardiovascular magnetic resonance (CMR) has been used to determine the in-vivo myocardial oxygenation of the left ventricle (LV). The aim of the present study was to (1) Determine the feasibility of RV targeted rest/stress OS-CMR imaging in PAH patients and normal volunteers; (2) To define the presence and extent of RV myocardial ischaemia in patients with known PAH.

Methods: We prospectively recruited 20 patients with right heart catheter proven PAH and 9 normal healthy volunteers (NV). The CMR examination involved standard functional imaging and OS-CMR Imaging. An OS-CMR signal intensity (SI) index (stress/rest signal intensity) was acquired at RV anterior, RV free-wall and RV inferior segments.

Results: Reliable OS signal intensity changes were only obtained from the RV inferior segment. As RV dysfunction in PAH is a global process, this segment was used in both patients and NV for further comparison. RV OS SI change between rest and stress in the NV was $17 \pm 4\%$ (mean $\pm$ SD). 9/20 (45%) of the PAH patients had a mean OS-CMR signal intensity change of less than 9% (or 2SD different from the mean values in normal volunteers). Overall, RV OS SI index between the PAH patients and NV was $11 \pm 9\%$ vs $17 \pm 5\%$ (p-value = 0.04) in RV inferior segment.

Conclusion: Pharmacological induced OS-CMR is a feasible and safe technique to identify and study myocardial oxygenation in the RV of PAH patients.

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Gadolinium Free Cardiovascular Magnetic Resonance (CMR) Stress T1 mapping in patients with Chronic Kidney Disease (CKD)

R. Shah [1,2,3,*], K. Sree Raman [1,2,3], A. Walls [1],
R. Woodman [2], R. Faull [4,5], J. Gleadle [2,3],
J. Selvanayagam [1,2,3]

[1] *South Australian Health and Medical Research Institute, Adelaide, Australia*
[2] *Flinders University, Bedford Park, Australia*
[3] *Flinders Medical Centre, Bedford Park, Australia*
[4] *Royal Adelaide Hospital, Adelaide, Australia*
[5] *University of Adelaide, Adelaide, Australia*

Background: Cardiovascular disease is the most common cause of mortality in patients with chronic kidney disease (CKD).

Purpose: Investigate the diagnostic utility of Stress/Rest CMR T1 mapping in differentiating myocardial segments with ischaemia and infarction from remote and normal myocardium in CKD patients.

Methods: 20 CKD patients with Egfr <30 mL/min/1.73 m^2 or dialysis and left ventricular ejection fraction (LVEF) $<45\%$ (9 with CAD, 15 with Diabetes mellitus) and 7 healthy age-matched controls underwent scanning in a 3-T MR scanner.

Rest and Stress T1 maps were acquired using Shortened Modified Look-Locker Inversion recovery (ShMOLLI) in three short axis slice positions (basal, mid-ventricular and apical CMR analysis was performed with CMR^{42} versions 5.6.3 and 5.9.3. The T1 change (ΔT1) was calculated as:

$$\Delta T1 = (T1_{\text{Stress}} - T1_{\text{Rest}})/T1_{\text{Rest}} \times 100\%$$

Results: When compared to normal controls, patients with CKD had higher resting T1 values (1206 ± 66 msec vs 1151 ± 50 msec, $p \leq 0.001$) and impaired ΔT1 ($4.0 \pm 4.8\%$ vs $7.1 \pm 3.8\%$, $p \leq 0.001$). CKD patients with CAD had significantly lower ΔT1 when compared to CKD patients without CAD ($1.7 \pm 3.9\%$ vs $5.8 \pm 4.6\%$, $p \leq 0.001$). The resting T1 values for remote, ischaemic and infarcted myocardium were 1204 ± 62 msec, 1198 ± 66 msec, and 1281 ± 97 msec and ΔT1 values were $4.7 \pm 4.5\%$, $1.0 \pm 4.1\%$, and $-1.1 \pm 6.1\%$ respectively.

Conclusion: Stress T1 is impaired in the CKD population. Our results are hypothesis-generating and needs to be confirmed with larger studies.

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Global Longitudinal Strain in Exercise Stress Echo; are there Different Responses Based on Cardiac Risk?

A. Swan [1,*], T. Su Wai [2], G. Mugwagwa [1], E. Khan [1], G. Lau [1], M. Joseph [1,2]

[1] Flinders Medical Centre, Bedford Park, Australia
[2] Flinders University, Bedford Park, Australia

Background: Exercise stress echo is a widely used tool for evaluation of inducible myocardial ischaemia. Using Automated functional imaging (AFI) for assessment of global longitudinal strain (GLS) may improve its utility for detecting ischaemia based on a more quantitative assessment. However It is important to understand the different response to exercise in patients with different disease states such as hypertension and diabetes as this may impact on the accurate assessment of ischaemia.

Methods: We compared resting and peak stress GLS using AFI in patients with negative stress echoes. Patients were divided into groups based on their cardiac risk factors using the Thrombolysis in myocardial infarction (TIMI) score. Patients without risk factors such as diabetes or hypertension were classified as the low risk group.

Results: There were 34 patients with low cardiac risk (defined by a TIMI score of 0) compared to 60 patients with moderate to high cardiac risk including diabetes and hypertension (defined by a TIMI score of 1–7). There was no significant difference seen between the low risk group compared with the moderate to high risk group (t value: -0.28, $p = 0.8$). The mean GLS difference in low risk group was -2.19% (SD: 2.659) and in the moderate to high risk group it was -2.06% (SD: 1.894).

Conclusion: Patients with a negative stress echo have similar increase in GLS irrespective of their risk factors.

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Glycaemic Control does not Prevent Plaque Progression in Acute Coronary Syndrome Patients. An Analysis of the Carat Trial

S. Jones

Sahmri, Adelaide, Australia

Background: Atherosclerosis in diabetes is associated with accelerated coronary artery disease and poor glycaemic control is associated with progressive disease. It is unknown with current high intensity statin therapy, whether glycaemic control affects plaque progression.

Methods: The CARAT study evaluated the effect of CER-001, a negatively charged engineered pre-β HDL mimetic, on coronary atherosclerosis in patients with ACS events. Intravascular ultrasound (IVUS) was performed at baseline and day 78 follow up after 10 weekly infusions of CER-001. This sub-analysis assessed the impact on plaque progression, as assessed with percentage atheroma volume (PAV), of glycaemic control assessed by baseline HbA1c.

Results: There were 272 patients with evaluable serial IVUS. The median age was 60 years and 80% were male. There was a high prevalence of atherosclerotic risk factors including elevated BMI (median = 28.7), hypertension (66%), and diabetes (20%). After qualifying ACS event, 95% of patients were on statins with 65% on high intensity statins. Patients were divided into baseline HbA1c tertiles (medians 5.3% vs. 5.7%, vs. 6.5%.) When comparing these tertiles, there were no statistical differences between PAV at baseline (37.6% vs. 37.5% vs. 38.6%, $p = 0.47$) or percentage change in PAV over the study (-0.1% vs. -0.2% vs. -0.4%, $p = 0.57$). This remained consistent in patients who achieved plaque regression (-1.5% vs. -1.1% vs. -1.2%, $p = 0.34$) and non-regressors (1.3% vs. 1.1% vs. 0.9%, $p = 0.13$). The proportion of patients who achieved plaque regression was also not significantly different between baseline HbA1c tertiles (53.1% vs. 52.8% vs. 60.9%, $p = 0.47$).

Conclusion: Greater baseline HbA1c levels did not associate with greater plaque progression in this study. With the intensity of statin therapies in current use, higher baseline blood glucose levels do not prevent the ability to achieve plaque regression.

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Idiopathic Ventricular Arrhythmias in the Absence of Structural Heart Disease are Associated with Concealed Structural Abnormalities as Detected by Speckle Tracking Strain Echocardiography

S. Trivedi [1,2,*], S. Kumar [1,2], L. Thomas [1,2]

[1] Department of Cardiology, Westmead Hospital, Sydney, Australia
[2] Westmead Clinical School, The University of Sydney, Sydney, Australia

Background: Idiopathic ventricular arrhythmias (IVA) are thought to occur in patients without overt heart disease. Mechanical dispersion (MD) and delta contraction duration (DCD), both reflecting myocardial heterogeneity and subclinical fibrosis, have been shown to predict ventricular arrhythmias.

Hypothesis: We hypothesised that IVA patients may have abnormal MD and DCD indices indicating subclinical fibrosis.

Methods: 2D strain analysis was performed (in sinus rhythm, exclusion of ectopic beats) in 23 consecutive patients with IVA (no structural heart disease by cardiac magnetic resonance imaging (MRI); Group A) prior to electrophysiological mapping/ablation, and compared to 23 age/gender matched healthy controls (Group B).

Results: Baseline characteristics were similar for age and left ventricular [LV] ejection fraction (EF) ($p = 0.1$ for both) (Table 1). LV global longitudinal strain (GLS) was significantly lower ($p = 0.03$) and LV MD was significantly prolonged ($p = 0.002$) in the IVA group. DCD was also increased in patients compared to controls ($p = 0.04$). Despite an overlap, GLS $< -18\%$ and MD of >46 ms identified 14/23 (61%) of

Table 1.

	Age (years)	LVEF (%)	LV GLS (%)	LV MD (ms)	DCD (ms)
IVA (Group A)	44 ± 16	61 ± 5	$-19.9 \pm 3^*$	$44 \pm 12^*$	$120 \pm 47^*$
Controls (Group B)	40 ± 13	64 ± 7	-21.2 ± 2	33 ± 8.6	83 ± 29

$^* p < 0.05$.

IVA patients. Using a MD >42 ms, there was a specificity of 87% and a sensitivity of 52% in identifying IVA patients from controls; MD >46 ms had 100% specificity but low sensitivity (35%).

Conclusion: Despite demonstratable absence of electrical and structural abnormalities with state-of-the-art mapping and cardiac MRI, 2D strain can detect subtle changes in myocardial heterogeneity. This may indicate the presence of subclinical fibrosis and the need to follow these patients long-term. Further study is needed to examine if these changes are reversible with ablation.

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Immediate Reduction in Left Ventricular Wall Stress Post Transcatheter Aortic Valve Replacement

S. Papapostolou[*], S. Gutman, S. Duffy, A. Walton, D. Stub, A. Taylor

Alfred Health, Melbourne, Australia

Background: Patients with aortic stenosis (AS) may have other competing comorbidities to account for their symptoms. Left ventricular wall stress (LVWS) is increased in patients with severe AS and is likely to be an indicator of AS severity, however the immediate effects of transcatheter aortic valve replacement (TAVR) have not been documented. We assessed acute changes in LVWS post TAVR.

Methods: Six patients (median age 82 years (IQR 81.8–84)) undergoing TAVR for severe, symptomatic AS (median AV V max: 4.1 m/s (3.8–4.4), AVA 0.7 cm^2 (0.68–0.85)) underwent MRI within 24 hours prior to TAVR. CMR-derived volumes were integrated with invasive haemodynamic data obtained using conductance catheters, to construct pressure-volume (PV) loops immediately before and after valve implantation. Pressures obtained on PV-loops were used to derive regional end-systolic (ES) and end-diastolic (ED) LVWS pre- and post-intervention (for 7 contiguous SAX planes).

Results: TAVR was associated with a significant reduction in average ES-LVWS (7.8 to 5.7×10^3 N/m^2, $p = 0.046$). There was a non-significant trend to suggest a reduction in median LV-ESP (133 mmHg pre, 129 mmHg post, $p = 0.6$), LV-EDP (15 mmHg pre, 13 mmHg post, $p = 0.46$) as well as a trend to suggest a reduction in maximum regional ES-LVWS (9.8 to 9.2×10^3 N/m^2, $p = 0.5$) and minimum regional ES-LVWS (5.6 to 4.9×10^3 N/m^2, $p = 0.46$). In contrast there was no significant change in ED-LVWS following TAVR (average ED-LVWS 2.3 to 2.3, $p = 0.46$, maximum ED-LVWS $2.6–2.8 \times 10^3$ N/m^2, $p = 0.46$).

Conclusion: In patients with severe, symptomatic AS, TAVR is associated with an immediate reduction in end-systolic wall stress, however end-diastolic wall stress is unchanged.

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Impact of Ethnicity on the Correlation between Body Mass Index and Epicardial Adipose Tissue

M. Moharram[1,2,*], H. Aitken-Buck[2,3], I. Van Hout[2,3], R. Reijers[2,3], M. Williams[1,2], G. Whalley[1,2], P. Jones[2,3], R. Lamberts[2,3], S. Coffey[1,2]

[1] *Dunedin School of Medicine, University of Otago, Dunedin, New Zealand*
[2] *HeartOtago, Dunedin School of Medicine, University of Otago, Dunedin, New Zealand*
[3] *Department of Physiology, School of Biomedical Sciences, University of Otago, Dunedin, New Zealand*

Background: Epicardial adipose tissue (EAT) has previously been shown to correlate with visceral fat and cardio-metabolic risk. However, the correlation between BMI and visceral fat differs among various ethnic groups. We aimed to investigate the correlation between echocardiographic assessed EAT and BMI in different ethnic groups in New Zealand.

Methods and results: The study included 184 individuals undergoing open heart surgery – 145 New Zealand Europeans (NZE) (106 males) and 39 Māori/Pacific (31 males). EAT was measured using 2D echocardiography in the parasternal long axis view, adjacent to the right ventricular free wall.

The mean age of the study group was 66.7 ± 9.9 (standard deviation) years, 68.2 ± 9.2 for NZE and 60.8 ± 10.5 for Māori/Pacific. BMI was 29.6 ± 5.54 Kg/m^2 for NZE and 32 ± 6.3 for Māori/Pacific. EAT thickness was 6.4 ± 2.0 mm and 6.1 ± 1.7 mm for NZE and Māori/Pacific, respectively. Using univariate linear regression, BMI showed moderate correlation with EAT in NZE ($R^2 = 0.25$, $p < 0.001$); however, there was no significant correlation between BMI and EAT in Māori /Pacific patients ($R^2 = 0.05$, $p = 0.16$). Multivariate analysis adjusting for age and sex showed that BMI remained a significant predictor of EAT thickness in NZE ($\beta = 0.19$, 95% CI: 0.13, 0.24, $p < 0.001$).

Conclusions: BMI was associated with EAT thickness in NZE patients, but not in Māori/Pacific patients. The same level of BMI can carry different connotations of risk in different ethnic groups, with BMI likely being an inconsistent measure of obesity in in Māori/Pacific patients.

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Impact of Incidental Coronary Artery Calcification on CT Pulmonary Angiography

A. Walsh [1,*], J. Marangou [1,2], H. Tayeb [1,2], N. Kangaharan [1,2], M. Ilton [1,2]

[1] Royal Darwin Hospital, Darwin, Australia
[2] NT Cardiac, Darwin, Australia

Background: Ischaemic heart disease (IHD) is a leading cause of death in Australia. Coronary artery calcification (CAC) is a marker of underlying atherosclerosis. There is limited data on the outcomes of those with incidental CAC seen on non-gated computed tomographic (CT) studies such as CT pulmonary angiography (CTPA).

Aim: To determine the incidence and clinical significance of CAC detected on CTPA.

Methods: A retrospective review of all CTPAs completed from July 2016–July 2017 in Northern Territory hospitals was performed using hospital and imaging databases. Cases with incidental CAC were assessed for further cardiac investigation and clinical events within one year follow up.

Results: There were 1050 CTPA studies reviewed of which 50 (4.76%) had CAC identified. Cohort mean age was 61 years, 60% male and Aboriginal and Torres Strait Islanders comprised 30%. Of these, 23 (46%) patients had known IHD and 22 (44%) had IHD risk factors. Seven (14%) had further investigation (100% invasive coronary angiography), which were all positive. Of the 5 (10%) patients in which CAC was identified with no risk factors, none had further cardiac investigation. Three (6%) patients represented with ACS within one year, all of whom had known IHD or risk factors.

CAC is readily identified on CTPA in those with and without known IHD. Patients with existing risk factors or IHD appear more likely to have cardiac investigation than those without. Incidental CAC in asymptomatic patients without established risk factors requires further research to determine its clinical significance.

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Improving Risk Stratification in Patients with Diabetes Mellitus; an 18F-Sodium Fluoride Positron Emission Tomography Study

J. Bellinge [1,2,*], W. Macdoland [3], S. Gan [1,4], G. Chew [1,4], A. Vikcery [1,5], J. Lewis [1], G. Watts [1], R. Francis [1,3], C. Schultz [1,2]

[1] Medical School, University of Western Australia, Perth, Australia
[2] Department of Cardiology, Royal Perth Hospital, Perth, Australia
[3] Department of Nuclear Medicine, Sir Charles Gairdner Hospital, Perth, Australia
[4] Department of Diabetes and Endocrinology, Royal Perth Hospital, Perth, Australia
[5] Black Swans Health, Perth, Australia

Introduction: Patients with diabetes mellitus (DM) are at increased risk of coronary heart disease (CHD) events. Coronary calcium scoring (CCS) effectively risk stratifies patients with DM [1]. However, CCS only detects established and irreversible disease. 18F-Sodium Fluoride Positron Emission Tomography (18F-NaF PET) non-invasively identifies areas of microcalcification activity (MCA), prior to the development of CT visible calcifications [2]. We aimed to determine whether 18F-NaF PET could be used to detect MCA in coronary arteries in subjects without prior CHD, and assess the potential for MCA to improve risk stratification.

Methods: Participants aged 50–80 with DM and no prior CHD that participated in the VIKCOVAC trial in Perth, Western Australia (ACTRN12616000024448) underwent a baseline assessment, CCS and 18F-NaF PET scan. Ten participants with CCS = 0 determined the normal ranges of coronary MCA. Lesions above this range were positive and regions of radiotracer overspill were excluded. The Chi-square and Mann-Whitney-U tests are used as appropriate.

Results: One-hundred and sixty-one participants were included. Eighty-four participants had at least one lesion positive for MCA. Compared to participants with no positive lesions, participants with one or more positive lesion were more likely to be male (77% vs 49%, $p < 0.01$), taking statin therapy (79% vs 64%, $p < 0.05$), taking insulin therapy (33% vs 16%, $p < 0.01$) and have a higher median [25th–75th percentile] CCS (338 [155–757] vs 58 [21–154], $p < 0.001$).

Conclusion: Coronary microcalcification activity is detectable using 18F-NaF PET, is associated with other CHD risk factors and may provide improved prognostication for CHD in patients with DM.

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Improving Understanding of the Bone-Vascular Axis with the Use of 18F-Sodium Fluoride Positron Emission Tomography

J. Bellinge [1,2,*], W. Macdonald [3], S. Gan [1,4], G. Chew [1,4], A. Vickery [1,5], J. Lewis [1], G. Watts [1], R. Francis [1,3], C. Schultz [1,2]

[1] Medical School, University of Western Australia, Perth, Australia
[2] Department of Cardiology, Royal Perth Hopsital, Perth, Australia
[3] Department of Nuclear Medicine, Sir Charles Gairdner Hospital, Perth, Australia
[4] Department of Diabetes and Endocrinology, Royal Perth Hospital, Perth, Australia
[5] Black Swans Health, Perth, Australia

Introduction: Vascular calcifications are a complex and poorly understood entity that, when quantified, retain strong prognostic capabilities. A frequent observation is the inverse relationship between bone mineral density and coronary calcifications. A disruption in the bone-vascular axis may be more pertinent in people with diabetes [1]. It is not known whether bone calcification activity, as measured using 18F-Sodium Fluoride Positron Emission Tomography (18F-NaF PET), is associated with coronary or aortic calcification activity.

Methods: Participants aged 50–80 with diabetes mellitus and no prior coronary heart disease, that participated in the VIKCOVAC trial in Perth, Western Australia (ACTRN12616000024448) underwent a baseline clinical assessment, coronary calcium score and 18F-NaF PET scan. Vertebral, coronary and aortic 18F-NaF PET scans were analysed in methods similar to previously described [2]. Pearson's and Spearman's correlations were used as appropriate.

Results: One-hundred and sixty-one participants were recruited and formed part of this analysis. The mean ($\pm$SD) age was 65.1 ± 7.1 and the majority (64%) of participants were male. Vertebral calcification activity (SUVmean) was inversely correlated with age (-0.21, $p < 0.01$) and duration of diabetes mellitus (-0.27, $p < 0.01$). Vertebral calcification activity was not significantly associated with coronary or aortic calcification activity (-0.10, $p > 0.05$ and -0.13, $p > 0.05$ respectively) but was negatively correlated with established coronary calcifications as marked by the coronary calcium score (-0.23, $p < 0.01$).

Conclusion: Vertebral calcification activity as determined by 18F-NaF PET is negatively associated with established coronary calcifications in patients with diabetes mellitus.

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Increased Mortality of High versus Normal Ejection Fraction – Insights from Big Echo Data

A. Haghi [*], G. Strange, M. Bulsara, D. Playford

The University of Notre Dame, Perth, Australia

Mortality with impaired left ventricular ejection fraction (LVEF) has been demonstrated. However, the prevalence and significance of increased LVEF in the community is unclear. We used the National Echo Database Australia (NEDA) to compare mortality in patients with normal and high LVEF.

Methods: 331,344 individuals aged >18 years (52% men, age = 60.8 ± 18.0 years) had a mean follow up of 5.4 person-years and 63,142 fatal events. LVEF using Method of Discs could be calculated in 116,544 individuals. We compared mortality in those with normal LVEF compared with high LVEF for males and females.

Results: Mortality was 11% higher in females with high LVEF vs normal LVEF. On multivariable logistic regression, high ejection fraction remained an independent predictor of mortality after correction for age, gender and body mass index. High LVEF was associated with female gender, age and diastolic dysfunction. Of 96,033 individuals in the study population, 44,282 males had normal LVEF (52–72%) as opposed to 2,594 with high LVEF (>72%). In females, 46,186 had normal LVEF (54–74%) and 2,971 had high LVEF. In Cox proportional hazard models, the hazard ratio (HR) for mortality in males with normal EF was 1.105 for age (95% CI 1.102 to 1.07) and 1.074 (95% CI 0.988 to 1.167) for high LVEF ($p < 0.001$ for all outputs). In females, the corresponding adjusted HR was 1.107 for age (95% CI 1.105 to 1.110) and 1.140 for high LVEF (95% CI 1.057 to 1.230).

Conclusion: High LVEF, particularly in older women, is associated with increased mortality compared with normal LVEF.

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Incremental Benefit of Left Ventricular Global Longitudinal Strain over Clinical and Left Atrial Parameters for Predicting New-Onset Atrial Fibrillation

H. Kawakami [1,*], S. Ramkumar [1], F. Pathan [2], L. Wright [1], T. Marwick [1]

[1] Baker Heart and Diabetes Institute, Melbourne, Australia
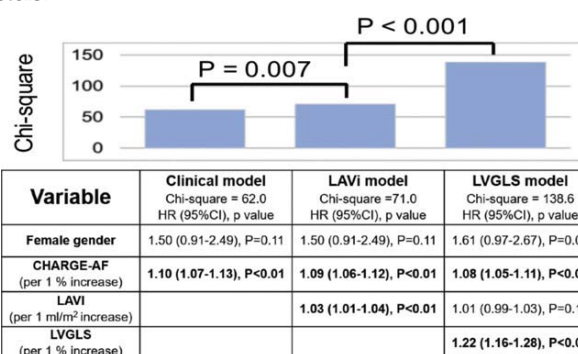[2] Menzies Institute for Medical Research, Hobart, Australia

Background: Although LV dysfunction is associated with atrial fibrillation (AF), AF often occurs in the absence of reduced LVEF. The effect of subclinical LV dysfunction on AF has not been fully studied. We sought the association between subclinical LV dysfunction (measured with global longitudinal strain, GLS) and new-onset AF.

Methods: We evaluated 531 consecutive pts without a history of AF who underwent strain echo after cryptogenic stroke. Standard echo parameters were measured, and speckle-tracking was used to measure LA and LV strain. Baseline clinical and echo parameters of the pts who developed AF and those who did not were compared.

Results: Over 2.5 years of follow-up, 61 pts (11%) had AF. Pts who developed AF were older, larger LA volume, worse LA strain, and worse GLS than those who did not. Area under the receiver-operating curve for GLS (0.84) was comparable to LA pump strain (0.83) and LA reservoir strain (0.85). In the nested Cox models, GLS demonstrated an independent and incremental predictive value over the clinical and LA parameters. Moreover, adding GLS to the combined clinical and LA parameters model resulted in a significantly improved reclassification (net reclassification improvement, 0.32; $p = 0.016$). Importantly, the predictive value of GLS was confirmed in pts with abnormal LA volumes (LA volume index $\geq 34\,\mathrm{ml/m^2}$) but not in pts with normal LA volumes.

Conclusion: GLS is associated with new-onset AF, especially in pts with abnormal LA volumes. This effect is independent of and incremental to the clinical and LA parameters.

Variable	Clinical model Chi-square = 62.0 HR (95%CI), p value	LAVi model Chi-square =71.0 HR (95%CI), p value	LVGLS model Chi-square = 138.6 HR (95%CI), p value
Female gender	1.50 (0.91-2.49), P=0.11	1.50 (0.91-2.49), P=0.11	1.61 (0.97-2.67), P=0.07
CHARGE-AF (per 1 % increase)	1.10 (1.07-1.13), P<0.01	1.09 (1.06-1.12), P<0.01	1.08 (1.05-1.11), P<0.01
LAVI (per 1 ml/m² increase)		1.03 (1.01-1.04), P<0.01	1.01 (0.99-1.03), P=0.15
LVGLS (per 1 % increase)			1.22 (1.16-1.28), P<0.01

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Indexation in Scaling Left Atrial Size, are we Normalising Pathology in an Increasingly Obese Population?

P. Jeyaprakash [1,2,3,*], A. Moussad [1,2,3], S. Sivapathan [1,2,3], K. Ellenberger [1,2,3], F. Pathan [1,2,3,4]

[1] Nepean Hospital Cardiology Department, West Pennant Hills, Australia
[2] University of Sydney, Sydney, Australia
[3] Nepean Clinical School, Kingswood, Australia
[4] Charles Perkins Centre, Camperdown, Australia

Introduction: Left atrial size is an integral diagnostic and prognostic marker in echocardiography. Over the last 40 years, echocardiographic guidelines for left atrial assessment have progressed from linear measurements to the three-dimensional volume, to reflect our understanding of atrial mechanics. However indexation of left atrial size to body surface area (BSA) has remained constant, despite data from paediatric and left ventricular mass studies highlighting the limitations of BSA as an isometric index. Our aim was to determine whether an alternate indexation method may more accurately scale for left atrial size, particularly in an increasingly obese population where isometric measures may overcorrect pathology.

Methods and Results: We used the PRISMA guidelines to perform a structured search of both Pubmed and Scopus databases, to identify scientific articles which discussed alternative methods of left atrial indexation. We found 3133 articles from the database search after removing duplicates. After abstract screening, 23 relevant papers were identified. Four key cohort studies where allometric indicies were used, showed that allometric indexation of left atrial volumes to height appeared to scale better than BSA. Allometric measures also reduced the risk of over correction to body size in obesity.

Conclusion: We found that non-linear allometric indexation does improve scaling of left atrial volumes, and that height raised to an allometric exponent best corrects for body size in the obese population. However no large scale outcome data are available, and more research is required to determine which allometric measures and exponents best correct for left atrial size.

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Insight into Differing Exercise Stroke Volume Mechanics between Endurance Athletes and Non-Athletes

F. Sully [1], D. Flannery [1,2], K. Janssens [1,*], L. Wright [1], A. La Gerche [1,3]

[1] Baker Heart & Diabetes Institute, Melbourne, Australia
[2] Department of Medicine Royal Melbourne Hospital, University of Melbourne, Parkville, Australia
[3] St Vincent's Hospital, Fitzroy, Australia

Background: In healthy subjects, stroke volume (SV) and heart rate (HR) combine to augment cardiac output. The degree to which SV can augment, compensating for abnormally low HR during exercise is unknown.

Aim: To investigate differences in SV augmentation between endurance athletes (EA) and non-athletes (C) during exercise under pharmacological rate retardation.

Methods: 25 participants (76% male) were divided into groups; EA ($n = 9$) bradycardic endurance athletes (BEA) ($n = 6$, resting HR <40 bpm), C ($n = 9$). All underwent cardiopulmonary exercise testing (CPET), determining maximal oxygen uptake (VO$_2$max) and associated workload (W). Exercise echocardiogram followed, with images acquired at 3 incremental stages, final stage set equivalent to upright VO$_2$max workload. On a second visit, tests were repeated following intravenous dual autonomic blockade (DAB) (0.04 mg/kg atropine, 0.2 mg/kg metoprolol). Left ventricle (LV) volumes (mL) calculated during rest and exercise using 2D bi-plane methods.

Results: EA and BEA had higher LVSV compared to C at rest (80 ± 21 and 101 ± 19 vs 60 ± 12; $p < 0.05$) and peak exer-

cise (94 ± 24 and 113 ± 30 vs 66 ± 16; $p < 0.05$). Exercise LVSV was not significantly affected by DAB in EA and BEA, however was reduced in C with DAB (66 ± 16 vs 57 ± 15; $p < 0.05$). Differences in SV were due to significantly lower exercise ESV in EA and BEA with DAB, C not significantly altered (interaction $p = 0.004$). No significant change in EDV with exercise or DAB across any groups (interaction $p = 0.997$).

Conclusions: Athletes can better maintain SV during exercise under the challenge of DAB, predominantly via greater reductions in ESV. DAB seems an effective challenge to elucidate enhanced cardiac physiology.

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Integration of Contemporary CT Coronary Angiography in Care of Patients Suspected to have Takotsubo Cardiomyopathy

U. Jhaveri[1,*], C. Jeffries[1], S. Ranjan[1,2], J. Latona[1], B. Jesuthasan[1], P. Challa[1], A. Dahiya[1,2]

[1] *Logan Hospital - Queensland Health, Meadowbrook, Australia*
[2] *Griffith University, Gold Coast, Australia*

Background: Takotsubo cardiomyopathy (TTC) is characterised by the presence of transient left ventricular wall dysfunction without significant culprit obstructive coronary artery disease (CAD). Invasive coronary angiography (CAG) is considered 'gold standard' for diagnosis. There is general concern that high heart rate and hyperdynamic left ventricle base may reduce success of non-invasive CT coronary angiography (CTCA). Contemporary CT scanners and imaging techniques may overcome these limitations. Therefore potential role for contemporary CTCA as an alternative to invasive CAG in ruling out high-grade stenosis in stable patients with suspected TTC remains unknown.

Aim: We sought to assess the ability of contemporary CTCA using Philips iCT 256 slice scanner using Iterative Model Reconstruction (IMR) in ruling out high-grade stenosis in stable patients suspected to have TTC on echocardiography.

Methods: We included 11 consecutive patients suspected to have TTC on Echocardiography (2:9 M:F, mean age 61 ± 9 years, BSA $1.86 \pm 0.22 \, cm^2$, EF $36 \pm 12\%$) in this study. We evaluated the ability of low-radiation contemporary CTCA with IMR to rule out obstructive CAD in these patients.

Results: Patients were scanned with an average heart rate of 63 ± 9 bpm (all in sinus rhythm). Average radiation dose was low (dose length 130.38 ± 52 mG*cm). Significant coronary artery disease was ruled out in 9 of 11 patients, confirming TTC. 2 patients required invasive CAG for further evaluation.

Conclusion: Contemporary CTCA using iterative model reconstruction ruled out high-grade coronary stenosis in high proportion of patients, supporting integration of non-invasive CTCA in the care of patients with suspected TTC.

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Is Spontaneous Coronary Artery Dissection (SCAD) Related to Vascular Inflammation and Epicardial Fat? Insights from Novel Markers of Computed Tomography Coronary Angiography

J. Yuvaraj[1,*], A. Lin[1], H. Rashid[1], N. Nerlekar[1], J. Cameron[1], S. Seneviratne[1], S. Nicholls[1], P. Psaltis[2,3], D. Wong[1]

[1] *MonashHeart, Melbourne, Australia*
[2] *University of Adelaide, Adelaide, Australia*
[3] *Royal Adelaide Hospital, Adelaide, Australia*

Background: Spontaneous coronary artery dissection (SCAD) is increasingly recognised as a cause of myocardial infarction particularly in young women. Vascular inflammation and epicardial fat volume (EFV) are associated with atherosclerotic disease but their relationship with SCAD remains unclear. Pericoronary adipose tissue (PCAT) attenuation is a novel computed tomography coronary angiography (CTCA) marker of vascular inflammation. We seek to evaluate the relationship between PCAT attenuation, EFV and epicardial fat density (EFD) with SCAD.

Methods: Asymptomatic patients (control group) and patients with SCAD who had undergone 320-detector CTCA within 2 weeks of acute presentation were studied. Using semi-automated software (AutoPlaque version 2.0), PCAT attenuation was quantified around the proximal 10–50 mm of the right coronary artery by including all voxels between -190 and -30 HU within the predefined volume of interest. PCAT attenuation was defined as the mean CT attenuation within this volume. EFV and EFD were assessed by QFAT software.

Results: 11 SCAD and 27 control patients (age 50 vs. 53 years, $p = 0.67$) were studied. There was no difference in cardiovascular risk factors such as diabetes mellitus ($p = 0.13$), dyslipidaemia ($p = 0.15$), hypertension ($p = 0.46$), smoking status ($p = 1.0$) and family history of IHD ($p = 0.46$) between the 2 groups. Median PCAT attenuation (-91.8 vs. -88.4 HU, $p = 0.1$), EFV (60.5 vs. 54.5 mL, $p = 0.5$) and EFD (-85.7 vs. -83.0 HU, $p = 0.35$) were not significantly different between SCAD and control patients.

Conclusion: Vascular inflammation may not be implicated as a pathophysiology of SCAD but our findings need confirmation in larger prospective studies.

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Is the Improvement in Mitral Regurgitation Post TAVR an Acute Phenomenon?

S. Shivakumar [1,*], M. Joseph [1], A. Swan [1], D. Chew [1], D. Jones [1,2], T. Hecker [1], A. Sinhal [1]

[1] Flinders Medical Centre, Bedford Park, Australia
[2] Royal Adelaide Hospital, Adelaide, Australia

Background: Mitral regurgitation (MR) is common in patients worked up for TAVR. Unfortunately, its presence portends poorer clinical outcomes and the question arises if these patients are best served by surgery to address both pathologies. Previous studies have shown MR improvement when assessed several months post TAVR. This study is unique as its objective was to assess changes in MR and possible mechanisms within the first 48 hours, with a view to develop a predictive model to determine which patients would improve.

Methods: This study consisted of 132 patients with aortic stenosis who underwent TAVR, with echocardiographic assessment prior and post TAVR. The echocardiographic parameters related to MR severity including mitral valve geometry, left ventricular size and function were assessed for significant correlation with MR improvement.

Results: 88 of the 132 patients had more than mild MR. In this cohort 52 patients (60%) had an improvement in MR of at least 1 grade immediately post TAVI. Subgroup analysis showed no significant change in mitral valve geometry after TAVI [tenting height (0.76 ± 0.20 vs 0.74 ± 0.17, $p = 0.78$) tenting area (2.14 ± 0.63 vs 2.00 ± 0.69, $p = 0.26$, coaptation depth (0.47 ± 0.12 vs 0.55 ± 0.18, $p = 0.07$]. Left ventricular volumes (44.19 ± 19.56 vs 45.6 ± 22.35, $p = 0.94$)] and LVEF (55.23 ± 9.93 vs 54 ± 9.98, $p = 0.60$) did not change significantly after TAVR.

Conclusions: A significant proportion of patients have a decrease in MR immediately (within 48 hours) post TAVR. This improvement relates to a reduction in afterload and hence the driving intraventricular pressure rather than immediate changes in LV dynamics or mitral valve geometry.

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Left Atrial Strain as a Marker of Diastolic Function in Post ST Elevation Myocardial Infarction

T. Vo [1,2,*], T. Nguyen [1,2,3], A. Chen [1,2], J. French [1,2], J. Otton [1,2], C. Mussap [1,2], D. Richards [4], H. Dimitri [1,2,3], L. Thomas [1,2,3,4]

[1] Liverpool Hospital - Cardiology Department, Liverpool, Australia
[2] The University of New South Wales - South Western Sydney Clinical School, Liverpool, Australia
[3] Ingham Institute for Applied Medical Research, Liverpool, Australia
[4] University of Sydney - Westmead Clinical School, Westmead, Australia

Background: Left atrial (LA) function is modulated by diastolic dysfunction. Adverse diastolic remodelling (ADR) is a stronger predictor of cardiovascular outcomes than single-point diastolic grading. Current diastolic grading guidelines include LA volume (LAV) analysis; more recently, LA strain has demonstrated association with diastolic dysfunction, with alterations prior to LAV enlargement. We compared LAV and LA strain with diastolic function in patients presenting with their first ST-elevation myocardial infarction (STEMI).

Methods: 157 percutaneously revascularised STEMI patients (85% male, 56.8 ± 10.7 years) underwent serial echocardiography at baseline (2–7 days) and follow-up (8–10 weeks) post-STEMI. Biplane LAV was measured and indexed to BSA. LA strain was analysed from apical 2-, 3- and 4-chamber views. Diastolic function was graded as per 2016 guidelines (grades 1–3); ADR at follow-up was defined as worsening of diastolic function grade (≥ 1) from baseline or persistent grade 3 dysfunction.

Results: Baseline LA strain had stronger correlations with both baseline and follow-up diastolic function, compared to LAV (baseline diastolic function: LAV $r = 0.378$, LA strain $r = -0.515$; follow-up diastolic function: LAV $r = 0.288$, LA strain $r = -0.495$; $p < 0.0001$ for all). Smaller or negative change in LA strain from baseline to follow-up was associated with ADR whereas changes in LAV showed no difference (ROC: AUC = 0.735, $p < 0.0001$ vs AUC = 0.605, $p = 0.103$) An increase in LA strain of $\leq 1.9\%$ predicted ADR with 71% sensitivity and 71% specificity.

Conclusion: LA strain is better associated with diastolic function and adverse diastolic remodelling than LAV, and its incorporation into the diastolic grading algorithm should be considered.

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Longitudinal Results of Cardiac MRI Left Ventricular Mapping Following Tangential Left Breast Radiotherapy

S. Tang [1,2,3], J. Otton [4,*], E. Koh [1,2,3,6], R. Rai [1,2,3], G. Delaney [1,2,3,6], D. Tran [4], L. Thomas [5,7], L. Holloway [1,2,3], G. Liney [1,2,3]

[1] *Ingham Institute for Applied Medical Research, Liverpool, Australia*
[2] *Liverpool Cancer Therapy Centre, Liverpool, Australia*
[3] *University of New South Wales, Kensington, Australia*
[4] *Department of Cardiology, Liverpool Hospital, Liverpool, Australia*
[5] *Department of Cardiology, Westmead Hospital, Westmead, Australia*
[6] *South Western Sydney Clinical School, Liverpool, Australia*
[7] *University of Sydney, Sydney, Australia*

Background: Acute and subacute changes of inflammation, reduced capillary density and early myocardial fibrosis have been reported following radiotherapy (RT). We sought to detect these changes by serial cardiac MRI using mapping techniques.

Methods: Using a clinically modified Look Locker Inversion Recovery (MOLLI) sequence at 3T, T1, T2 and ECV maps were generated prior to RT, at 6 weeks and 12 months following completion of breast radiotherapy in left sided breast cancer patients. No patients received chemotherapy. Map values were generated in cvi42.

Results: Average mean heart dose was 2.6 Gy. Average mean dose to basal, mid and apical regions was 1.7 Gy, 3.9 Gy, and 16.3 Gy. Regionally, a significant increase in T2 relaxation was seen in the mid region at 12 months post RT (43.5 vs 42.1 ms $p = 0.02$). Segmentally, 6 weeks post RT, segment 12 (43.5 vs 42.1 ms $p = 0.02$) displayed a significant reduction in T2 relaxation, and segments 5 (28.3 vs 27.2% $p = 0.2$), 9 (29.1 vs 27.6% $p = 0.01$) and 10 (28.7 vs 27.1% $p = 0.01$) had significant reductions in in ECV values. At 12 months, segment 11 demonstrated an increase in T1(1192.4 vs 1218.0 ms $p = 0.03$) and T2 values (41.7 vs 44.1 ms $p < 0.01$), and segment 10 (42.0 vs 43.7 ms $p = 0.03$) demonstrated an increase in T2 values.

Conclusion: Preliminary results from this small study demonstrated an increase in T2 signal in the mid region 6 weeks post RT, and discrete changes involving the basal inferolateral, mid inferoseptal, inferior and inferolateral segments. Further studies are required to verify this pattern of change and their relationship to future cardiac events.

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Low-Flow, Low-Gradient Aortic Stenosis: An Increasing Phenomenon or Simply Wider Recognition?

J. Sen [1,2,3,*], C. Neil [1,2,3], T. Marwick [1,2,3]

[1] *Western Health, St Albans, Australia*
[2] *University of Melbourne, Melbourne, Australia*
[3] *Baker Heart and Diabetes Institute, Melbourne, Australia*

Background: Aortic stenosis (AS) is the most common primary heart valve disease in the elderly. Low-flow, low-gradient (LF-LG) AS is an increasingly important phenotype but it is unclear whether this represents wider recognition of an existing phenotype or a new disease of increasing incidence.

Methods: We analysed 37,240 consecutive transthoracic echocardiograms (Jan 2013–March 2019 at a single institution. LF-LG AS was defined as mean transvalvular pressure gradient (MPG) <40 mmHg and stroke volume index (SVi) <35 mL/m^2, aortic valve area (AVA) <1 cm^2 or indexed AVA <0.6 cm^2/m^2, with either normal (paradoxical LF-LG) or decreased (<40%; classical LF-LG) left ventricular ejection fraction. The proportion of LFLG pts with E/e' >12 were sought each year.

Results: Of 1860 cases that fulfilled AS criteria, there were 445 cases of LF-LG AS (118 classical and 327 paradoxical LF-LG AS), and the incidence appears to be rising per year. There was a statistically significant difference in incidence of paradoxical LF-LG AS between each year ($p < 0.0001$), but not for classical LF-LG AS ($p > 0.05$). The proportion of cases with severe AS appears to be declining in recent years ($p = 0.026$).

	2013	2014	2015	2016	2017	2018	2019	p (trend)
AS (% TTE)	201 (7%)	531 (8%)	571 (9%)	154 (2%)	186 (3%)	190 (3%)	27 (2%)	p=0.15
Age		66	72	77	79	79	76	p>0.05
AS w. E/e' >12		13%	55%	70%	73%	61%	84%	P<0.001
LFLG (% AS)	7 (3%)	8 (2%)	38 (7%)	21 (14%)	23 (12%)	18 (10%)	3 (11%)	p>0.05
PLFLG (%AS)			97 (17%)	40 (26%)	58 (31%)	69 (36%)	13 (48%)	p<0.001

Conclusion: This is the first study to describe the increasing incidence of paradoxical LF-LG AS in an hospital echocardiogram service. It appears to parallel increasing LV filling pressure in AS patients. There is a need to better understand the driving force of this trend and potential corresponding effective treatments.

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Molecular Calcium Score from 18F-Sodium Fluoride Positron Emission Tomography to Improve Risk Stratification in Patients with Acute Coronary Syndrome

J. Bellinge [1,2,*], K. Majeed [1,2], D. Chieng [2], R. Alcock [2], J. Spiro [1,2], G. Hillis [1,2], T. Mori [1], R. Francis [1,3], C. Schultz [1,2]

[1] *School of Medicine, University of Western Australia, Perth, Australia*
[2] *Department of Cardiology, Royal Perth Hospital, Perth, Australia*
[3] *Department of Nuclear Medicine, Sir Charles Gairdner Hospital, Perth, Australia*

Introduction: Patients with acute coronary syndrome are at increased risk of recurrent CVD events. 18F-Sodium Fluoride Positron Emission Tomography (18F-NaF PET) accurately and non-invasively identifies culprit lesions and high risk coronary microcalcification activity [1]. Whether a single highest measure of coronary microcalcification activity or a global average of coronary microcalcification activity is most associated with clinical risk is unknown [2].

Methods: Participants with an acute coronary syndrome were admitted to Royal Perth Hospital, Perth, Australia, and underwent coronary angiography, CT coronary angiogram (CTCA) and 18F-NaF PET imaging as part of the MOTI-VATOR study (ACTRN12615001234505). The SYNTAX and GRACE scores were calculated. 18F-NaF PET scans were co-registered with CTCA scans and coronary microcalcification activity was analysed to result a single highest measure of microcalcification activity and the molecular calcium score (mean activity from all coronary segments).

Results: Sixty-two participants were recruited. The mean $\pm$ SD age of the cohort was 61.2 ± 9.2 and the majority of the cohort was male (85.5%). The mean GRACE score was 122.0 ± 25.8 and the median [25th–75th] SYNTAX score was 10.5 [5.75–19.00]. The GRACE and SYNTAX scores were not correlated (Spearman's Rho $= 0.21, p > 0.05$). A single reading of coronary microcalcification activity was not correlated with the SYNTAX score ($0.20, p > 0.05$), but the molecular calcium score was ($0.28, p < 0.05$). No measures correlated with the GRACE score.

Conclusion: A coronary molecular-calcium-score, derived from 18F-NaF PET is associated with the SYNTAX score and prospective studies are needed to determine the value of microcalcification activity to predict recurrent events in patients with acute coronary syndrome.

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Multi Reader Assessment of Accuracy and Interobserver Variability in Aortic Stenosis by Echocardiography

K. Haji [1,*], C. Wong [1], C. Neil [1], M. Gupta [1], T. Marwick [2]

[1] *Western Health, Melbourne, Australia*
[2] *Baker Heart and Diabetes Institute, Melbourne, Australia*

Background: Guidelines recommend a multiparametric echocardiographic measurements when assessing aortic stenosis (AS). However, the absence of a hierarchical weighting of discordant parameters could cause interobserver variability. We sought to define and the accuracy interobserver variability of AS assessment.

Method: Participants were presented with a set of 12 echocardiographic cases to grade AS type and severity, the cases were de-identified images. The cases comprised uncomplicated AS, paradoxical low-flow low-gradient (LFLG), LFLG with low ejection fraction (EF), hyperdynamic circulation/or high-pressure recovery and patient-prosthesis mismatch; all the cases with varying degree of severity. Types and gradings were compared with that of three expert readers, whose interpretations were used as the reference standard for the purposes of this study.

Results: A group of 35 participants (36% cardiac sonographers, 26% cardiologist, 27% cardiology trainees and the rest were non-cardiologist physicians) answered the 12 questions. The median echocardiography experience of the group was 6 years. 64% of the readers were from Australia and the rest were from Asia, north America and Europe. The overall baseline accuracy was only 56%. There was also suboptimal concordance among the readers, with an average kappa of 0.36 (0.23,0.44).

Conclusion: The result seems to be that discordances between observers are frequent, and new means of delivering effective QC exercises warrant attention. Possible explanation for low accuracy and high discordances is the increasing complexity of AS and the need to integrate a number of variables.

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Multivendor Analysis of Left Atrial Strain using Multilayer Analysis

A. Ferkh[1,2,*], S. Trivedi[1,2], L. Stefani[2],
P. Brown[1], F. Pathan[2,3], L. Thomas[1,2]

[1] *Westmead Hospital, Westmead, Australia*
[2] *University of Sydney, Camperdown, Australia*
[3] *Nepean Hospital, Nepean, Australia*

Background: Left atrial strain (LAS) is increasingly being recognised as a measure of left atrial function. Different vendors have proposed different methods of measuring LAS in echocardiography.

Aims: To determine if there is a difference between multilayer endocardial and mid-myocardial measurements of LA strain on General Electric (GE) Echopac compared to TOMTEC endocardial strain.

Methods: Peak reservoir left atrial strain (LAS) was measured on 20 healthy controls using two different software packages. GE Echopac (v201) 2D-speckle tracking echocardiography technique (LV package) was used to measure conventional mid-myocardial (GE-mid) and endocardial (GE-endo) LAS. This was compared to LAS measurement using TOMTEC (v4.6) which uses an endocardial tracking technique. LAS was measured in 4ch and 2ch views and average biplane strain measurement was obtained.

Results: The mean of GE-mid LAS was $39 \pm 5.8\%$, GE-endo LAS was $48.0 \pm 7.8\%$, and TOMTEC LAS was $44.9 \pm 6\%$. GE-mid and GE-endo LAS correlated well with TOMTEC LAS ($r = 0.9$, $p < 0.001$ for both). On Bland-Altman Analysis, GE-mid LAS measurements were systematically lower than TOMTEC LAS (mean difference -5.76), whereas GE-endo LAS had no systematic bias (mean difference 3.07).

Conclusions: Mid-myocardial peak reservoir left atrial strain, which is routinely measured using GE Echopac software, systematically underestimates LAS as compared to TOMTEC LAS or GE endocardial LAS. These systems cannot be used interchangeably for serial follow up of patients.

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Myocardial Oxygenation in Hibernating Myocardium: Insights from Oxygen-Sensitive (OS) Cardiac Magnetic Resonance Imaging (CMR)

K. Sree Raman[1,2,3,*], S. Grover[2],
R. Woodman[1], R. Ananthakrishna[2],
A. Sinhal[1,2], C. Bradbrook[2],
J. Selvanayagam[1,2,3]

[1] *Flinders University, Adelaide, Australia*
[2] *Flinders Medical Centre, Adelaide, Australia*
[3] *South Australian Health and Medical Research Institute (SAHMRI), Adelaide, Australia*

Background: The underlying pathophysiological mechanisms of hibernating myocardium are controversial. Specifically, whether down-regulation of myocardial oxygenation occurs in response to chronic ischaemia in dysfunctional but viable myocardium is unclear. The aim of the present study is to examine the pathophysiological relationship between coronary stenosis, regional wall motion abnormalities (RWM) and myocardial oxygenation in hibernating myocardium.

Method: OS-CMR images was acquired at rest and stress after 5 minutes of administration of adenosine (140 µg/kg/min) and assessed quantitatively (using a OS signal intensity (SI) index [stress/resting signal intensity] in 18 patients pre and (>6 months) post revascularisation. Significant stenosis was classed as >50% by QCA. All segments were matched for RWM and OS-CMR SI.

Results: Of the segments evaluated, 18% did not have a significant coronary stenosis, 57% had significant stenosis and 26% had stenosis with collaterals. 84 out of 108 (78%) of total myocardial segments were dysfunctional (RWM score ≥ 1) before revascularisation, and 63% (53/84) of these segments improved contraction post revascularisation ($p < 0.001$). OS-CMR SI for the overall group improved from -3.2 ± 14.3 at baseline to $2.1 \pm 8.8\%$, post revascularisation ($p = 0.002$). There was an inverse relationship between delta OS-CMR SI and the presence of significant coronary stenosis ($p = 0.02$). Importantly, myocardial segments with significant coronary stenosis with subsequent improvement of RWM score post revascularisation (hibernating segments) demonstrated significant improvement in delta OS-CMR SI (-8.9 ± 11.3 to $8.6 \pm 7.8\%$, $p < 0.001$).

Conclusion: OS-CMR response is impaired in hibernating myocardium and myocardial oxygenation is not down-regulated in the affected myocardial segments.

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Myocardial Strain as a Predictor of Acute Total/Subtotal Occlusion of Culprit Vessel in Patients with Non-ST Elevation Myocardial Infarction with Normal Left Ventricular Function

Y. Chia[*], P. Pati, S. Kashkavij, M. Arstall

Lyell Mcewin Hospital, Adelaide, Australia

Background: Acute total occlusion (ATO) of culprit vessel in patients with non ST elevation myocardial infarction (NSTEMI) accounts for a third of all NSTEMI patients. These patients have higher mortality and morbidity, hence earlier identification and appropriate interventions may improve their clinical outcomes.

Aim: We attempted to identify such patients with newer echocardiographic parameters. We used global longitudinal strain (GLS) and regional myocardial strain to identify such patients in setting of normal echocardiograms.

Methods: Single centre retrospective study that included all NSTEMI patients in 2018 who had angiographically proven acutely occluded culprit vessel with peri-procedure echocardiography.

Results: 130 out of 321 NSTEMI patients who had angiograms in 2018 had ATO or sub-total culprit vessel occlusion. 71 patients either had left ventricular systolic dysfunction or had no echocardiogram performed immediately

peri-procedure. 5 patients had poor images, unsuitable for strain analysis. 54 patients had good quality echocardiogram suitable for analysis. This was compared against 10 age and sex matched NSTEMI patients with near normal coronary arteries. Mean global longitudinal strain was 14 ± 3 as compared to 18 ± 1 in patients with normal coronaries. Regional strain abnormality correlated well in 96% of cases with culprit vessel occlusion. In one patient it was falsely positive and the other had abnormal GLS but did not localise the culprit vessel.

Conclusion: GLS and regional myocardial strain can identify patients with NSTEMI who have acutely occluded culprit vessel and may enhance their targeted therapy. Prospective registry and randomised studies are necessary to prove the same.

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Non-Invasive Assessment of Vascular Impedance using Cardiac Magnetic Resonance Imaging and Applanation Tonometry to Better Estimate the Severity of Aortic Valve Stenosis

S. Hungerford [1,2,3,*], & A. Adiji [1,2],
N. Bart [1,2], L. Lin [1], M. Namasivayam [1,2,3],
A. Jabbour [1,2,3], M. O'Rourke [1,2],
C. Hayward [1,2,3], D. Muller [1,2]

[1] St Vincent's Hospital, Sydney, Australia
[2] University of New South Wales, Sydney, Australia
[3] Victor Chang Cardiac Research Institute, Sydney, Australia

Background: The left ventricle (LV) faces a double afterload in patients with aortic stenosis (AS) valvular load due to the AS, and an arterial load as a consequence of reduced arterial compliance. Simultaneous high-fidelity radial artery tonometry (AT) and cardiac magnetic resonance imaging (CMR) may help to provide a more comprehensive assessment of aortic flow velocity, pressure and vascular impedance (Zc) than transthoracic echocardiogram (TTE) or left heart catheterisation alone.

Objectives: To measure non-invasively ascending aortic pressure and Zc, including systemic vascular resistance (SVR), in patients with severe AS being assessed for TAVR.

Methods: Patients with clinically severe AS were enrolled to undergo a simultaneous AT/CMR protocol. AT provided aortic end-systolic pressure. CMR provided LV volume and aortic flow at the time of pressure acquisition. Radial AT pressure was used to derive ascending aortic pressure using transfer function. Zc was determined as the relationship of derived aortic pressure to CMR aortic flow velocity.

Results: 10 patients (age 78 ± 11 years; 7 males; BP $141/71 \pm 23$ mmHg) with severe AS on transthoracic echocardiogram (peak gradient 92 ± 18 mmHg; mean 55 ± 12 mmHg; peak velocity 442 ± 32 cm/sec; AVA 0.89 ± 0.18 cm^2) were enrolled. Average peak-to-peak gradient was 51 ± 25 mmHg (average mean pullback gradient 40 ± 17 mmHg). CMR aortic flow velocity data were recorded in the ascending aorta

(forward volume 66 ± 22 ml; total volume 61 ± 21 ml; maximum flow 285 ± 61 ml/s). Representative AT/CMR derived ascending aorta pressure, velocity, impedance and SVR measurements are demonstrated in Fig. 1 below.
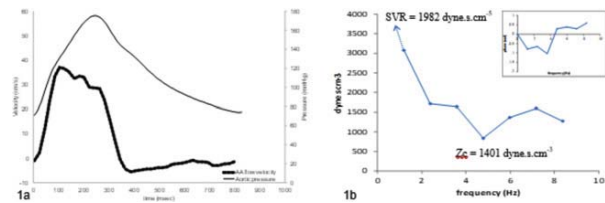

Fig. 1.

Conclusions: Simultaneous AT/CMR can characterise non-invasively LV load as vascular impedance to better estimate the severity of AS.

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Obstructive Sleep Apnoea is Associated with Increased Aortic Size

E. Robertson [1,2,*], E. Fulthorp [2], C. Gover [1],
B. Hambly [1], I. Wilcox [1,2], P. Cistulli [1],
R. Jeremy [1,2]

[1] University of Sydney, Sydney, Australia
[2] Central Sydney Cardiology, Sydney, Australia

Aims: Obstructive sleep apnoea (OSA) is associated with significant haemodynamic and metabolic abnormalities during sleep. Previous studies have suggested an association between OSA and aortic dilatation in patients with hypertension and patients with Marfan syndrome. We hypothesised that OSA would be associated with increased aortic size in all patients irrespective of other risk factors.

Methods: A retrospective analysis of ApneaLink[TM] (ResMed) and echocardiographic databases at Central Sydney Cardiology was performed. Patients were divided into three groups according to their apnoea-hypopnea index

Table 1.

	AHI < 5 (n = 235)	AHI 5.1–15 (n = 270)	AHI >15 (n = 279)	p Value
Aortic Root				
mm	34.01	34.97	36.41	<0.0001[*]
Z-Score	0.03		0.39	0.01[**]
Ascending Aorta				
mm	34.01	34.97	36.33	<0.0001[*]
Z-Score	−0.00		0.40	0.03[**]

[*] p-value determined by ANOVA.
[**] p-value determined by t-test with Welch's correction.

(AHI), with AHI<5 considered unlikely to have OSA; AHI 5.1–14.9 considered equivocal; and AHI>15 considered likely to have OSA. Aortic dimensions were assessed according to AHI group both as absolute dimensions and normalised for age, gender and body surface area (Z Score).

Results: 802 patients were identified who had both echocardiographic and ApneaLink^{TM} data available (Age = 65 ± 13 years, Female = 331). There was a significant, progressive increase in aortic size (mm) compared with AHI (Table 1), with a significant increase in Z-score in patients likely to have OSA (AHI >15) compared with those that were not (AHI <5).

Conclusions: These results support an association between OSA and increasing aortic size, indicating a role for echocardiographic screening of patients with OSA.

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Patients Understanding and Perceptions of Coronary Artery Calcium as a Method of Cardiovascular Risk Assessment

C. Vargas García [1], J. Pang [1], G. Watts [1,2,*], W. Bishop [3]

[1] *The University of Western Australia, Perth, Australia*
[2] *Royal Perth Hospital, Perth, Australia*
[3] *Calvary Lenah Valley Hospital, Hobart, Australia*

Background: Cardiac computed tomography (CT) scanning is being increasingly employed in cardiovascular risk assessment. Patients have been encouraged to become more involved in their medical care and health decisions. It is therefore important to investigate patients understanding and perception of the cardiac imaging.

Aim: To assess whether patients who have a cardiac CT scanning have a favourable understanding and perception of the investigation and test results.

Methods: This was a single-centre, cross-sectional study of asymptomatic adults from Hobart, Tasmania. Patients completed a questionnaire about test understanding and health perception following a cardiac CT scan. Data were described as proportions and group comparisons were undertaken by chi-squared test.

Results: Ninety-one patients were included (participation rate 63%). The mean age was 58 ± 8 years, 59% were men and a coronary artery calcium score (CACS) >0 was present in 69%. Over 96% of patients understood the rationale for the scan and the nature of results, 85% considered that the test was very important for their health, 66% that it would influence their risk, and 45% that it made a difference to the way they viewed their treatment for cholesterol. A significantly higher proportion of patients without CAC felt that results did not influence their treatment for cholesterol compared with those without CAC (32% vs 14%, respectively; $p = 0.048$).

Conclusion: Patients have a high level of understanding of the nature of the results and a favourable perception following a cardiac CT scan. The results suggest that CAC found on cardiac CT scanning may be valuable in motivating patients

in whom lifestyle modifications and drug therapy could be recommended.

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Patient-Specific Computer Simulation of Transcatheter Aortic Valve Implantation in Bicuspid Aortic Valve Morphology

C. Dowling [1,*], A. Bavo [2], N. El Faquir [3], P. Mortier [2], P. de Jaegere [3], O. De Backer [4], L. Sondergaard [4], P. Ruile [5], D. Mylotte [6], H. McConkey [7], R. Rajani [7], J. Laborde [1], S. Brecker [1]

[1] *Cardiology Clinical Academic Group, St. George's, University of London and St. George's NHS Foundation Trust, London, United Kingdom*
[2] *FEops NV, Ghent, Belgium*
[3] *Department of Cardiology, Erasmus MC, Rotterdam, The Netherlands*
[4] *The Heart Center, Rigshospitalet, University of Copenhagen, Copenhagen, Denmark*
[5] *Department of Cardiology and Angiology II, University Heart Centre Freiburg-Bad Krozingen, Bad Krozingen, Germany*
[6] *Department of Cardiology, University Hospital Galway, Galway, Ireland*
[7] *Cardiovascular Division, The Rayne Institute BHF Centre of Research Excellence, King's College London and St. Thomas' Hospital, London, United Kingdom*

Background: A patient-specific computer simulation of transcatheter aortic valve implantation (TAVI) in tricuspid aortic valve morphology has been developed which can predict the transcatheter heart valve (THV) frame deformation, paravalvular regurgitation (PVR) and conduction disturbance. We wished to validate a patient-specific computer simulation of TAVI in bicuspid aortic valve morphology (BAV).

Method: A retrospective study was performed on 37 TAVI in BAV patients that had both pre- and post-procedural computed tomography (CT) imaging. Pre-procedural CT imaging was used to create finite element models of the aortic root. Finite element analysis and computational fluid dynamics were performed. The computer simulation output was compared to post-procedural CT imaging, cineangiography, echocardiography and electrocardiograms. For each patient, multiple computer simulations were performed, in order to identify an optimal THV size and position for the patient's specific anatomical characteristics.

Results: The computer simulations accurately predicted the THV frame deformation (minimum diameter intraclass correlation coefficient [ICC] 0.84, maximum diameter ICC 0.88, perimeter ICC 0.91, area ICC 0.91), more than mild PVR (area under the receiver operating characteristic curve [AUC] 0.86) and major conduction abnormalities (new left bundle branch block or high-degree atrioventricular block) (AUC 0.87). When compared to the implanted THV size and implant

depth, optimal patient-specific THV sizing and positioning reduced predicted PVR and/or markers of conduction disturbance.

Conclusion: Patient-specific computer simulation of TAVI in BAV may predict the development of important clinical outcomes, such as PVR and conduction abnormalities. Patient-specific THV sizing and positioning may improve clinical outcomes of TAVI in BAV.

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Phenotyping the Left Ventricular Outflow Tract (LVOT) and Aortic Annulus of Bi- (BAV) and Trileaflet (TAV) Aortic Valves with 3D Transthoracic Echocardiography (TTE) – Geometrical Insights to Guide Optimal Aortic Valve Area (AVA) Calculations and Minimize Errors

A. Frampton[1], S. Wahi[2], M. Dooris[1,*],
K. Kostner[1], P. Cramp[1], K. Davies[1],
A. Chong[1,2]

[1] *Mater Adult Hospital, Brisbane, Australia*
[2] *Princess Alexandra Hospital, Brisbane, Australia*

Background: AVA by the continuity equation ($AVA_{CE} = 0.785 \times (LVOTd)^2 \times LVOT_{VTI}/AV_{VTI}$) defines severity of aortic stenosis. LVOT diameter (LVOTd) remains the weakest link. There is no guideline consensus on measurement site (0.5–1 cm "apical" in the LVOT (API) vs "annulus" (ANN) levels). Geometrical differences in the LVOT/annulus exist between BAVs/TAVs. Evidence to guide this fundamental but critical parameter is lacking. Inaccurate AVA_{CE} may compromise therapeutic decisions.

Purpose: To define the optimal LVOTd (API vs ANN by 2D vs 3D) for AVA_{CE} calculations in BAVs and TAVs. AVA by 3D TTE planimetry (AVA_{3D}) was the reference standard.

Methods: BAV and TAV TTEs with 3D datasets were included. $2D\text{-}LVOTd_{API}$/$2D\text{-}LVOTd_{ANN}$ were measured from parasternal long-axis images. 3D-LVOTd values were derived from circumference ($3D\text{-}LVOTd_{CIRC}$), area ($3D\text{-}LVOTd_{AREA}$), and average of minor/major dimensions ($3D\text{-}LVOTd_{AVE}$) at API and ANN levels using multiplanar reconstruction. $LVOT_{VTI}$/AV_{VTI} were traced from spectral Doppler waveforms.

Results: 53 BAVs and 52 TAVs were included. Mean $BAV\text{-}AVA_{3D}$ and $TAV\text{-}AVA_{3D}$ were 3.55 ± 0.96 cm^2 and 3.42 ± 0.67 cm^2. $3D\text{-}LVOTd_{CIRC}$ performed best for AVA_{CE} calculations in BAVs ($API\text{-}AVA_{CE}$ 3.43 ± 0.99 cm^2, Intraclass correlation (ICC) 0.989; $ANN\text{-}AVA_{CE}$ 3.41 ± 0.96 cm^2, ICC 0.988). $3D\text{-}LVOTd_{AREA}$ was preferred in TAVs ($API\text{-}AVA_{CE}$ 3.28 ± 0.69 cm^2, ICC 0.981; $ANN\text{-}AVA_{CE}$ 3.25 ± 0.68 cm^2, ICC 0.973) over $3D\text{-}LVOTd_{CIRC}$ which resulted in overestimations of the AVA. $2D\text{-}LVOTd_{ANN}$ was more accurate in both BAVs ($API\text{-}AVA_{CE}$ 3.03 ± 0.87 cm^{2}2, ICC 0.840) and TAVs ($API\text{-}AVA_{CE}$ 3.08 ± 0.67 cm^2, ICC 0.913) than $2D\text{-}LVOTd_{API}$ but both predictably underestimated AVA_{3D}.

Conclusions: AVA_{CE} in BAVs were best calculated using $3D\text{-}LVOTd_{CIRC}$ values. $3D\text{-}LVOTd_{AREA}$ was better in TAVs

due to their relatively more elliptical LVOTs/annuli. $2D\text{-}LVOTd_{ANN}$ was uniformly more optimal for both BAVs and TAVs.

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Pilot Study: Utilising MRI to Measure Cardiac Function in the Sheep Foetus

K. Cho[1,*], J. Darby[6], B. Saini[2], M. Lock[6],
S. Holman[6], S. Perumal[3], C. Macgowan[4,5],
J. Morrison[6,*], M. Seed[7,8,*]

[1] *Department of Physiology, University of Toronto, Toronto, Canada*
[2] *Institute of Medical Science, Faculty of Medicine, University of Toronto, Toronto, Canada*
[3] *South Australian Health & Medical Research Institute, Preclinical, Imaging & Research Laboratories, Adelaide, Australia*
[4] *Translational Medicine, Hospital for Sick Children, Toronto, Canada*
[5] *Department of Medical Biophysics, University of Toronto, Toronto, Canada*
[6] *Early Origins of Adult Health Research Group, School of Pharmacy and Medical Sciences, University of South Australia, Adelaide, Australia*
[7] *Division of Cardiology, Hospital for Sick Children, Toronto, Canada*
[8] *Department of Paediatrics, University of Toronto, Toronto, Canada*

We assessed the feasibility of foetal sheep cardiac magnetic resonance (CMR) measurements of ventricular volume for chamber sizes and cardiac output against gold standard cine phase-contrast (PC) measurements made in the ascending aorta (AAo) and main pulmonary artery (MPA).

Methods: 5 ewes with singleton pregnancies underwent surgery at 112–120 d (term = 150 d) to catheterise the foetal femoral artery. At 139–140 d, ewes were anaesthetised to undergo foetal CMR using the femoral arterial pressure waveform for cardiac gating. Short-axis cine imaging of the foetal hearts was acquired and the right (RV) and left (LV) ventricles were segmented to measure ejection fraction (EF), stroke volume (SV), right and left ventricular output (CO) and CVO.
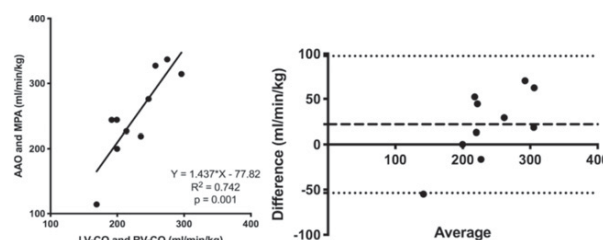

Fig. 1. *Left, Comparison of CO by PC vs ventricular volumetry. $R^2 = 0.742$, $P = 0.001$. Right, Bland-Altman plot comparing CVO measurement by PC vs ventricular volumetry. Bias = 21.88, standard deviation of Bias = 38.55.*

LV-CO and RV-CO were also measured by cine PC acquisitions of AAo and MPA flow respectively. All cardiac measurements were indexed to foetal weight. The ventricular output by ventricular volumetry and PC were compared by linear regression and Bland-Altman analysis.

Results: Our results are in keeping with previously reported microsphere measurements and we found good agreement between LV-CO and RV-CO by ventricular volumetry versus PC but with underestimation of output of approximately 10% by ventricular volumetry, which we attributed to incomplete coverage of the entire ventricular volume (Fig. 1).

Conclusion This data suggest that following appropriate modification of the field of view, this technique represents a valid approach to assessing cardiac function, chamber sizes, and cardiac output in foetal sheep.

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Postural Orthostatic Tachycardia Syndrome: A Heart which is Stressed but not Strained

A. Goff[1,*], M. McGrady[2,3], N. Lawson[3],
M. Price[3], E. Fulthorp[3], A. Patel[4],
I. Wilcox[1,2,3]

[1] *Sydney Medical School, University of Sydney, Sydney, Australia*
[2] *Department of Cardiology, Royal Prince Alfred Hospital, Sydney, Australia*
[3] *Central Sydney Cardiology, Sydney, Australia*
[4] *George Institute for Global Health, Sydney, Australia*

Postural Orthostatic Tachycardia Syndrome (POTS) is a clinical syndrome primarily affecting young women in which inappropriate sinus tachycardia occurs due to postural change. The pathophysiology is not well understood but dysautonomia is present and has potentially adverse cardiac effects.

Whether POTS is associated with structural heart disease is unknown. Global longitudinal LV strain (GLS) can detect pre-clinical left ventricular dysfunction [1]. We measured LV GLS as well as right ventricular (RV) free wall and left atrial strain in 23 women (age 26 ± 8 yrs) including 15 with POTS confirmed by Tilt Table Test and 6 normal women. Two senior sonographers (NL and MP) reviewed studies independently, blinded to diagnosis. Measurements of GLS, RV free wall strain, left atrial (LA) stiffness and peak atrial longitudinal strain (PALS) were compared. Concordance between sonographers was measured based on clinically significant changes in both GLS and RV free wall strain using the Kendal W test ($W = 0.56$, $p = 0.31$ for GLS and $W = 0.83$, $p = 0.03$ for RV free wall strain). Concordance was not measured between sonographers for PALS and LA stiffness, as no set normal range has been identified.

A Mann-Whitney U test demonstrated no significant difference in GLS, RV free wall strain or PALS between groups. Student's t test demonstrated no significant difference in LA stiffness between groups.

We found no clinically significant difference in strain imaging between women with POTS and healthy controls suggesting that POTS, while characterised by dysautonomia, is not associated with subclinical structural heart disease.

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Prediction of Ventricular Arrhythmias with Mechanical Dispersion Assessed by Strain Echocardiography: A Systematic Review and Meta-Analysis

H. Kawakami[1,*], N. Nerlekar[1], K. Haugaa[2],
T. Edvardsen[2], T. Marwick[1]

[1] *Baker Heart and Diabetes Institute, Melbourne, Australia*
[2] *Oslo University Hospital, Oslo, Norway*

Background: Recent studies have demonstrated that LV mechanical dispersion (LVMD) assessed by speckle tracking might be a powerful marker for ventricular arrhythmias (VA). We performed a systematic review and meta-analysis to assess the prognostic value of this parameter and define the value relative to other parameters.

Methods: A systemic review of studies reporting the predictive value of LVMD for VA was undertaken from a search of Medline and Embase. LVMD was defined as the standard deviation of time from Q/R on ECG to peak negative strain from each LV segment. Hazard ratios (HRs) were extracted from univariable and multivariable models reporting on the association of LVMD and VA. The predictive value of LVMD was compared to that of LVEF and global longitudinal strain (GLS).

Results: Among 3198 pts (63 years, 82% IHD) in 12 published articles, 387 (12%) had VA events over a follow-up (17–70 months). Pts with VA events had a significantly greater LVMD compared with those without VA events (weighted mean difference, -20.3 ms; 95% CI, -27.3 to -13.2; $p < 0.01$). Each 10 ms increment of LVMD was significantly and independently associated with VA events (HR, 1.19; 95% CI, 1.09 to 1.29; $p < 0.01$). The predictive value of LVMD was superior to that of LVEF or GLS and LVMD was independently associated with outcome.

Conclusion: LVMD assessed by speckle tracking provides important predictive value for VA and has superior predictive value to LVEF and GLS for risk stratification.
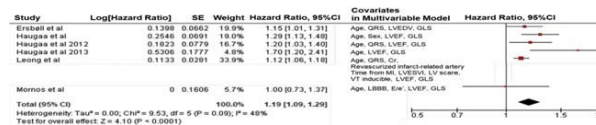
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Predictors of a Coronary Artery Calcium Score of Zero in Patients with Familial Hypercholesterolaemia

C. Vargas García[1], J. Pang[1], G. Watts[1,2,*]

[1] *The University of Western Australia, Jolimont, Australia*
[2] *Royal Perth Hospital, Perth, Australia*

Background: A coronary artery calcium score (CACS) of zero is a warranty of a very low risk of a coronary event over 15 years in asymptomatic subjects. Familial hypercholesterolaemia (FH) is a condition characterised by a markedly high risk of premature coronary artery disease (CAD). Therefore, it is useful to define the factors that predict a CACS of zero in this high-risk population.

Aim: To determine the predictors of a CACS of zero, as assessed by cardiac computed tomography (CT) scanning, in asymptomatic patients with FH.

Methods: Cross-sectional study of asymptomatic patients diagnosed with FH in a specialist clinic at Royal Perth Hospital in whom a cardiac CT for CACS was performed. Univariate and multivariable logistic regression were carried out to investigate the predictors of a CACS of zero.

Results: Data from 198 adult patients (40% males) were analysed. The mean age was 50.9 ± 10.0 years and 50% had a pathogenic mutation causative of FH. A CACS = 0 was found in 42% of the patients and the median CACS was 4.9 Agatston units (IQR 79.5). From a set of potential predictive variables, age, pre-statin LDL-C, hypertension, phenotypic Dutch Lipid Clinic Network Score (DLCNS), and the absence of a genetic mutation, were included in the multivariable analysis. Age, hypertension and DLCNS, particularly LDL-C concentrations, were independent predictors of a CACS of zero ($p < 0.001$, $p = 0.014$ and $p = 0.011$, respectively).

Conclusion: In asymptomatic, middle-age patients with FH, younger age, the absence of hypertension and a lower DLCNS are the major drivers of the absence of CAD, as assessed by CACS.

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Preload Dependence of Myocardial Work Parameters

R. Perry*, S. Bihari, U. Wiersema, A. Bersten, M. Joseph, C. DePasquale, J. Selvanayagam

Flinders Medical Centre, Bedford Park, Australia

Background: Myocardial work (MW) is a novel technique which utilises speckle tracking strain derived global longitudinal strain (STGLS) in conjunction with the blood pressure to account for afterload. However there are limited data on the effect of preload on MW parameters. Therefore our aim was to determine the degree of alteration in MW with changes in preload.

Table 1.

Fluid	ΔLVEDV (mL)	ΔGWI (mmHg)	ΔGCW (mmHg)
0.9% Saline	10.9 ± 7.4	402.5 ± 227.8	372.0 ± 204.1
Hartmann's	5.0 ± 5.3	497.0 ± 261.5	493.2 ± 256.0
4% albumin	5.7 ± 5.8	332.5 ± 120.3	282.7 ± 99.1
20% albumin	8.5 ± 8.9	247.5 ± 207.3	228.0 ± 139.2

Methods and results: In a double blind, cross over study of 6 healthy male subjects we compared the effects of IV administration of 30 ml/kg of 0.9% saline, Hartmann's solution and 4% albumin, and 6 ml/kg of 20% albumin (albumin dose equivalent) on global work index (GWI), global constructive work (GCW), and global work efficiency (GWE) as measured by STGLS. Preload, as measured by 3D left ventricular end-diastolic volume (LVEDV) increased in all fluids as did GWI and GCW (Table 1) however there was no change in GWE with changes in preload. 0.9% saline induced the largest change in LVEDV; nonetheless Hartmann's solution had the largest effect on both GWI and GCW although this change was not statistically different from the changes observed with the other fluids.

Conclusion: GWI and GCW are parameters that are preload dependent. GWE may be the most reproducible parameter of MW however preload should be considered when performing serial follow up measurements using MW.

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Prevalence of Fabry Disease in A Cohort with Unexplained Late Gadolinium Enhancement on Cardiac MRI

A. Moonen[1], S. Lal[1,2], J. Ingles[1,2,3,*], L. Yeates[1,2,3], C. Semsarian[1,2,3], R. Puranik[1,2]

[1] *Royal Prince Alfred Hospital, Campderdown, Australia*
[2] *Sydney Medical School, University of Sydney, Camperdown, Australia*
[3] *Agnes Ginges Centre for Molecular Cardiology, Centenary Institute, Camperdown, Australia*

Background: Fabry disease is a rare X-linked genetic disorder in which cardiac manifestations include LVH, contractile dysfunction, and fibrosis, visible on cardiac MRI (cMRI) as late gadolinium enhancement (LGE) of the myocardium. Fabry disease is an important diagnosis to make as treatment is available as lifelong replacement of the deficient enzyme.

Aim: To define the prevalence of Fabry disease in a cohort of patients with unexplained LGE on cMRI.

Methods: The study population was recruited from patients aged >16 years who had cMRI performed between 2010–2018 to investigate LVH, idiopathic LV dysfunction and/or idiopathic ventricular arrhythmia. Patients with 'unexplained' LGE (i.e. without a genetic diagnosis of an alternate cardiomyopathy such as HCM or biopsy-proven

infiltrative cardiomyopathy such as sarcoid or amyloid) were tested for Fabry disease by either genetic testing or the Dried Blood Spot test (*Sanofi-Genzyme*).

Results: Of the 79 patients with unexplained LGE on cMRI, 2 patients tested positive for Fabry disease, both using genetic sequencing techniques. The prevalence of Fabry disease in this selected cohort was 2.5%. Specifically, 1 patient was a 65 year old male and the other patient a 75 year old female. In both cases, the pattern and distribution of LGE on cMRI was of patchy mid-wall enhancement in the inferoseptum.

Conclusion: Unexplained LGE on cMRI may be an isolated manifestation of late-onset Fabry disease. This finding should prompt testing for Fabry disease given this is a potentially treatable condition.

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Prognostic Value of Computed Tomography Coronary Angiography (CTCA) in Remote Indigenous and Non-Indigenous Australians

A. Jeffries [1,2,*], B. Costello [3], H. Tayeb [4,5], S. Varghese [5], C. Gallagher [1,2], D. Chang [1,2], N. Clarke [1,2], B. Pitman [1,2], N. Kanagaharan [4,5], C. Wong [1,2]

[1] *Department of Cardiology, Royal Adelaide Hospital, Adelaide, Australia*
[2] *Centre for Heart Rhythm Disorders, The University of Adelaide, Adelaide, Australia*
[3] *Baker IDI Heart and Diabetes Institute, The Alfred Hospital, Melbourne, Australia*
[4] *Department of Cardiology, Darwin Hospital, Darwin, Australia*
[5] *Department of Cardiology, Alice Springs Hospital, Alice Springs, Australia*

Background: Although computed tomography coronary angiography (CTCA) is a well-validated and useful non-invasive test in general populations, it is not known whether its prognostic utility is comparable in Indigenous populations. Evaluating this is important in remote Central Australian Indigenous populations where cardiovascular disease is prevalent and invasive angiography unavailable.

Methods: Consecutive patients undergoing CTCA in Central Australia over a five-year period (2013–2017) were included and followed up for major adverse cardiovascular events (MACE).

Results: A total of 347 patients (162 female, 124 [39%] Indigenous, mean age 50 ± 12 years) were included. CTCA demonstrated normal coronary arteries in 137 (39.5%) patients, non-obstructive coronary artery disease (CAD) ($\leq$50%) in 149 (42.9%) patients, and obstructive CAD (>50%) in 61 (17.6%) patients. Over a median follow-up of 24 ± 14 months, a total of 20 MACE occurred. The incidence rate of a MACE was 0.35, 1.36 and 13.06 per 100 person-years in patients with normal, non-obstructive, and obstructive CAD on CTCA, respectively ($p < 0.001$). In univariate analyses, increasing Agatston score, obstructive CAD, and extensive CAD (segment-involvement score >4) were significant predictors of MACE ($p < 0.05$ for all). After multivariate

adjustment, obstructive CAD remained statistically significant ($p = 0.001$). Indigenous ethnicity was not a significant predictor of MACE in either univariate ($p = 0.29$) or multivariate analyses ($p = 0.96$).

Conclusion: Despite a propensity for accelerated atherosclerosis, CTCA provides similar prognostic information in Indigenous individuals compared to their non-Indigenous counterparts. Our data suggest that CTCA can adequately risk stratify remote Indigenous individuals and their risk of MACE over a two year period.

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Prospective Comparison of Semi-Automated 2-Dimensional Global Longitudinal Strain Measurements using three Different Software Programs in a Busy Clinical Setting

S. John, A. Bhat*, G. Gan, T. Tan

Blacktown Hospital Sydney, Blacktown, Australia

Introduction: Global longitudinal strain (GLS) is a measure of myocardial function which can provide incremental information in certain clinical conditions. Previously, measurement of GLS was time-consuming and subject to variability. Recent revisions of algorithms for assessment of GLS based on the 2015 EACVI/ASE/Industry Task Force consensus recommendations for standardisation of deformation imaging are aimed at improving its application in the clinical setting. Our aim was to compare peak GLS measurements obtained using three different commercially available software systems in a busy clinical setting.

Methods: Twenty patients in sinus rhythm (45% female) were scanned systematically with head-to-head acquisition and no modification of patient's position using equipment from two different vendors (Philips and GE). GLS was measured off-line using Philips QLAB 10.5 and GE EchoPAC BT13). Inter- and intra-observer variability and agreement between the measurements using the two software products were evaluated. Comparisons were also made with measurements made using vendor independent software (TomTec, Germany).

Results: Mean heart rate was 72 ± 14 bpm and mean LVEF $61 \pm 10\%$. Inter-observer CVs for GLS were 4.50% (Philips) and 2.69% (GE); and intra-observer CV were 5.60% (Philips) and 3.98% (GE), indicating good reproducibility. The Pearson's correlation coefficients (CC) between GLS values were high (A, C, E) indicating good agreement between the three algorithms with minimal bias (see Bland-Altman plots; B, D, F).

Conclusion: There was a high level of agreement and reproducibility for GLS measurements using Philips, GE and TomTec software, with all giving comparable GLS values, suggesting feasibility of routine GLS assessment in a busy clinical setting.

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Pyrophosphate (PYP), and Hydroxymethylene Diphosphonate (HDP) are Reliable and Readily Available Tracers for use in Bone Scintigraphy for the Diagnosis of Transthyretin Cardiac Amyloidosis (TTR)

C. Wong[1,*], M. Lasica[1,2], J. Cooke[1],
J. Hare[3], D. Saddik[1], J. Hocking[1,2],
A. Slocombe[1,2], S. Ting[1,2], S. Gibbs[1,2]

[1] *Eastern Health, Box Hill, Australia*
[2] *Victorian and Tasmanian Amyloidosis Service, Box Hill, Australia*
[3] *Alfred Health, Melbourne, Australia*

3,3-diphosphono-1,2-propanodicarboxylic acid (DPD) is the most validated tracer for detecting cardiac amyloidosis with bone scintigraphy. PYP and HDP are more readily available in Australia, and considered possible alternatives. We sought to examine experience using HDP and PYP at the Victorian and Tasmanian Amyloidosis Service.

69 patients diagnosed with TTR underwent bone scintigraphy. TTR was confirmed on direct biopsy in 25, including 12 cardiac; and/or genetic studies confirming TTR mutations in 5; and/or on clinical phenotype (older male with isolated HFpEF ± carpal tunnel releases), with echocardiographic features (IVSD >12 mm) and elevated cardiac biomarkers in 57. Six underwent bone marrow biopsies demonstrating <5% plasma cells and Congo red negative, thus AL was excluded. All but one had normal serum free light chain (SFLC) ratios. Cardiac MRI confirmed amyloidosis in 25.

Tracers used were: HDP in 61, PYP in 6, and 1 each for DPD and MDP. 65 demonstrated cardiac uptake. For negative scan patients, one had normal cardiac biomarkers with no clinical evidence of amyloidosis but positive for Met30 mutation, thus deemed an asymptomatic carrier; another had normal echocardiography with isolated biopsy-proven gastrointestinal disease; another had isolated biopsy-proven bladder disease with normal cardiac biomarkers. The final patient had bone scintigraphy using methylenediphosphonate (MDP), which was falsely negative. MDP is not validated for detecting cardiac amyloidosis.

HDP and PYP are sensitive tracers to detect cardiac amyloidosis. MDP should not be used. SFLC measurement is essential. For those with abnormal SFLC, biopsy and referral to an amyloidosis service to exclude AL is recommended.

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Quality Assurance of Transthoracic Aortic Dimensions in Adults – Excellent Performance, but Room for Improvement

J. Humphries, P. Eades, G. Scalia*

Genesis Care, Auchenflower, Australia

Background: Accurate assessment of aortic sinus (Sinus), sino-tubular junction (STJ) and ascending aortic (Asc Ao) dimensions are critical to decision-making regarding timing of surgery and pharmaceutical interventions. We present a quality assurance audit of a large cohort of adults studied with transthoracic echo (TTE).

Methods: 188 randomly selected adult patients with complete TTE were randomly assigned to 9 auditing sonographers (~20 studies each), blinded to the recorded measurements. Re-measurements were made using ASE guideline-driven techniques. Studies were graded for completeness, technique and reproducibility.

Results: Sinus dimensions were recorded in 87/188 (46%), via the ASE leading edge technique in 82/87 (94%), at the appropriate point in the cardiac cycle in 69/87 (79%). There was excellent agreement with the audited re-measurements (35.3 ± 5.78 mm vs 35.9 ± 5.76 mm, $p = 0.48$, $r^2 = 0.93$, mean difference -0.58 mm). STJ dimensions were recorded in only 39/188 (21%), via leading edge technique in 37/39 (95%), with appropriate timing in 36/39 (93%). There was excellent agreement with the audited measurements (31.0 ± 5.55 m vs 32.2 ± 5.0 mm, $p = 0.31$, $r^2 = 0.85$, mean difference -1.2 mm). Asc Ao 162/188 (86%) were correctly recorded at the leading edge in 150/162 (93%), at the appropriate time 117/162 (72%). There was excellent agreement with the audited measurements (34.6 ± 5.62 mm vs 35.0 ± 5.8 mm, $p = 0.76$, $r^2 = 0.488$, mean difference -0.3 mm). Right sternal edge measurements were recorded in 1% of cases.

Conclusions: Ascending aortic measurements are well measured in almost all standard TTE studies in this audit. Sinus and sino-tubular junction measurements are accurate, but too infrequently measured in this audited group.

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Quantified Coronary Plaque Characteristics between Caucasians and Morise Score-Matched South Asian Populations

N. Gahungu[1,*], B. Chow[2], S. Tewari[2],
S. Bhat[3], J. Rankin[4], G. Dwivedi[2,3,4]

[1] *Royal Perth Hospital, Perth, Australia*
[2] *Department of Medicine (Cardiology), University of Ottawa Heart Institute, Ottawa, Canada*
[3] *Harry Perkins Institute of Medical Research, The University of Western Australia, Australia*
[4] *Fiona Stanley Hospital, Murdoch, Australia*

Background: Low-attenuation plaques (LAP) are associated with an increased risk of cardiovascular mortality and morbidity. South Asian populations experience poorer cardiovascular outcomes compared to Caucasian populations. We hypothesised that South Asian populations have a higher prevalence of LAP compared to Caucasians and would predict major adverse cardiovascular events.

Methods: 72 Caucasian and 72 Morise score-matched South Asian patients were identified from a Cardiac Computed Tomography Angiography (CCTA) registry. Coronary artery plaque subtypes in proximal major epicardial and left main arteries were analysed from CCTA images using pre-determined attenuation ranges in Hounsfield units: 1 to 30

HU (low attenuation), 31 to 70 HU (intermediate attenuation), 71 to 150 HU (high attenuation), and mean coronary lumen + 2 standard deviations to 1000 HU (calcified). For each analysis, data comparison was performed for plaque volumes before and after normalising for coronary artery segment length, coronary artery outer vessel wall volume, and the volume between lumen and outer vessel wall.

Results: The baseline characteristics and total plaque score of the two cohorts were similar. There were no statistically significant differences in low, intermediate, and high attenuation, or calcified plaques between Caucasian and Morise score-matched South Asian cohorts. After a mean follow up of 32 months, major adverse cardiovascular events were similar between Caucasians and South Asians.

Conclusion: In a Morise score-matched ethnicity study, we found no significant differences in plaque subtypes including LAP in South Asians compared to a Caucasian cohort. Other factors accounting for poor outcomes in South Asians should be investigated.

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Quantitative but not Qualitative Computed Tomography Coronary Angiography High Risk Plaque Characteristics are Associated with Major Adverse Cardiovascular Events in Patients with Non-Significant Invasive Fractional Flow Reserve

D. Scherer [1,*], J. Abdelmalak [2], N. Nerlekar [2], C. Jiang [2], K. Fernandes [2], A. Lin [2], K. Munnur [2], P. Psaltis [1], J. Cameron [2], S. Senevirantne [2], S. Nicholls [2], D. Wong [2]

[1] SAHMRI, Adelaide, Australia
[2] MonashHeart, Clayton, Australia

Background: Functionally non-significant coronary stenoses by fractional flow reserve assessment (FFR >0.8) are not routinely intervened upon. These patients may still remain at risk of major adverse cardiovascular events (MACE). Computed tomography coronary angiography (CTCA) allows non-invasive assessment of qualitative and quantitative high-risk plaque (HRP) morphology which are associated with future MACE. We seek to determine if HRP was associated with MACE in patients with functionally non-significant FFR.

Methods: Consecutive patients with stable chest pain who underwent CTCA and FFR within a 3-month interval, between 2009–2017, at MonashHeart were examined. Qualitative HRP were low attenuation plaque (LAP, <30 Hounsfield units), positive remodelling and spotty calcification. Quantitative HRP was regarded as LAP volume normalised to vessel length analysed (distal plaque to ostium). MACE was defined as cardiovascular death, myocardial infarction (MI) or unstable angina.

Results: 54 patients (age 63 ± 11, 70% males) were evaluated. There were 39 vessels in 39 patients (72%) with qualitative HRP. Seven patients (13%) experienced MACE over 5.4-year median follow-up with 5 demonstrating qualitative HRP. The mean interval between CTCA and MACE was

576 days. Qualitative HRP features were not associated with MACE, LAP ($p = 0.2$), positive remodelling ($p = 0.99$), spotty calcification ($p = 0.69$). Normalised LAP volume was predictive of MACE (Hazard Ratio 1.10, 95% confidence interval 1.01–1.10, $p = 0.02$). Traditional anatomic predictors of MACE, including total plaque burden ($p = 0.91$), minimal luminal area <4 mm ($p = 0.99$) and total plaque volume ($p = 0.4$) were not significant predictors.

Conclusions: In patients with functionally non-significant FFR, there remains a risk of MACE and quantitative but not qualitative HRP characteristics appear to associate with prognosis.

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Radiation Dose Determines Segmental Cardiac Dysfunction in Breast Cancer

S. Trivedi [1,2,*], S. Tang [3,4,5], E. Koh [3,4,5], J. Otton [5,6], G. Delaney [3,4,5], L. Holloway [3,4,5,7], G. Liney [3,5], L. Thomas [1,2,5]

[1] Department Of Cardiology, Westmead Hospital, Sydney, Australia
[2] Westmead Clinical School, The University of Sydney, Sydney, Australia
[3] Ingham Institute of Applied Medical Research, Liverpool, Sydney, Australia
[4] Cancer Therapy Centre, Liverpool Hospital, Sydney, Australia
[5] University of New South Wales, Sydney, Australia
[6] Department of Cardiology, Liverpool Hospital, Sydney, Australia
[7] The University of Sydney, Sydney, Australia

Background: In breast cancer patients, subclinical left ventricular (LV) dysfunction by 2D global longitudinal strain (GLS) immediately following radiotherapy (RT) and persisting at 12 months has been described.

Hypothesis: Subclinical LV dysfunction may be differential and correlate with the amount of segmental RT.

Methods: Transthoracic echocardiograms were performed at baseline (pre-RT), 6 weeks and 12 months post-RT on 21

Table 1.

Parameter	Baseline	6 weeks	12 months	P value	RT dose (Gy)
LV GLS (%)	-22.0 ± 2.7	-20.4 ± 2.6	-20.1 ± 2.3	**0.03***	Total = 9.0
Basal strain (%)	-18.2 ± 2.9	-17.4 ± 2.2	-16.6 ± 3.0	0.21	1.7
Mid strain (%)	-20.2 ± 2.8	-19.4 ± 2.2	-18.8 ± 2.5	0.16	4.9
Apical strain (%)	-27.3 ± 3.8	-25.4 ± 4.2	-25.1 ± 3.6	**0.06***	20.5
Lateral strain (%)	-21.9 ± 3.9	-19.9 ± 3.5	-18.8 ± 3.9	**0.009***	13.4
Anterior strain (%)	-21.9 ± 4.1	-21.1 ± 3.7	-18.5 ± 4.5	**0.04***	16.4
Anteroseptal (%)	-23.1 ± 4.2	-20.5 ± 3.3	-21.4 ± 3.2	**0.06***	15.8
Septal (%)	-22.2 ± 3.3	-20.6 ± 2.5	-20.8 ± 2.4	0.14	10.8
Inferior (%)	-21.5 ± 3.2	-22.5 ± 3.5	-21.8 ± 3.1	0.48	6.7
Posterior (%)	-22.0 ± 4.7	-19.6 ± 3.9	-19.6 ± 3.7	0.45	4.1

chemotherapy-naïve women with left sided breast cancer. The amount of radiation received by individual LV segments was quantified.

Results: LV GLS and segmental strain were significantly decreased following RT (Table 1); a significant reduction was noted in the apical segment. In all regions (basal, mid and apical), the least change in strain occurred in the posterior segment (i.e. the segment receiving the minimum radiation dose), while maximum and significant decreases occurred in the anterior, anteroseptal, and lateral segments, and coincided with these segments receiving a higher radiation dose (>13 Gy).

Conclusion: RT causes segmental myocardial dysfunction, and areas receiving the highest RT demonstrate the largest impairment in strain.

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Regional Epicardial Adipose Tissue (EAT) Analysis as a Better Predictor of Localised Cardiac Pathology than Total Epicardial Adipose Tissue Volume

S. Binny [1,*], C. Nalliah [1,3], S. Joshi [1], E. Lui [2], J. Bui [2], P. Kistler [4], J. Kalman [1,3]

[1] Department of Cardiology, Royal Melbourne Hospital, Melbourne, Australia
[2] Department of Radiology, Royal Melbourne Hospital, Melbourne, Australia
[3] The University of Melbourne, Melbourne, Australia
[4] Department of Cardiology, The Alfred Hospital, Melbourne, Australia

Introduction: Epicardial adipose tissue (EAT) has been associated with both coronary atherosclerosis and arrhythmias. Our RMH group has recently shown that localised right atrial appendage (RAA) EAT correlates with both RA electrical conduction velocities and RAA adiposity on histology. Most EAT studies only quantify total EAT using semi-automated software without regional assessment. We sought to determine whether RAA EAT volume is just a reflection of total EAT or accumulates variably between individuals.

Method: Regional analysis of EAT was undertaken on a cohort of 18 patients undergoing surgery to evaluate the correlation between regional EAT volumes, histological right atrial appendage wall adiposity and electrical conduction slowing using external electrodes at the time of surgery. Manual segmentation was performed using Osirix software with 3 mm slices from a gated cardiac CT subdivided into 28 anatomical regions comprising the entire EAT volume. Pearson correlation coefficients were then calculated between volumes.

Results: The volume of RAA EAT that correlated with both the histology and electrical conduction did not correlate with either total right atrial EAT ($r^2 = 0.39$), combined atrial EAT ($r^2 = 0.33$) or total EAT volumes ($r^2 = 0.42$). This lack of correlation persisted regardless of using multiple definitions of the regional RAA EAT borders.

Conclusion: Regional RAA EAT volume correlates poorly with total EAT volume and appears to disperse in a non-uniform fashion between individuals. Therefore EAT studies interested in regional atrial or coronary pathologies should utilise regional EAT volume analysis and not rely on faster semi-automated software-derivedd total EAT volume analysis.

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Reproducibility of FFR-CT at High Levels of Iterative Reconstruction

S. Montalto [*], H. Pascoe, J. Bui, E. Lui, F. Langenberg, M. McCusker, A. Finnegan, N. Better, S. Joshi

Royal Melbourne Hospital, Parkville, Australia

Introduction: FFR-CT has a developing presence as a non-invasive means of assessing myocardial ischaemia. Reproducibility of workstation-based FFR-CT is crucial, and data in this area are limited, particularly with differing reconstruction algorithms. Iterative reconstruction algorithms are used to lower radiation dose while maintaining image quality. While these techniques are widely applied to CTCA, there are limited data on the accuracy of FFR-CT at high levels of iterative reconstruction.

Methods: FFR-CT was retrospectively performed on 20 patients who underwent both CTCA and stress MIBI within 60 days at a single centre between January 2014 and December 2018. Two radiologists independently calculated the FFR at three points along the RCA, LAD and LCx onsite using prototype software (cFFR version 3.1, Siemens GmbH, Forchheim, Germany) on either ADMIRE 4 ($n = 11$) or SAFIRE 4 ($n = 9$) i26. Intraclass correlation coefficients (ICC) were calculated using a two-way consistency model.

	Observer 1 mean FFR	Observer 2 mean FFR	ICC (95% CI)
Proximal	0.99 (+/− 0.01)	0.99 (+/− 0.01)	0.82 (0.70–0.89)
Mid	0.93 (+/− 0.05)	0.94 (+/− 0.04)	0.94 (0.90–0.97)
Distal	0.84 (+/− 0.08)	0.85 (+/− 0.09)	0.93 (0.79–0.92)
Total	0.92 (+/− 0.04)	0.93 (+/− 0.04)	0.97 (0.96–0.98)

Results: 8 patients had lesions in proximal or mid vessels that were thought to be of at least moderate severity on CTCA.

Conclusion: Onsite FFR-CT has excellent levels of reproducibility and this is maintained despite high levels of iterative reconstruction. This may allow CTCA to be acquired at lower radiation doses even if CT-FFR is planned.

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Resting Global Myocardial Work Derived from Non-Invasive LV Pressure-Strain Loops Discriminates between True Positive and False Positive Exercise Stress Echocardiography

N. Edwards [1,*], G. Scalia [1], S. Sabapathy [2], B. Anderson [1], R. Chamberlain [1], J. Chan [1,2]

[1] *The Prince Charles Hospital, Chermside, Australia*
[2] *Griffith University, Gold Coast, Austalia*

Background: Non-invasive detection of obstructive CAD by exercise stress echocardiography (ESE) results in varied sensitivity and specificity due to qualitative interpretation of regional wall motion abnormalities (RWMA). This study sought to determine whether resting global myocardial work (MW) can differentiate between true (TP) and false positive (FP) ESE.

Methods: Resting global MW was derived from non-invasive LV pressure-strain loops constructed from GLS and brachial SBP on 70 patients (mean age 56 ± 12 yrs; 31 males) referred for clinically indicated ESE (EF $\geq 55\%$ with no evidence of RWMA). Indices of constructive work (positive work by myocardial shortening in systole including lengthening during isovolumic relaxation), wasted work (energy loss by myocardial lengthening in systole and shortening in isovolumic relaxation) and MW efficiency (percentage ratio of constructive and wasted work) were obtained. Coronary angiography was performed on those with a positive ESE ($N = 18$) to determine presence and/or severity of CAD ($n = 10$ significant CAD; $n = 8$ no significant CAD).
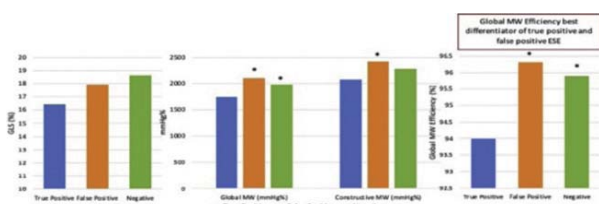
Results: Resting global MW was significantly reduced ($p < 0.05$) in TP compared with FP ESE (1733 vs 2099 mmHg%). Global MW efficiency was the best differentiator and significantly reduced ($p < 0.05$) in TP vs FP ESE (94 vs 96%) due to significant reductions ($p < 0.05$) in constructive MW. 52 patients with a negative ESE showed a significantly higher ($p < 0.05$) resting GLS (18.6 vs 16.4%) and global MW (1971 vs 1733 mmHg%) compared to TP ESE.

Conclusion: Non-invasive estimation of global MW may be a more sensitive tool than GLS to help distinguish between TP and FP ESE.

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Rheumatic Heart Disease in an Urban Adult Patient Population - Overseas Migrants the Largest Patient Group

K. Rhodes [1,*], A. Kennington [1], W. Wang [1,2]

[1] *Princess Alexandra Hospital, Woolloongabba, Australia*
[2] *The University of Queensland, Australia*

Aim: Current registry data suggest a low prevalence of Rheumatic Heart Disease (RHD) in metropolitan South East Queensland (SE Qld). We aim to identify patients with RHD, as determined by echocardiography in an urban public adult hospital or clinic setting.

Method: RHD patients were identified by retrospectively searching the MetroSouth health services (SE Qld) echocardiography data management system from the period 2007–2018 for the key word 'rheumatic'. Patients were grouped according to Indigenous status and country of birth.

Results: 538 patients with RHD were identified. RHD patients were more likely to be female (68% vs 32%). There were 55 (10%) Indigenous Australian patients with a mean age of 46 yrs (range 15–74). There were 211 (39%) Australian-born Non-Indigenous patients with a mean age of 65 yrs (range 15–92). There were 272 (51%) overseas-born RHD patients. The NZ and Pacific Islander patients group had 102 patients (19% total RHD patients) and mean age 52 yrs (range 18–85). Asian and European regions each comprised 13% ($n = 68$) and 12% ($n = 65$) of total patients, with Asian-born patients younger on average (mean 56 yrs) than European-born (mean 72 yrs).

Conclusion: RHD in the SE Qld urban adult public healthcare setting is not an infrequent finding. The majority of RHD patients identified were overseas migrants with the largest group from New Zealand and the Pacific Islands. In regions with relatively high overseas migrant populations from the Pacific and Asian regions, rates of RHD may increase.

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Right Ventricular Dysfunction in AL-Amyloidosis Cardiomyopathy

P. Geenty[1,*], S. Sivapathan[1], T. Deshmukh[1], A. Boyd[6], P. Brown[1], M. Altman[1], F. Kwok[2], G. Stewart[3,4], D. Richards[4,6], L. Thomas[1,4,5]

[1] Department of Cardiology, Westmead Hospital, Annandale, Australia
[2] Department of Haematology, Westmead Hospital, Westmead, Australia
[3] Department of Immunology, Westmead Hospital, Westmead, Australia
[4] University of Sydney, Sydney, Australia
[5] University of New South Wales, Sydney, Australia
[6] Westmead Private Hospital, Westmead, Australia

Background: Cardiac amyloidosis manifests as a progressive infiltrative cardiomyopathy for which delayed diagnosis is common and predicts a poor prognosis. Additionally, right ventricular dysfunction has been a predictor of mortality in cardiac amyloidosis. Strain imaging has been shown to detect subclinical cardiac dysfunction in a range of cardiomyopathies.

Aims: We sought to evaluate RV function in a cohort of AL-amyloid patients, to determine if additional evaluation of the right heart allows earlier detection than conventional assessment of left ventricular function.

Method: 64 AL-amyloid patients were retrospectively analysed and compared to 31 healthy controls. RV systolic function was assessed using conventional parameters including TAPSE and s' velocity, as well as 2-dimensional RV free wall strain.

Results: RV free wall strain (28.1 ± 2.8 vs $22.1 \pm 5.8\%$, $p < 0.0001$) and TAPSE (24.5 ± 3.7 vs 19.8 ± 4.7 mm, $p < 0.0001$) were reduced in amyloid patients; however TAPSE remained within normal limits. S' was not significantly different between groups (11.4 ± 2 vs 11.2 ± 2.8 cm/s; $p =$ NS). RV FWS correlated with LVEF, LV wall thickness and LV global longitudinal strain (GLS). However, RV GLS was significantly lower in AL patients with moderate to severe vs mild or normal LV wall thickness. Importantly, in 8 AL patients despite preserved LV GLS, a reduced RV strain was demonstrated (RV FWS <22%). RV FWS showed a higher sensitivity than both LV GLS and TAPSE.

Conclusion: RV strain demonstrated subclinical RV dysfunction in amyloid patients in whom conventional parameters remained normal. Additionally, 28% of patients with preserved LV function (GLS >17%) showed evidence of RV dysfunction.

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Right Ventricular Strain in the STEMI Population

S. Kazi[1,*], P. Geenty[1,2,3], D. Selvakumar[1], H. Klimis[1], A. Ferkh[1], J. Chong[1,2,3], L. Thomas[1,2,3]

[1] Westmead Hospital, Westmead, Australia
[2] The University of Sydney, Sydney, Australia
[3] Department of Cardiology, Westmead Hospital, Sydney, Australia

Introduction: Right ventricular (RV) dysfunction in STEMI increases morbidity and mortality; however, RV dysfunction is not routinely evaluated in these patients [1–4]. We sought to assess RV function after STEMI, with particular reference to different vascular territories, using RV free wall strain (FWS) on echocardiography.

Methods: Retrospective analysis of first presentation STEMI treated with primary PCI who underwent an echocardiogram within 1 week; a group of healthy controls used as comparators. RV FWS, TAPSE and S' velocity were measured.

Results: There were 58 STEMI patients and 31 controls. Mean age of the STEMI group was 60 years (76% males), mean door to reperfusion time was 72 mins and LVEF was >55% in 47%. Culprit artery was LAD in 36%, LCx in 14% and RCA in 31%. RV FWS was decreased in 64% of STEMI patients (RV FWS patients vs controls (-20.2 ± 5.6 vs $-28 \pm 2.8\%$, $p < 0.05$). When segregated based on target vessel, combining patients with LCx and RCA had 69% with abnormal RV FWS vs 59% in the LAD group. There was lower RV strain in those with an LVEF <55% (22% vs 15%) and no significant difference based on reperfusion time < or >90 mins (63% vs 65%). Of the STEMI patients with normal TAPSE and RVS', RV strain was abnormal in 66% and 62%, respectively.

Conclusion: Our results demonstrate subclinical RV dysfunction is present in STEMI patients irrespective of culprit vessel and may be the result of ischaemia in general. Follow up studies are needed to evaluate if early alterations in RV strain determine future adverse cardiac events.

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Safety and Efficacy of Computer Tomography Coronary Angiography (CTCA) in a Remote Centre for Outpatients Otherwise Requiring Invasive Coronary Angiography (ICA) for Chest Pain Assessment

V. Wilson [*], K. Johnson

Nelson Hospital, Nelson, New Zealand

Background: Recent guidelines recommend earlier utilisation of CTCA in assessing non-acute chest pain. There is potential to provide a functional service within remote centres where ICA would otherwise require transfer of outpatients to a secondary care centre.

This study assesses the quality, safety and efficacy in reducing follow-up investigations for outpatients undergoing CTCA at a remote New Zealand centre between May 2018 to January 2019 without a cardiologist on site.

Methods: Retrospective data were collected for patients undergoing CTCA in Blenheim hospital between May 2018 and January 2019. Patient selection criteria, quality of CTCA, adverse events and further follow-up or engagement with the service were analysed.

Results: 45 patients underwent imaging, 42% male with mean age 59 years. The mean Framingham risk was 10% (range <2.5% to >30%). 43 patients (96%) had prior functional testing, other testing or were unsuitable for stress testing. Mean heart rate at the time of scan was 58 beats per minute requiring 49 mg oral and 3 mg intravenous Metoprolol. Five (11%) patients had significantly impaired CTCA quality, two attributable to movement artefact and three to pericardial calcification. One patient had an adverse event related to bradycardia. 35 patients avoided further ICA and 18 patients were discharged from the service completely. There were no 30-day hospitalisations or re-referrals to the service for chest pain. All studies were reported by accredited CTCA cardiologists.

Conclusion: The remote CTCA service for outpatients provides equitable, patient focused care while exhibiting good quality control and significant reduction in ICA and follow-up requirements.

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Speckle Tracking Echocardiography Identifies Selective Regional Pattern of Strain Abnormalities and Propensity for Ventricular Arrhythmias in Patients with Non Ischaemic Cardiomyopathy

S. Trivedi [1,2,*], S. Kumar [1,2], L. Thomas [1,2]

[1] *Department of Cardiology, Westmead Hospital, Sydney, Westmead, Australia*
[2] *Westmead Clinical School, The University of Sydney, Sydney, Australia*

Background: Speckle tracking strain echocardiography (STE), namely alterations in left ventricular (LV) global longitudinal strain (GLS) and mechanical dispersion (MD), may identify patients with a predilection for ventricular arrhythmias (VA) in non ischaemic cardiomyopathy (NICM).

Hypothesis: We sought to determine if STE parameters are abnormal in NICM, and whether regional differences in strain patterns are associated with VA in these patients.

Methods: 2D strain analysis was performed in 22 consecutive NICM patients with VA (Group A), 22 NICM patients without VA (Group B), and compared to healthy controls (Group C).

Results: There was a statistically significant difference in GLS, MD and delta contraction duration (DCD) between controls and NICM patients (Table). When regional differences were assessed using the 18-segment model for those with and without VA (Group A vs. B), there were significant differences in strain in the basal septal (-7.2 ± 4.1 vs. -9.9 ± 4.2; $p = 0.05$) and mid inferior regions (-10.1 ± 6.0 vs. -12.7 ± 5.8; $p = 0.05$). There were no significant differences in strain in the other regions.

Conclusion: STE parameters are significantly abnormal in patients with NICM. Furthermore, in NICM patients with VA, STE is able to identify regional differences in strain localised to basal septal and mid inferior walls, both of which are well known cardiac fibrosis sites on electroanatomic voltage mapping. STE may be a useful non-invasive tool to identify NICM patients with a propensity for VA in virtue of differences in regional strain.

	Age (years)[*]	LVEF (%)[*]	LV GLS (%)[*]	LV MD (ms)[*]	DCD (ms)[*]
NICM with VA (Group A)	66 ± 10	41 ± 18	-13.2 ± 5.4	75 ± 34	247 ± 126
NICM without VA (Group B)	63 ± 11	41 ± 8	-12.8 ± 4.1	70 ± 26	225 ± 91
Healthy controls (Group C)	40 ± 12	64 ± 4	-21.0 ± 1.5	33 ± 9	113 ± 38

[*] $p < 0.05$.

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Subclinical Left Ventricular Dysfunction and Coronary Artery Disease: A Strained Relationship?

P. Venkataraman*, Q. Huynh, L. Wright, T. Marwick

Baker Heart And Diabetes Institute, Melbourne, Australia

Background: Subclinical disease evidences early pathology and may select for early intervention. CT coronary calcium scoring (CCS) shows that preclinical coronary artery disease (CAD) and echocardiography-derived abnormal global longitudinal strain (GLS), left ventricular hypertrophy (LVH) and diastolic dysfunction (DD) are markers of preclinical heart failure. We studied whether these disease entities overlap.

Methods: This sub-study of CAUGHT-CAD comprised community-recruited, asymptomatic and statin-naïve individuals, 40–70 yo with a family history of premature CAD. Participants underwent detailed clinical assessment, CT CCS and echocardiography. Subclinical CAD was defined as CCS >0. Subclinical LV dysfunction (Sub-LVD) by (a) DD: E/e'>15 or E/e' 10–15 with left atrial enlargement (LAVi >35 ml/m^2); (b) systolic dysfunction (SD) (GLS <16% or GLS 16–18% with LAE).

Results: 125 patients were studied with a mean age of 60, 69 (55%) were female and 63 (50%) had CCS >0. Sub-LVD was present in 12 (10%) with CCS >0 in 7, compared to 56 of 113 without LVD (58% vs 50%, $p = 0.78$). 11 of 24 participants had abnormal GLS (46% vs 51%, $p = 0.66$). With univariable analysis, older age, male sex and Framingham were associated with CCS >0 but not S-LVD.

Conclusion: Among pts >40 yo with risk factors, subclinical CAD and LVD are likely unrelated entities. Traditional CVD risks poorly stratify for subclinical LVD, and heart failure-specific scores may be more appropriate.

	CCS > 0 OR (95%CI)	Sub-LVD OR (95%CI)
Age	1.08 (1.06,1.10)	1.02 (0.64,1.10)
Male	2.33 (1.82, 3.00)	1.27 (0.44,3.63)
FRS	1.11 (1.05, 1.18)	1.03 (0.97,1.10)
BMI	0.99 (0.97, 1.02)	0.94 (0.83,1.07)

	0 CCS $n = 62$	+ CCS $n = 63$	p
Age	58 ± 7	58 ± 7	<0.05
FRS	9 ± 5	13 ± 9	<0.05
GLS	19 ± 2	20 ± 2	0.14
E/e'	7 ± 2	7 ± 2	0.51
LAVi	31 ± 11	31 ± 11	0.92
LVMi	74 ± 15	76 ± 17	0.55
S-LVD	4 (6%)	7 (11%)	0.36

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Surrogate Measurements to Simplify Regional Epicardial Adipose Tissue (EAT) Analysis

S. Binny[1,*], S. Joshi[1], E. Lui[2], C. Nalliah[1,3], J. Bui[2], J. Kalman[1,3]

[1] *Department of Cardiology, Royal Melbourne Hospital, Melbourne, Australia*
[2] *Department of Radiology, Royal Melbourne Hospital, Melbourne, Australia*
[3] *The University of Melbourne, Melbourne, Australia*

Introduction: Evidence is increasing that epicardial adipose tissue (EAT) is associated with coronary atherosclerosis and arrhythmias. Importantly, it appears that influence is greatest from the volume of localised EAT. However EAT analysis requires either semi-automated derived total EAT volume only or very time-consuming manual segmentation around particular structures of interest. We sought to determine whether simple axial linear measurements correlate with manually segmented regional EAT volumes or whether the dispersal of EAT is too variable between individuals.

Method: Regional analysis of EAT was undertaken on a cohort of 18 patients undergoing surgery to evaluate correlation between several regional EAT volumes, total EAT volume and several axial linear measurements to assess for correlation (Pearson). Manual segmentation was performed using Osirix software with 3 mm slices from a gated cardiac CT subdivided into 28 anatomical regions comprising the entire EAT volume.

Results: Correlations between specific regional EAT and axial dimensions (below).

	LM	LV	Proximal LAD	Distal LAD	RV	RCA	RAA	LCX	LAA
Correlation	0.85	0.79	0.78	0.66	0.66	0.64	0.60	0.47	0.42

Conclusion: The use of simple axial dimensions could potentially be used as a surrogate for regional EAT volumes of the left main, left ventricular free wall, proximal left

anterior descending (LAD), distal LAD, right ventricular free wall, right coronary and right atrial appendage but not for the circumflex or left atrial appendage based upon this cohort. This indicates that despite variable EAT dispersal certain defined axial measurements may provide a simple assessment of regional EAT volumes.

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The Effect of Atrial Fibrillation on Right Heart Function in Patients with Heart Failure with Reduced Ejection Fraction

H. Chen[*], B. Chiang, A. Bhat, D. Makarious, C. Ng, S. Khanna, G. Gan, T. Tan

Blacktown Hospital, Blacktown, Australia

Background: Left (LV) and right ventricular (RV) function are proposed to be intimately linked. We previously demonstrated that RV dysfunction increases with severity of LV dysfunction. Atrial fibrillation (AF) is an established cause of LV systolic dysfunction, but its effect on RV size and function in this population is not well characterised. We aim to evaluate the effect of AF on RV systolic function in a cohort of non-ischaemic cardiomyopathy patients.

Methods: We compared 64 consecutive patients in sinus rhythm (SR) with 32 patients in AF with stable HFrEF in the absence of coronary artery, significant valvular, congenital, or pulmonary disease. Patients in both SR and AF were categorised based on LVEF (mild 40–49%, moderate 30–39%, severe <30%). Standard and novel echocardiographic parameters of right heart were assessed. RV free wall peak systolic strain (RVFWS) was measured (TomTec Image Arena, Germany v4.6).

Results: Patients with SR (mean age 56 ± 19 y; 61% male), and AF (mean age 67 ± 11 y; 75% male) groups had similar proportions of patients in the mild, moderate and severe groups (SR: $n = 25$, 21, 18 vs AF $n = 10$, 12, 10, respectively). Conditional regression analysis revealed that patients with AF had significantly worse RV impairment compared to patients with SR as defined by RV fractional area change (RVFAC; $p < 0.001$) and RVFWS ($p < 0.001$) across all grades of LV impairment.

Conclusions: Our results demonstrate that AF is associated with worse RV impairment compared to patients in SR as defined by RVFAC and RVFWS. This highlights the potential benefits of restoration of SR in this cohort of HFrEF patients.

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The Role of Cardiac Imaging in Monitoring Response to Therapy in Anderson-Fabry disease: A Systematic Review

R. Perry[1,*], R. Shah[2], M. Saiedi[2], S. Patil[2], A. Ganesan[2], J. Selvanayagam[1]

[1] *Flinders Medical Centre, Bedford Park, Australia*
[2] *Flinders University, Bedford Park, Australia*

Background: Anderson-Fabry disease (AFD) is a rare X-linked inherited metabolic disorder, which results in a deficiency or absence of the enzyme α-galactosidase A, leading to the accumulation of glycosphingolipids in various cells and organs including the heart. Cardiac involvement is common and results in increased myocardial inflammation, left ventricular hypertrophy (LVH) and myocardial fibrosis. Due to the rarity of AFD the utility of cardiac imaging techniques in monitoring pharmacologic therapy has not been fully elucidated.

Methods: Using the MEDLINE database a search was performed by an experienced information specialist using the terms "Fabry disease," "enzyme replacement therapy" (ERT), "chaperone therapy' and "cardiac".

Results: Of 472 studies found 32 were included in this systematic review that included one or more imaging parameter prior to initiation of therapy and at least 6 months post therapy. Both echocardiographic (echo) and cardiovascular magnetic resonance imaging (CMR) looking at LV mass regression demonstrated that LVH at baseline is one of the best indicators for regression across all treatment regimes. Furthermore, the absence of replacement fibrosis, as determined by either echo strain imaging or the preferred technique of CMR late gadolinium enhancement (LGE) results in improved cardiac remodelling with treatment.

Conclusion: In patients with AFD the degree of cardiac change with therapy varies according to baseline level of LV mass and presence of cardiac fibrosis. This would indicate that treatment of the AFD cardiomyopathy is most effective prior to the development of myocardial fibrosis.

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The use of 2-Dimensional Strain Imaging for the Detection of Right Ventricular Dysfunction After Bone Marrow Transplantation Involving Anthracycline Chemotherapy

P. Geenty [1,*], T. Deshmukh [1,5],
S. Sivapathan [1,5], L. Geraghty [1,5],
D. Emmering [1,5], M. Hogg [2,5], L. Do [2,5],
S. Panicker [2,5], P. Brown [1,5], M. Altman [1,5],
D. Gottlieb [1,3,5], L. Thomas [1,3,4,5]

[1] *Department of Cardiology, Westmead Hospital, Westmead, Australia*
[2] *Department of Haematology, Westmead Hospital, Westmead, Australia*
[3] *University of Sydney, Sydney, Australia*
[4] *University of New South Wales, Sydney, Australia*
[5] *Westmead Private Hospital, Westmead, Sydney, Australia*

Background: 2D strain imaging detects subclinical myocardial dysfunction in a range of disease states; however strain analysis has largely been applied to the left ventricle.

Aims: We sought to evaluate RV function in bone marrow transplant (BMT) patients who have received anthracycline chemotherapy. Due to its thinner wall, we hypothesised that the right ventricle (RV) may show evidence of toxicity earlier, thus allowing earlier diagnosis.

Method: 68 BMT patients were retrospectively analysed; 47 patients had received anthracyclines. BMT patients were compared to 31 age and gender matched healthy controls. RV systolic function was assessed using conventional parameters including TAPSE, s' and RV fractional area change (FAC), as well as 2-dimensional RV free wall strain.

Results: TAPSE (21.1 ± 3.7 vs 24.5 ± 3.7 cm, $p = 0.001$), FAC (38.8 ± 5 vs $43.8 \pm 5\%$, $p < 0.0001$) and RV free wall strain (28.1 ± 2.8 vs $23.2 \pm 4.0\%$, $p < 0.0001$) were reduced in patients who had received anthracyclines compared with controls. Importantly, traditional RV function parameters failed to detect RV dysfunction as compared to RV free wall strain (i.e. 13 patients with preserved FAC and 12 patients with preserved TAPSE had reduced RV strain). Further, despite preserved LV function (LVEF >53% and GLS >17) a reduced RV GLS (<22%) was noted in 9 patients, all of whom had preserved FAC and TAPSE.

Conclusion: Traditional parameters of RV dysfunction were less sensitive than RV GLS strain to identify RV dysfunction. Additionally, RV function using strain identified RV subclinical dysfunction even in the absence of LV dysfunction.

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The Utility of Cardiovascular Magnetic Resonance in the Assessment of Patients before Pacemaker Implantation

Y. Situ [*], L. Lin, M. Namasivayam,
B. Watson, S. Emmanuel, A. Jabbour,
J. McCrohon, C. Holloway

St Vincent's Hospital Sydney, Darlinghurst, Australia

Background: The cause of cardiac conduction disturbance is often not determined before cardiac device implantation. Cardiovascular magnetic resonance (CMR) assesses cardiac structure and tissue characterisation, including fibrosis, though the value of routine CMR before a cardiac device is unknown.

Methods: Using CMR (1.5 Tesla), we performed an observational prospective study of 97 consecutive patients with a history of bradycardia, heart block, conduction disease and/or syncope prior to consideration of a pacemaker. We aimed to determine the incidence of cardiac abnormalities, and the relationship between late gadolinium enhancement (LGE) and incidence of device implantation. Statistical analysis was conducted using SPSSv25(IBM).

Results: CMR identified LGE in 37 patients, 28 of which had clinically significant CMR findings with previously undiagnosed: sarcoidosis ($n = 4$), old or acute myocarditis ($n = 11$), likely myocarditis or sarcoidosis ($n = 5$), myocardial infarction ($n = 3$), HCM ($n = 1$), DCM ($n = 2$), ARVC ($n = 1$) and Athlete's heart ($n = 1$). Of the 49 patients who received a cardiac device post CMR, 25 (51%) had myocardial LGE compared with 12 (25%) in the group without pacemaker ($p = 0.012$). In the group with pacemaker and LGE ($n = 25$), 21 (84%) had LGE in the interventricular septum which was strongly associated with pacemaker implantation ($p = 0.007$) and atrioventricular block ($p = 0.039$).

Conclusion: CMR identified a high rate of previously undiagnosed cardiac pathology in patients being considered for a pacemaker. The presence of LGE, particularly in the septum, was most associated with heart block and subsequent pacemaker implantation. CMR likely has a clinically significant role in routinely assessing patients before pacemaker implantation.

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Towards Clinical Application of 4D Flow MRI: A 2D/4D Quantitative Comparative Study

A. Elsayed [1,2,*], K. Gilbert [3], B. Pontre [1],
M. Nash [5], R. Doughty [4], M. Stubbs [4],
A. Young [6]

[1] *Department of Anatomy and Medical Imaging, Faculty of Medical and Health Sciences, University of Auckland, New Zealand*
[2] *Department of Anatomy and Embryology, Faculty of Medicine, Cairo University, Egypt*
[3] *Auckland Bioengineering Institute, New Zealand*
[4] *School of Medicine, Faculty of Medical and Health Sciences, University of Auckland, New Zealand*
[5] *Department of Engineering Science, Faculty of Engineering, University of Auckland, New Zealand*
[6] *Department of Biomedical Engineering, King's College London, United Kingdom*

Introduction: Current 2D MRI flow quantification is acquired during different breath holds, resulting in variations in cardiac output. 4D flow MRI is faster but in need of clinical validation and improved software to achieve widespread clinical application.

Objective: Comparison of velocity and volume measurements acquired from 2D MRI and echocardiography, with 4D flow MRI.

Methodology and Results: Twenty participants were imaged on a 1.5 T MRI, and SC2000 ultrasound. Stroke volume was measured using standard methods and compared with 4D flow. The two methods showed correlation for the left ventricular (ICC 0.864) and right ventricular outputs (ICC 0.904). The mean forward flow through the pulmonary valve was 91.55 ($\pm$19.17) ml/cycle measured with 4D and 99.32 ($\pm$22.9) ml/cycle measured with 2D ($p = 0.0006$, $r = 0.838$). The aortic valve flow was 91.82 ($\pm$19.90) ml/cycle with 4D and 87.77 ($\pm$23.5) ml/cycle measured with 2D ($p = 0.001$, $r = 0.771$). Lower agreement was seen when comparing 4D flow with echocardiography regarding peak velocity in the ascending aorta ($r = 0.335$). To test the accuracy of the acquisition, correlation between 4D flow volume in the main pulmonary, and the sum of the left and right branches was 0.965; the pulmonary to the aortic flow volumes showed excellent correlation of 0.927. Another test was the average regurgitant volume for 4D flow across all the planes in all vessels, which was 1.36 ml/cycle.

Conclusion: Stroke volume was accurately quantified using 4D flow MRI, it also enabled measuring peak velocities and regurgitant fractions.

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Use of Left Ventricular Strain imaging to Predict Long Term Heart Failure Risk in High Risk Patients

K. Haji [1,*], T. Marwick [2,4], C. Neil [1],
M. Carrington [2,4], S. Stewart [3,4], Y. Chan [4,4],
C. Wong [1,4]

[1] *Western Health, Melbourne, Australia*
[2] *Baker Heart and Diabetes Institute, Melbourne, Australia*
[3] *Monash University, Melbourne, Australia*
[4] *Australian catholic University, Melbourne, Australia*

Background: The increasing prevalence of heart failure (HF), due to hypertension, ischaemic heart disease, diabetes, obesity, and ageing population demands identification of an at-risk subgroup whom we could target on prevention strategies. In a cohort of patients at risk of HF (70% with CAD), 15% developed new HF hospitalisation or death. We sought whether advanced echo measure on deformation, global longitudinal strain (GLS) would predict HF admission over a long term follow up and thereby define an at-risk group.

Aim: To determine which of the LV morphology, function and deformation parameters best predict new HF admission or HF death in pts at risk but without prior diagnosis of HF.

Method: Echocardiograms (including measurement of LV, size, function, morphology and deformation) were obtained in 431 inpatients (mean age 65 ± 11, 72% male) at risk of HF. LV global longitudinal strain (GLS) and strain rate (GLSR) were measured offline (EchoPac, GE). Long term (9 years) follow up data were obtained via data linkage.

Results: 63 pts (15%) reached the end-point of HF admission or HF death. LV deformation showed a univariable association with outcome (Table). In multivariable analysis, including known significant predictors of outcome (age, sex, BMI, diabetes, hypertension), GLS < 18 remained an independent predictor (Table), in addition to age and DM at baseline. EF and LV mass were not predictors of heart failure.

Conclusion: GLS < 18 is independently associated with increasing new onset heart failure admission and HF mortality in patients at risk of HF.

	Univariate		Full adjustments		Full adjustments	
	HR (95% CI)	P value	HR (95% CI)	P value	HR (95% CI)	P value
Age	1.1 (1–1.1)	< 0.01	1.1 (1–1.1)	0.04	1 (1–1.1)	0.04
Sex	1.0 (0.6–1.7)	0.9	0.8 (0.4–1.8)	0.6	0.8 (0.4–1.8)	0.6
BMI	1.0 (1–1.1)	0.05	1 (0.9–1.1)	0.7	1 (0.9–1.1)	0.7
DM	2.6 (1.6–4.3)	< 0.01	2.7 (1.4–5.3)	<0.01	2.7 (1.4–5.2)	0.04
HTN	1.4 (0.8–2.3)	0.2	1.1 (0.6–2.2)	0.7	1.2 (0.6–2.2)	0.7
E/e′	1.1 (1.1–1.2)	< 0.01	1.1 (1–1.1)	0.04	1.1 (1–1.1)	0.06
LVMI	1.0 (1.0–1.0)	< 0.01	1 (0.9–1.0)	0.7	1 (0.99–1.0)	0.7
Impaired EF %	1.0 (0.9–1.0)	< 0.01	1 (0.9–1.0)	0.16	0.97 (0.94–1.0)	0.04
Diastolic dysfunction	2.3 (1.4–3.7)	< 0.01	0.8 (0.3–1.7)	0.5	0.7 (0.3–1.7)	0.5
GLS	1.3 (1.4–1.2)	< 0.01	1.1 (1–1.2)	0.07		
GLS < 18	5.3 (2.8–10.2)	< 0.01			2.3 (1.1–5.1)	0.04

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Using Markers of Left Ventricular Filling Pressure to Predict Mortality in Mild to Moderate Aortic Stenosis: Insights from the National Echo Database of Australia (NEDA)

L. Giudicatti [1,*], S. Burrows [2,3], G. Strange [4], D. Playford [4], G. Hillis [1,2]

[1] Royal Perth Hospital, Perth, Australia
[2] The University of Western Australia, Perth, Australia
[3] Harry Perkins Institute of Medical Research, Perth, Australia
[4] The University of Notre Dame, Fremantle, Australia

Background: Echocardiographic measures of elevated left ventricular filling pressure (LVFP) predict a worse prognosis in many conditions. We hypothesised that they would reflect the haemodynamic consequences of aortic stenosis (AS) and be useful in predicting survival in this setting. The current study tested this in patients with mild-moderate AS.

Objective: To determine the relationship between acute (ratio of early transmitral flow to mitral annular velocities; E/E′) and chronic (indexed left atrial volume; LAVI) markers of LVFP and mortality in mild-moderate AS.

Method: Retrospective analysis of data from the National Echo Database of Australia. The first record for patients >18 years showing mild-moderate AS (mean gradient 10–40 mmHg) or no AS (<10 mmHg) was included. Data on sex, age, examination date and death were also recorded.

Results: 134,500 patients were included; 53% male, mean age 63 years, mean follow-up 4.6 years, 25,929 (19%) mild-moderate AS and 108,571 (81%) no AS. The hazard ratio (HR) for mortality in mild-moderate versus no AS was 1.11 (95% CI 1.08–1.13), adjusted for age and sex. In mild-moderate AS, LAVI >34 ml/m^2 (HR = 1.96) and E/E′ >14 (HR = 2.15) were associated with an increased risk of death and remained independently predictive of survival (LAVI >34 HR = 1.26 and E/E′ HR = 1.45) in a multivariate model that also included age, sex and LV ejection fraction.

Conclusion: Our data confirm higher mortality associated with mild-moderate AS compared to no AS. Indices of LVFP independently predict death in this group and may be useful in risk-stratifying patients prior to developing severe AS.

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Utility of the Mitral Valve Doppler Velocity Index in Detecting Significant Mitral Regurgitation Post-Surgical Mitral Valve Repair

B. Anderson [*], G. Scalia, D. Burstow

The Prince Charles Hospital, Chermside, Australia

Background: The mitral valve (MV) Doppler velocity index (DVI) *(velocity time integral ratio of the continuous-wave MV and pulsed-wave left ventricular outflow tract (LVOT) measurements)* is useful in the detection of MV prosthesis dysfunction (stenosis or regurgitation). The value of this Doppler velocity index (DVI) in the detection of significant mitral regurgitation (MR) post-surgical MV repair is investigated in this large dataset.

Methods: A retrospective database search for surgical MV repair transthoracic echocardiograms performed between 2004 and 2019 at the Prince Charles Hospital was executed. Two groups (Group 1 - moderate or more MR and Group 2 - trace or no MR) were compared. DVI was calculated in studies with no or trace aortic regurgitation and no significant LVOT or MV obstruction. For Group 2, studies with a mean MV pressure gradient >3 mmHg were also excluded.

Results: Of 7,739 MV repair studies in the database, 1,303 studies in 728 patients (aged 62 ± 17 years, 67% males) met the study criteria. There were 561 studies in Group 1 and 741 studies in Group 2. There was a significant difference in DVI between Group 1 (2.21 ± 0.68) and Group 2 (1.92 ± 0.48, $p < 0.0001$). The receiver operator curve (ROC) analysis identified a cut-off of 2.13 for differentiating between Groups 1 and 2 with a sensitivity and specificity of 51.69% and 70.72%, respectively and an area under the curve (AUC) of 0.634.

DVI
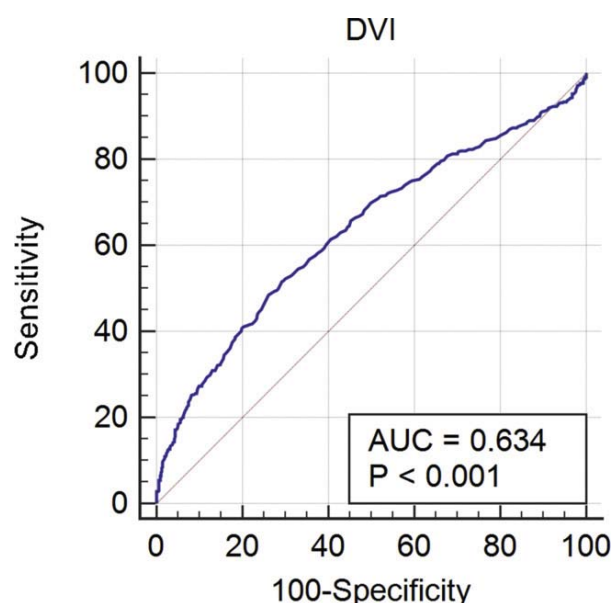
Conclusions: A DVI >2.13 may be useful in detecting significant MR following MV repair, especially when MR severity is difficult to evaluate by traditional methods.

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Utility of Transthoracic Echocardiograms in Patients with Chronic Kidney Disease Living in Western Sydney

I. Wen [1,2,*], K. Gu [1,2], A. Bhat [1,2,3],
H. Chen [1,2], M. Kayes [2], G. Gan [1,2,3,4]

[1] Western Sydney University, Sydney, Australia
[2] Department of Cardiology, Blacktown Hospital, Sydney, Australia
[3] University of New South Wales, Sydney, Australia
[4] Department of Cardiology, Westmead Hospital, Sydney, Australia

Background: Chronic Kidney Disease (CKD) is associated with adverse cardiac remodelling, most notably left ventricular (LV) hypertrophy and LV diastolic dysfunction, [1–3] the presence of which has been associated with adverse cardiovascular outcomes [4]. Despite this, transthoracic echocardiography (TTE) is not routinely performed in this population, limiting opportunities for early effective intervention. The aim of our study was to evaluate local trends in utility of TTE studies in patients with CKD.

Methods: Patients attending the Nephrology Clinics at Blacktown Hospital from Jan-2014 to Dec-2016 were evaluated. Patients who were referred for TTE studies in the course of their care were assessed and the indications for referral were categorised and evaluated.

Results: 1179 patients (mean age 66.47 ± 16.88; 55% males) were assessed of which 386/1179 (33%) received TTE studies. The most common indication for TTE referral was for evaluation of dyspnoea 178/386 (46%) followed by evaluation of

cardiac function following acute coronary syndrome ($n = 129$, 32%). In patients with dyspnoea, 147/178 (83%) patients had clinical findings of fluid overload on clinical assessment and 95/178 (53%) had findings of impaired LV systolic function (LVEF< 50%) on TTE. Other indications for TTE referral include arrhythmia ($n = 30$, 8%), evaluation of cardiac murmur ($n = 21$, 5%), pre-operative evaluation ($n = 11$, 3%) and sepsis ($n = 26$, 7%) A total of 177/386 (45.9%) patients had more than 1 TTE, with 100/386 (25.9%) having 2 or more TTE within 12 months.

Conclusions: Our findings suggest that TTE studies are commonly performed in patients with CKD and for various indications, but with a significant proportion of studies occurring only after an adverse cardiovascular outcome.

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Validation of ASE/EACVI Guideline Cut Off Values of Diastolic Dysfunction by Using CATHARSIS Data

S. Adusumalli [1,2,*], K. Lau [1,2], M. Savage [1,2],
D. Burstow [1,2], G. Scalia [1,2]

[1] The Prince Charles Hospital, Chermside, Australia
[2] University of Queensland, Brisbane, Australia

Objective: To validate the parameters used to determine diastolic dysfunction according to American Society of Echocardiography and the European Association of Cardiovascular Imaging (ASE/EACVI) guidelines comparing to standard left ventricular end diastolic pressure (LVEDP) measured during cardiac catheterisation as part of the CATHARSIS trial.

Method: We measured standard diastolic parameters including TR Vmax, E/e', indexed LA volume (iLAV), septal and lateral e' velocity in 306 patients. These measurements were compared against LVEDP. The echocardiographic parameters were measured within 3 hours prior to the cardiac catheterisation.

Results: Despite lack of linear correlation with standard diastolic parameters with LVEDP, there was a statistically significant relationship with LVEDP with TR Vmax >2.8 m/sec (p value 0.01) and E/e' <14 (p value 0.02). No significant relationship was found with E/A, iLAV, lateral and septal e'.

Conclusions: We demonstrated a significant relationship between standard echocardiographic diastolic parameters such as TR Vmax and E/e′ with invasively measured LVEDP but not with other parameters iLAV, E/A, septal and lateral e′.

Diastolic Parameter	Mean LVEDP (mmHg)	P Value
TR Vmax >2.8 m/sec	18.44	0.0101
TR Vmax <2.8 m/sec	15.60	
E/e′ <14	**15.78**	**0.0185**
E/e′ >14	**18.38**	
iLAV <34 mls/m^2	15.60	0.1331
iLAV >34 mls/m^2	16.72	
E/A >2	**18.50**	**0.1214**
E/A <2	**16.01**	
Lateral e′ < 10 cm/s	16.00	0.37
Lateral e′ > 10 cm/s	16.00	
Septal e′ < 7 cm/s	**16.00**	**0.711**
Septal e′ > 7 cm/s	**16.00**	

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Vortex Visualisation and Qualitative Assessment Using 4D Flow MRI

A. Elsayed [1,2,*], K. Gilbert [3], B. Pontre [1], M. Nash [5], R. Doughty [4], M. Stubbs [4], A. Young [6]

[1] *Department of Anatomy and Medical Imaging, Faculty of Medical and Health Sciences, University of Auckland, New Zealand*
[2] *Department of Anatomy and Embryology, Faculty of Medicine, Cairo University, Egypt*
[3] *Auckland Bioengineering Institute, New Zealand*
[4] *School of Medicine, Faculty of Medical and Health Sciences, University of Auckland, New Zealand*
[5] *Department of Engineering Science, Faculty of Engineering, University of Auckland, New Zealand*
[6] *Department of Biomedical Engineering, King's College London, United Kingdom*

Introduction: Alterations in flow patterns are believed to be a cause of some pathological consequences of irreversible cardiac modelling and have recently gained interest. 4D flow MRI is a faster, single acquisition, with no breath holds and is recently moving towards clinical settings.

Objective: Visualisation and qualitative assessment of vortices in the cardiac chambers and large vessels with 4D flow MRI

Methodology and Results: Twenty subjects were imaged with a 1.5T MRI at a Velocity encoding (VENC) of 150 and 50 cm/s and visualised using 4D Flow Demonstrator V2.3 (Siemens AG, Erlangen, Germany). Flow through particle traces from emitter planes in the pulmonary arteries (main, right and left), the aorta and big veins was observed. Right atrium showed a clockwise vortex during systole in rapid filling phase from the superior and inferior vena cava (A), flow went directly up the outflow tract towards the pulmonary artery (B) with minimal flow in the apex of the right ventricle. Organised flow was observed in most cases up the aorta and pulmonary arteries. Vortices in the left atrium were more complex with a dominating anteroposterior clockwise vortex (C). Filling through the mitral valve (D) was with a sub-mitral clockwise vortex that reached the ventricular apex (E). VENC using a single value of 150 cm/s is acceptable in flow visualisation in the large arteries. Lower VENC is suggested for visualisation of intraventricular flow vortices.
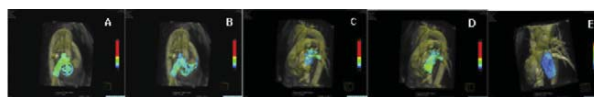
Conclusion: Visualisation of intracardiac vortices is feasible with a high potential of qualitative assessment via the current software.

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Which is the Best Measure of Left Atrial Size Following Myocardial Infarction: Minimal or Maximal Volume? Insights from Prognostic and Haemodynamic Validation

S. Prasad, K. Guppy-Coles, T. Stanton, R. Krishnaswamy, J. Armstrong, G. Whalley, J. Atherton, L. Thomas *

Royal Brisbane And Women's Hospital, Brisbane, Australia

Background: The inter-relationships between minimal and maximal left atrial volume index (LAVI), left ventricular filling pressures (LVFP) and survival have not been well studied. This study aimed to compare LAVImin with LAVImax with respect to (i) relative prognostic value, and (ii) correlation with left ventricular end-diastolic pressure (LVEDP), in patients with myocardial infarction (MI).

Methods: Retrospective study of 419 consecutive patients with a first-ever MI. LAVImax and LAVImin were determined using Simpson's method from echocardiography performed the day after admission. LAVmin ≥18 mls/m^2 and LAVImax ≥34 mls/m^2 were considered enlarged. The primary endpoint was composite MACE (death/MI/heart failure). Correlation between LVEDP and LAVI was assessed in 120 patients who underwent echocardiography and cardiac catheterisation either simultaneously ($n=30$) or same-day ($n=90$).

Results: At a median follow-up of 24 months, there were 61 MACE events. On Cox proportional hazards multivariate analysis incorporating significant clinical predictors and

LVEF, LAVImin $\geq$18 mls/m^2 (HR 3.15 [95% CI 1.70–5.54], $p < 0.001$) showed a stronger association with outcome than LAVImax $\geq$34 mls/m^2 (HR1.79 [95% CI 1.02–3.14], $p = 0.041$). Intermodel comparisons of the model χ^2 and Harrell's C-statistic confirmed superiority of LAVImin. In the invasive cohort, whilst LAVImin and LAVImax had a similar correlation with LVEDP $\geq$15 mmHg ($r = 0.41$ [$p < 0.001$] versus $r = 0.42$ [$p < 0.001$]), LAVmin $\geq$18 mls/m^2 had a greater sensitivity for LVEDP $\geq$15 mmHg than LAVImax $\geq$34 mls/m^2 (sensitivity 59.4% versus 34.4%).

Conclusions: Using thresholds of $\geq$18 and $\geq$34 mls/m^2 respectively, LAVImin was a better predictor of survival than LAVImax, the pathophysiologic basis of which relates to LAV-Imin having improved sensitivity for detection of elevated LVFP. There could be incremental clinical value in measuring LAVImin alongside LAVImax.

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Who should be Screened for Subclinical Myocardial Dysfunction?

Q. Huynh [1,*], A. Venn [2], C. Magnussen [2], T. Marwick [1]

[1] *Baker Heart And Diabetes Institute, Melbourne, Australia*
[2] *Menzies Institute for Medical Research, Hobart, Australia*

Background: Detection of subclinical left ventricular (LV) dysfunction requires echocardiography, but it is unclear in whom and when screening should be performed.

Methods: This study assessed 617 young adults (aged 26–36 years) and followed for 13 years. Physical measurements, biochemistry and questionnaire were done at both baseline and follow-up. Echocardiogram was done at follow-up to detect reduced global longitudinal strain (GLS>-18% in 109/617 participants), LV hypertrophy (LVH in 60/617), dilated left atrium (LA volume index >34 in 291/617) and increased LV filling pressure (E/e' >8 in 35/617).

Results: Measurements at follow-up were generally stronger than those at baseline in predicting abnormal myocardial function and structure. Sex, body mass index (BMI), education and heart rate (HR) at both baseline (C-statistic = 0.75 [0.70, 0.80]) and follow-up (C-statistic = 0.78 [0.74, 0.83]) predicted reduced follow-up GLS with very good discrimination. BMI, cardiorespiratory fitness (CRF), education, HR and mean pressure at both baseline (C-statistic = 0.73 [0.66, 0.80]) and follow-up (C-statistic = 0.74 [0.67, 0.80]) also had good discrimination in predicting LVH. Sex, CRF and HR at baseline (C-statistic = 0.67 [0.62, 0.71]) and follow-up (C-statistic = 0.70 [0.65, 0.74]) predicted dilated LA with fair discrimination. Age, sex and BMI at baseline (C-statistic = 0.67 [0.59, 0.75]) and age, BMI and mean arterial pressure at follow-up (C-statistic = 0.70 [0.61, 0.80]) predicted increased LV filling pressure with fair discrimination.

Conclusions: Asymptomatic myocardial disease may be detected in substantial numbers of apparently healthy middle-aged individuals. Prediction models derived from simple clinical and demographic variables are helpful in identifying individuals likely to have asymptomatic disease detectable with echocardiography.

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Clinical Cardiology/Clinical Trials (336–451)

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A Comparison of Cardiologist and Intensivist Clinical Assessment in Determining Type 1 Versus Type 2 Myocardial Infarction in a Critical Care Setting

S. Sivapathan [1,2], P. Jeyaprakash [1,2,*], K. Ellenberger [1,2], S. Orde [1,2], F. Pathan [1,2]

[1] *Nepean Hospital, Kingswood, Australia*
[2] *University of Sydney, Sydney, Australia*

Introduction: High sensitivity troponin has been critical in detecting both thrombotic myocardial injury (type 1 MI), and non-thrombotic myocardial injury (type 2 MI) caused by demand ischaemia. However, non-specific troponin elevation in critical care settings creates a diagnostic dilemma in balancing the increased risks of invasive coronary assessment against misdiagnosis and incomplete revascularisation. Making this distinction relies on clinical assessment; however there is significant anecdotal discrepancy between cardiologists and intensivists. We sought to determine the accuracy of clinical assessment between these two groups in categorising type 1 versus type 2 MI.

Method: Forty clinical vignettes comprising cardiac history, electrocardiograms, and echocardiograms were presented to a group of blinded cardiologists ($n = 9$) and intensivists ($n = 7$). Participants were asked to predict likelihood of type 1 MI for each case on a 10-point Likert scale. This was compared against further definitive investigation including coronary angiograms and/or serial echocardiography.

Results: There was strong average inter-class correlation within cardiology and intensive care groups of 0.82 and 0.85 respectively. Comparing Likert scores to definitive cardiac investigations, cardiology had a sensitivity of 83.3% and specificity of 55.9% for diagnosing type 1 MI, compared to 83.3% and 73.5% for intensivists. The ROC curve analysis showed no significant difference between the two groups ($p = 0.4$).

Conclusion: This study highlights the limitation of reliance on clinical assessment alone in stratifying types of myocardial injury, and that additional non-invasive tests are required. While there was a higher pre-disposition for intensivists to score troponin elevation as type 1 MI, this was not statistically significant.

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A District Wide ACS Dataset

L. Savage, M. Price, T. Williams, F. Dee*,
P. Collard, H. Orvad

*Hunter New England Health, Newcastle,
Australia*

Introduction: The ECG is the initial diagnostic tool in the management of Acute Coronary Syndrome. The ability for expert review over large distances has been challenging for Cardiology services. The ability to store and review ECG for clinical changes over time has also been problematic. Hunter New England Local Health District (HNELHD) collects over 70,000 ECG per annum via 28 hospitals across an area the size of England.

Objectives: To develop a District wide ECG collection and storage system where download and review of ECG across all facilities is possible within a very short time interval.

Method: A collaborative team with representatives from Information Technology, Cardiology, the ECG company (Mindray) and led by Biomedical Engineering was established. Seventy-five ECG machines were purchased with bar-code scanning to allow immediate and complete patient identification. The ECG devices were placed in all 28 Emergency departments in HNELHD. All were connected to the Districts wireless network and set to automatically download into a central storage system.

Results: All hospitals in HNELHD are now able to undertake immediate review of Patients' ECG regardless of collection facility. Patients' serial ECG are able to be assessed irrespective of collection location. Further developments may see possible use of this system as a tool in STEMI management service.

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A MicroRNA Signature Modulated by Colchicine in Acute Coronary Syndrome Patients

J. Barraclough [1,2,3,*], M. Joglekar [4],
A. Januszewski [4], G. Martínez [1,2,3,5],
D. Celermajer [1,2,3], A. Keech [1,4],
A. Hardikar [4], S. Patel [1,2,3]

[1] *Cardiology Department, Royal Prince Alfred
Hospital, Camperdown, Australia*
[2] *Heart Research Institiute, Newtown, Australia*
[3] *Sydney Medical School, University of Sydney,
Camperdown, Australia*
[4] *NHMRC Clinical Trials Centre, Faculty of
Medicine and Health, The University of Sydney,
Camperdown, Australia*
[5] *Division of Cardiovascular Diseases, Pontificia
Universidad Católica de Chile, Santiago, Chile*

Background: Circulating microRNAs (miRNAs) may play a pathogenic role in acute coronary syndromes (ACS). We simultaneously profiled miRNA levels across three sites in ACS patients treated with standard therapy or with standard therapy and colchicine 6–24 hrs prior to angiography.

Methods: 754 miRNAs were quantified by TaqMan[TM] real-time polymerase chain reaction from EDTA-plasma in a discovery cohort of 15 patients ($N = 3$ controls, $N = 6$ ACS standard therapy, $N = 6$ ACS standard therapy plus colchicine). Expression levels of circulating microRNAs from the discovery cohort were analysed using ANOVA across groups to identify a set of 51 most differentially regulated miRNAs ($P < 0.01$). These 51 miRNAs formed our custom panel, to assess expression of these selected miRNAs in a validation cohort of 92 patients ($N = 13$ controls, $N = 40$ ACS standard therapy, $N = 39$ ACS standard therapy plus colchicine). Plasma samples were simultaneously obtained from the coronary sinus, aortic root and right atrium of all study participants.

Results: Thirty miRNAs were higher in ACS standard therapy patients compared to controls (fold change >1.5; $P < 0.05$). Interestingly, seven of these miRNAs higher in ACS returned to levels seen in control subjects after colchicine treatment (fold change >1.5; $P < 0.05$). Three of these miRNAs were identified as key regulators in inflammatory pathways. In both cohorts, miRNAs were comparable across sampling sites.

Conclusion: The levels of specific microRNAs elevated in ACS returned to levels similar to control individuals with colchicine therapy. These miRNAs may mediate ACS (via inflammatory pathways) or increase post-ACS risk, and could be potentially used as biomarkers of treatment efficacy in ACS.

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A Prospective Audit of Inpatient Cardiology Consults in a Major Tertiary Centre

Z. Al Falahi*, N. Nguyen Nguyen, S. Lo

Liverpool Hospital, Warwick Farm, Australia

There is paucity of data regarding the inpatient consults service provided by cardiology units despite its importance. A prospective audit with all consecutive formal consults performed by the primary authors (292 patients) were audited over three separate months and grouped into referral indications.

There was an average of 100 consults per month. Medical subspecialties constituted (62%) of consults, most commonly Geriatrics (16%) and Pulmonology (16%), followed by Nephrology (14%), General Medicine (13%) and Gastroenterology (12%). Surgical specialties constituted (37%) of consults, most commonly by Vascular Surgery (23%), Orthopaedics (21%) and Cardiothoracics (12%).

Across the spectrum, atrial fibrillation management (new or known) was the most common referral (16%), followed by Heart Failure management (New, known or suspected) (13%), interpretation of incidentally raised troponins (12%), preoperative assessment (10%) and medication management (inc. antithrombotics) (9%). From the medical teams, the most common referrals were heart failure management (18%), medication management (15%) and interpretation of raised

troponins (13%). From the surgical teams, the most common referrals were AF management (25%), preop assessment (17%) and syncope workup (9%). A majority of consult patients (58%) are already managed by a Cardiologist in the community. Data collection is ongoing.

Conclusion: Cardiology consults is a busy service. The majority of referrals relate to common indications with extensive published literature. Improved outcomes vs delays to patients' journey is difficult to quantify. Establishing local guidelines for common questions within a consults framework could empower teams and facilitate relevant data collection and decision-making for consulting teams.

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A Retrospective Analysis of Remote Monitoring Alerts for Atrial Fibrillation: Implications for Anticoagulation

C. O'Shea [1,2,3,*], A. Brooks [1], K. Campbell [1], J. Hendriks [1,2], D. Lau [1,2,3], P. Sanders [1,2,3]

[1] Centre for Heart Rhythm Disorders, University of Adelaide, Adelaide, Australia
[2] Royal Adelaide Hospital, Adelaide, Australia
[3] South Australian Health & Medical Research Institute, Adelaide, Australia

Background: Remote monitoring (RM) allows for the early detection of both subclinical and symptomatic atrial fibrillation (AF), providing an opportunity to evaluate the need for anticoagulation for stroke prevention.

Objective: To assess AF alerts in a large RM patient cohort, and impact on anticoagulation status.

Methods: We performed a retrospective analysis of 12,521 consecutive patients who underwent RM during a six-month window in 2018, via an automated software system, with rapid alert processing. Analysis included device type, all AF alerts, and anticoagulation status. Anticoagulation status at the time of RM enrolment was unknown but was intermittently updated following each AF alert transmission.

Results: 2112 patients (16.9% of the cohort) transmitted 5771 AF alerts. At the end of the six-month window, 64.3% of patients with AF alerts were anticoagulated. 48% of patients with AF alerts were aged ≥75 years (minimum CHA2DS2-VASc score of 2); 329 (32.4%) of whom remained unanticoagulated. 21.4% of patients with AF alerts were aged 65 to 74 years, with an implantable defibrillator in situ (likely to reach the CHA2S2-VASc threshold for anticoagulation due to underlying heart failure); however, 181 (40.1%) of these patients remained unanticoagulated.

Conclusions: In a large RM patient cohort, AF alerts accounted for 28.4% of all alerts over a six-month period. Despite participation in an intensively managed automated RM software system, a significant proportion of patients with increased stroke risk remained unanticoagulated after an AF alert. These data highlight the need for the development of clinical response pathways and an integrated care approach to RM.

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A Study of Patient Satisfaction and Uncertainty in a Rapid access Chest pain Clinic

R. Lembo [1], J. Gullick [2], C. Chow [3], G. Figtree [1,4,5], R. Kozor [1,4,5,*]

[1] Sydney Medical School (Northern), incomplete faculty in 341, Sydney, Australia
[2] Sydney Nursing School, Faculty of Medicine and Health, University of Sydney, Sydney, Australia
[3] Department of Cardiology, Westmead Hospital, Sydney, Australia
[4] Kolling Institute, Northern Sydney Local Health District, Sydney, Australia
[5] Department of Cardiology, Royal North Shore Hospital, Sydney, Australia

Australian hospitals are beginning to establish outpatient rapid access chest pain clinics (RACC) as a new clinical pathway. These clinics aim to provide an alternative to inpatient care for timely access to specialist cardiology assessment whilst improving quality of care and experience. An understanding of overall patient satisfaction can be considered a marker of overall clinical success, contributes to cost-effectiveness, and is needed to develop improvement strategies. This study aims to evaluate patient uncertainty, satisfaction and experience among patients treated in an RACC.

Methods: All consecutive patients presenting with troponin negative intermediate risk chest pain treated in a new RACC in a public quaternary teaching hospital over a 12-month period were invited to participate in two core components: A paper-based questionnaire, and a one-month follow-up telephone conversation. Patient satisfaction and uncertainty were assessed by the short form of the Mishel Uncertainty in Illness Scale and Picker Dimension of care.

Results: There was a 51.2% response rate (190/371). Patients ranged in age from 20 to 89 years (56.4 ± 13.6 years) and 47% were female. Findings illustrated a global high level of satisfaction in all areas: care, comfort, communication and engagement, with low levels of uncertainty in illness experienced by patients.

Conclusion: There were high levels of satisfaction and minimal uncertainty for patients in the RACC during the study period. Results provided valuable insight into overall satisfaction and have formed part of the formal cost-effectiveness assessment of the RACC used to support its transition from a pilot implementation to standard of care.

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A Suggested Clinical Approach for the Diagnosis and Management of 'Statin Intolerance'

A. Sivashanmugarajah [1,2,*], J. Fulcher [1,2], D. Sullivan [3], A. Jenkins [1,4], A. Keech [1,2]

[1] National Health and Medical Research Council (NHMRC) Clinical Trials Centre, University of Sydney, Camperdown, Sydney, Australia
[2] Royal Prince Alfred Hospital, Camperdown, Sydney, Australia
[3] NSW Health Pathology, Royal Prince Alfred Hospital, Camperdown, Sydney, Australia
[4] Department of Endocrinology and Diabetes, St. Vincent's Hospital, Fitzroy, Melbourne, Australia

Background: HMG-CoA reductase inhibitors ("statins") are first-line drugs used for management of hyperlipidaemia, a major risk factor for cardiovascular morbidity and mortality [1]. For each 1.0 mmol/l reduction in low-density lipoprotein cholesterol (LDL-C), statins curb major vascular events by 21% and all-cause mortality by 9% [2]. While statins offer major cardiovascular disease (CVD) risk reduction and a generally excellent safety profile, their widespread use and common misconceptions have resulted in frequent labelling of patients as 'statin intolerant', of whom only a subset may be truly intolerant.

Methods: We searched databases (PubMed, Embase, CINAHL, Scopus and Cochrane Database of Systematic Reviews) for original and review articles published between 1980 – 2019. Search strategies included MeSH terms and keywords associated with "cardiovascular disease", "statin intolerance" and "alternative therapies". Recent guidelines and specialist experience were also sought to conduct a narrative review.

Results: Although there is clinical consensus for diagnosing rare side effects such as rhabdomyolysis, confirming that statins cause less common side effects (e.g. memory impairment) has proven difficult. Moreover, there is as yet no strong randomised trial evidence for nearly all these other potential side effects, despite statins being widely investigated globally. A step-wise approach to possible statin intolerance, using consistent definitions and a simple flowchart that we have formulated, will enable better diagnosis and management.

Conclusions: Outcomes from this project may potentially enable patients with an established CVD risk to adhere better to statin therapy and subsequently improve cardiovascular outcomes. Potential treatment strategies are emerging including intermittent dosing regimens, emerging drugs and nutraceuticals.

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A Systematic Review and Descriptive Analysis of Acute Dissection of the Proximal Aorta Presenting as Acute Pericarditis

S. Eather [1,2,*], B. I'Ons [2]

[1] St Vincent's Hospital Sydney, Darlinghurst, Australia
[2] Department of Forensic Medicine, Wollongong Hospital, Wollongong, Australia

Introduction: Acute aortic dissection (AAD) is a rare cause of pericarditis[1]. Intrapericardial rupture of the proximal aorta leads to pericardial effusion and tamponade. Early, or impending rupture, may present as pericarditis with blood tracking into the pericardial space causing irritation.

Method: A systematic literature review was performed. All case reports published in English of AAD presenting as pericarditis were included in a descriptive analysis of clinical data.

Results: Eighteen cases published between 1956–2017 were identified. 71% were male. Median age was 37 years. All presented with chest pain, 15 (83%) described "pleuritic" chest pain. 6 (33%) described pain radiating to either back, jaw, shoulder or arm. 9 (50%) had a pericardial friction rub and 6 (33%) had a diastolic murmur. Of the 16 cases with an electrocardiogram, 15 (94%) showed an abnormality, 11 (69%) had diffuse ST elevation. Transthoracic echocardiogram (TTE) was reported in 13 cases, pericardial effusion was present in 10 (77%), dilated aortic root in 6 (46%), aortic valve insufficiency in 5 (38%) and a dissection flap in 3 (23%). Diagnosis was made at autopsy in 10 (55%) cases, aortography in 3 (17%), TTE in 3 (17%), intraoperatively in 1 (6%) and Computed Tomography in 1 (6%) case. Of the 8 diagnosed pre-mortem, 6 (75%) survived to discharge. Median time from symptoms to diagnosis or death was 5 days (range 1 day to 6 months).

Conclusion: AAD presenting as pericarditis has mainly been reported in young men and is associated with heterogeneous clinical findings and delay in diagnosis.

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A Systematic Review of Early Hospital Discharge Following Successful Reperfusion of ST Elevation Myocardial Infarction

K. Hyasat[1,*], K. Singh[2]

[1] *The Prince Charles Hospital, Brisbane, Australia*
[2] *Gold Coast University Hospital, Gold Coast, Australia*

Background: Early reperfusion strategy has led to a reduction in the mortality of ST elevation myocardial infarction (STEMI) patients. The reduction in the length of hospital stay (LOS) in successfully reperfused STEMI patients is due to lower post-infarct complications. However, the optimal LOS in STEMI patients is not clear. We assessed the safety and feasibility of early discharge (ED) among STEMI patients.

Methods: A computer-based search was performed using 4 major databases. We only included studies utilising either invasive or pharmacological reperfusion strategy. The 30-day outcome of all-cause mortality, rehospitalisation, stroke or reinfarction was analysed.

Results: Six randomised controlled trials (RCTs) and five observational studies were included. The LOS in the ED group varied among studies (24–96 hours). Overall analysis demonstrated a lower 30-day all-cause mortality in the ED group (OR 0.46, 95% CI 0.34–0.62, $p < 0.00001$), which remained significant when analysing studies with LOS <48 hours. There was no difference in the 30-day rehospitalisation rate (OR 1.19, 95% CI 0.88–1.59, $p = 0.26$) or re-infarction rate (OR 0.58, 95% CI 0.17–1.97, $p = 0.39$). The stroke rate was lower in the ED group (OR 0.47, 95% CI 0.28–0.78, $p = 0.004$). There was a trend towards lower rehospitalisation with radial access and higher rehospitalisation with smoking status of patients.

Conclusion: ED of successfully treated STEMI patients is safe. Low risk patients can be safely discharged within 48 hours of the STEMI reperfusion.

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Acute Coronary Syndromes (ACS) in Western Sydney: 1-year follow-up of ACS patients at Blacktown Hospital

J. Ravindran*, R. Talisayon, A. Bhat, S. Khanna, K. Garikapati, H. Chen, G. Tsihlis, A. Latumahina, G. Hall, G. Gan, B. Changsiri, D. Burgess

Department of Cardiology, Blacktown Hospital, Blacktown, Australia

Background: Ischaemic heart disease (IHD) is a major cause of death in Western society. While improvements in the field of cardiology have reduced high morbidity and mortality rates, ACS is still associated with a significant healthcare burden with regards to hospital re-presentations and chronic cardiac care. The aim of this study was to evaluate the re-presentations of ACS patients to Western Sydney Hospitals and the factors predisposing them.

Methods: ACS patients who underwent angiography between January 2014–2018 at Blacktown Hospital were followed up for 12 months. Re-presentations to local network hospitals along with cardiovascular events were retrospectively evaluated.

Results: A total of 1268 ACS patients were followed up for 12 months post-angiography via hospital records. Of these, 336 patients had at least one cardiac re-presentation and 74 patients had re-infarctions. Excluding miscellaneous reasons, common re-presentations included undifferentiated chest pain (23%), NSTEACS (7%) and heart failure (6%). Sex, ACS type, in-hospital interventions/complications had no impact on re-presentations. However, old age ($p < 0.01$), history of IHD ($p < 0.001$) or heart failure ($p < 0.005$) and diabetes ($p < 0.05$) were associated with increased cardiac re-presentations. Furthermore, smokers were likely to re-present for all-cause cardiac events ($p < 0.05$), while patients with hypertension had increased repeat ACS events ($p < 0.05$).

Conclusion: Hospital re-presentations in the intermediate period following an ACS event is common. Our results suggest that several modifiable risk factors are associated with repeat cardiovascular re-presentations and events. Management of predisposing cardiac risk factors and substrates for accelerated atherosclerosis presents an avenue for a reduction in hospital re-presentations.

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Administration of Geranylgeraniol in a Rodent Model of Statin-Induced Myalgia Prevents Skeletal Muscle Damage Without Adversely Affecting Cardiovascular Performance

J. Irwin

Central Queensland University, North Rockhampton, Australia

Several *in vitro* studies have identified that the administration of geranylgeranyl pyrophosphate (GGPP) can prevent statin-induced damage in skeletal muscle cells. The depletion of GGPP by statins in cardiac tissue, however, is postulated to be important in mediating the pleiotropic benefits of these medications. Accordingly, the aim of this study was to determine whether GGPP supplementation is feasible for the management of statin-associated muscle symptoms (SAMS) *in vivo*, or if the co-administration of this compound may compromise the cardio-protective effects of statins. Young (12-week old) female Wistar rats were randomised to one of four treatment groups: control, control with geranylgeraniol (GGOH) (the precursor of GGPP), simvastatin ($80\,mg\,kg^{-1}$) or simvastatin with GGOH. *Ex vivo* assessment of skeletal muscle force production was conducted in isolated muscles of varying fiber composition. Changes in left ventricular performance and blood vessel functionality were also assessed. Administration of GGOH completely abrogated reduced skeletal muscle performance caused by simvastatin in predominately fast-twitch muscle. GGOH also improved functionality in those muscles not adversely

affected by statin treatment (i.e. slow-twitch muscles), as well as in the control animals. Rodents given GGOH showed no evidence of impaired left ventricular pump function or electrophysiology. Furthermore, relaxation responses in isolated conduit and resistance arteries were either maintained or improved by GGOH administration. Hence, this *in vivo* study has provided evidence that GGOH administration can prevent statin-induced muscle damage without causing adverse cardiovascular effects. As such, the effectiveness of this compound in managing SAMS warrants further investigation.

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Adverse Cardiovascular Events in Patients with Rheumatic Conditions and Biologic Therapy Interruption

A. Sehly*, O. Ek, K. Lyckenblad,
H. Marsden, J. Rankin, H. Keen, G. Dwivedi

Fiona Stanely Hospital, Murdoch, Australia

Background: Recent studies in patients with rheumatologic conditions support the importance of inflammation in the development of atherosclerosis. Moreover, targeting inflammation upstream with biological agents for atherosclerosis progression has become the focus of intense research. Whilst biologics suppress inflammation, they increase serious infection (SI) risk. We hypothesised that biologic therapy interruption due to SI in patients would lead to rebound inflammation and more major adverse cardiovascular events (MACE) compared to those with no interruption.

Methods: We retrospectively analysed a cohort of 265 patients above the age 18 who received biologics for rheumatoid arthritis; ankylosing spondylitis; and psoriatic arthritis with regular follow-ups. Patient characteristics, biologic therapy interruptions, SIs and MACE (non-fatal MI, non-fatal stroke and cardiovascular death) were captured in detail. Patients were categorised into 3 groups for analysis: (1) pause AND SI, (2) pause AND no SI, and (3) no pause.
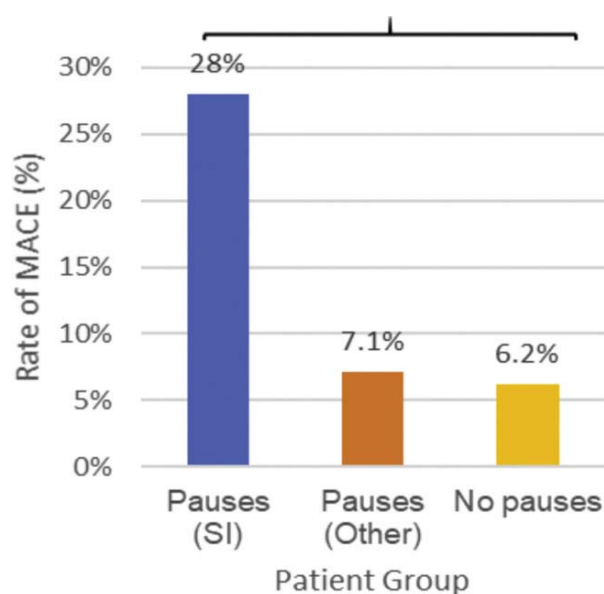
Results: Baseline characteristics were similar between the groups. A total of 357 pauses in biologic therapy was noted among 152 patients, of which 39 (11%) were observed in 25 patients due to SI. A significantly higher rate of MACE was observed in the group who paused for SI compared to others (Figure). Also, whilst pausing biologic therapy due to SI was associated with an increased incremental odds of experiencing MACE [OR 4.08 (95% CI 1.21–13.74), $p = 0.023$], pausing biologics for other reasons was not [OR 1.17 (95% CI 0.41–3.29), $p = 0.77$].**Conclusions:** In rheumatic patients, biologic therapy interruption due to SI leads to increased MACEs.

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Antithrombotic Therapy and Bleeding Outcomes in Atrial Fibrillation Patients after PCI: Insights from the CADOSA Registry

B. Stretton [1,*], R. Tavella [1,2], C. Zeitz [1,2], M. Arstall [1,3], A. Sinhal [4], M. Worthley [1,2], J. Beltrame [1,2], C. Labrosciano [1,*]

[1] *Adelaide Medical School, The University of Adelaide, Adelaide, Australia*
[2] *Department of Cardiology, Central Adelaide Local Health Network, SA Health, Adelaide, Australia*
[3] *Department of Cardiology, Northern Adelaide Local Health Network, SA Health, Adelaide, Australia*
[4] *Department of Cardiology, Southern Adelaide Local Health Network, SA Health, Adelaide, Australia*

Background: Management of atrial fibrillation (AF) in patients who have PCI is difficult. To prevent thromboembolic events (TEE), Triple Therapy (oral anticoagulation [OAC]+Dual Antiplatelet Therapy [DAPT]) is gold standard but confers a high bleeding risk.

Method: Using the Coronary Angiogram Database of South Australia (CADOSA), 205 AF patients undergoing PCI in 2015–16 were identified. One-year outcomes were compared between patients prescribed (1) Dual Therapy (OAC+1 antiplatelet), or (2) DAPT at discharge against Triple Therapy (OAC+DAPT). The primary endpoint was bleeding (as per International Society on Thrombosis and Haemostasis) and the secondary endpoint was TEE (MI, stroke and systemic-embolism).

Results: At discharge, 60% of patients were prescribed DAPT (72 ± 11 yrs, 30% female), 32% Triple Therapy (76 ± 10 yrs, 29% female) and 8% Dual Therapy (76 ± 18 yrs, 24% female).

Outcome 1 yr	Dual $n = 17$	DAPT $n = 122$)	Triple $n = 66$	OR 95%CI Dual vs Triple	OR 95%CI DAPT vs Triple
Bleeding-All	18%	6.6%	20%	0.3; 0.1–0.7, $p = 0.01$	0.9; 0.2–3.5, $p > 0.05$
Bleeding-CR[*]	18%	0.4%	11%	2.1; 0.5–9.6, $p > 0.05$	0.3; 0.1–1.2, $p = 0.08$
Bleeding-Major	0%	3.3%	11%	-	0.2; 0.1–0.8; $p = 0.04$
TEE	5.9%	6.6%	14%	0.4;0.1–3.4, $p > 0.05$	0.4; 0.2–1.2, $p > 0.05$

[*] Clinically Relevant – prompts clinical response but not major bleeding.

Conclusion: In this real-world setting of AF patients receiving PCI, the risk of bleeding was lower in patients discharged on dual therapy and DAPT, with a trend for lower TEE, compared to triple therapy. This small study suggests acceptability of a clinical benefit of dual therapy in this scenario so that further investigation in larger studies is warranted.

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Are Rate Pressure Product and Age Predicted Maximum Heart Rate Predictors of Future Cardiovascular Events During Dobutamine Stress Echocardiography?

M. Whitman[1,2,3,*], C. Jenkins[1], S. Sabapathy[2,4], L. Adams[2,4]

[1] Logan Hospital, Yatala, Australia
[2] Menzies Health Institute, Gold Coast, Australia
[3] University of Queensland, Brisbane, Australia
[4] Griffith University, Gold Coast, Australia

Background: Dobutamine stress echocardiography (DSE) is a commonly used diagnostic stress test for the assessment of various cardiac pathologies on patients unable to perform exercise. Unlike exercise, there is no reliable subjective termination end-point such as fatigue to rely on. Consequently, DSEs are often concluded at a predetermined age predicted maximal heart rate (APMHR) such as 85%, however the validity of this practice is undefined. The aim of this study was to assess if the maximum rate pressure product (MRPP) and APMHR are valid measures of future cardiovascular (CV) events during DSE.

Methods: Following exclusions, receiver operating curve (ROC) analyses were performed on 740 patients for MRPP and APMHR, using CV events during the follow-up period (3.7 ± 1.7 years) as the outcome variable.

Results: ROC analyses failed to produce a statistically valid model for MRPP ($p = 0.130$, area under curve (AUC) = 0.556) with a sensitivity and specificity of 24.8% and 90.2% respectively at the optimal cut point (15147 MRPP). To the contrary, analyses of APMHR demonstrated a heart rate percentage of 89.3 to be a useful predictor of future CV events with a sensitivity and specificity of 70.3% and 60.1% respectively ($p < 0.0001$, AUC 0.680).

Conclusion: The current study demonstrates MRPP as a poor measure of CV event prediction during DSE. However, an APMHR of 89.3% demonstrated a statistically valid model, suggesting a better termination end-point than the previously unverified 85% APMHR during DSE where subjective measures such as fatigue do not apply.

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Artificial Intelligence Methods for Real-Time Pharmacovigilance Monitoring to Predict Adverse Cardiac Events

J. Lu[1,*], G. Dwivedi[1,2,3], M. Bennamoun[1], F. Sohel[1,4], S. An[5], J. Rankin[3], F. Sanfilippo[1]

[1] The University of Western Australia, Perth, Australia
[2] Harry Perkins Institute of Medical Research, Nedlands, Australia
[3] Fiona Stanley Hospital, Murdoch, Australia
[4] Murdoch University, Murdoch, Australia
[5] Curtin University, Bentley, Australia

Background: Machine learning methods have previously been applied in pharmacovigilance monitoring, but have focused on natural language processing of text data. Our aim was to apply artificial intelligence methods to linked administrative data to predict major adverse cardiac events from medications at the population level. Our goal was to see if we could detect the increased risk of cardiovascular events and death from rofecoxib that led to its withdrawal from the market in 2004.

Methods: We identified, from Pharmaceutical Benefits Scheme data, patients in Western Australia who were supplied with Cox-2 inhibitors between 01-01-2003 and 31-12-2004. Using linked hospital admissions and death data, patients who died or were admitted within 30 days after the first supply were excluded. Variables from the linked data were used as inputs, and acute coronary syndrome (ACS) admissions or death within one year after the first supply were outputs. We applied artificial neural networks, decision trees and random forests to build models, and measure and optimise their performance.

Results: There were 42,695 patients in the cohort, and 2803 died or were admitted for ACS during follow-up. The multi-layer neural network model yielded the best predictive performance with an area under the receiver operating characteristic curve of 0.73.

Conclusion: Machine learning models applied to linked administrative data have the potential to be used in real-time pharmacovigilance monitoring. Further work is required to optimise the models to improve predictive performance, but our analysis shows that such models would have detected rofecoxib as a drug for close monitoring.

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Atraumatic Splenic Rupture After Myocardial Infarction: A Literature Review

C. Robinson

Toowoomba Hospital, Toowoomba, Australia

Background: Atraumatic splenic rupture is a rare complication of anti-coagulant and anti-platelet therapy in myocardial infarction (MI). We present the case of a 61 yr old female with late presentation (day 5) of inferolateral ST elevation MI. Initial management included ticagrelor, aspirin and weight adjusted enoxaparin without thrombolysis due to delayed presentation. After 4 days, profound hypotension with abdominal discomfort developed. A CT abdomen demonstrated a splenic haematoma with arterial contrast extravasation. Percutaneous splenic artery coiling and embolisation failed to arrest the bleeding, leading to laparotomy and splenectomy. This prompted a literature review of the association between MI and splenic rupture.

Method: A PubMed and Embase literature review was performed, using the terms "splenic rupture", "spleen", "haemorrhage" and "myocardial infarction" or "acute coronary syndrome". All publications from 1980 onwards with an English language abstract were manually reviewed.

Results and Conclusion: 11 cases of atraumatic splenic rupture in patients with MI in the preceding 3 months were identified. 10 patients had a histologically normal spleen (1–11). 1 patient was subsequently diagnosed with polycythaemia vera. 8 cases were associated with thrombolysis. Inflammatory cytokine release from ischaemic myocardium causes immune cell recruitment and activation of a splenic reservoir of myeloid lineage cells (12,13). Iatrogenic activation of similar pathways with high dose G-CSF has also been linked to splenic rupture (14). Atraumatic splenic rupture has been rarely reported post myocardial infarction, often but not exclusively associated with thrombolytic therapy.

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Baseline and Short-Term Change in Plasma Uric Acid on Fenofibrate Predict Cardiovascular Risk: A Post Hoc Analysis of FIELD

J. Cao [1,*], B. Waldman [1], R. O'Connell [1], D. Sullivan [2], V. Gebski [1], I. Marschner [1], R. Scott [3], M. Taskinen [4], J. Simes [1], N. McGill [2], A. Jenkins [1], A. Keech [1], on behalf of the FIELD investigators

[1] *National Health and Medical Research Council Clinical Trials Centre, Sydney, Australia*
[2] *Sydney Medical School, University of Sydney, Sydney, Australia*
[3] *Lipid and Diabetes Research Group, Christchurch Hospital, Christchurch, New Zealand*
[4] *Research Programs Unit, Diabetes and Obesity, University of Helsinki and Department of Internal Medicine, Helsinki University Hospital, Helsinki, Finland*

Background: Fenofibrate increases renal clearance of uric acid (UA). Relationships between baseline and short-term changes in plasma UA with fenofibrate and subsequent cardiovascular risk in patients with type 2 diabetes (T2D) are unknown.

Method: *Post hoc* analyses of the FIELD trial explored the relationships between CVD events and (1) baseline UA level; and (2) short-term change in UA level over 6-week single-blind active fenofibrate run-in.

Results: Data were from 9,622 patients with T2D. The FIELD trial showed 11% fewer cardiovascular events in patients with T2D assigned to fenofibrate compared to placebo over 5 years (HR = 0.89, 95% CI: 0.80–0.99, $p = 0.035$). Baseline UA ranged between 0.11 to 0.79 mmol/L (mean = 0.33, SD = 0.078). Each 0.1 mmol/L higher baseline UA increased CVD events by 21% (HR = 1.21 95% CI: 1.13–1.29, $p < 0.001$; Fig. 1A), and remained after adjusting for
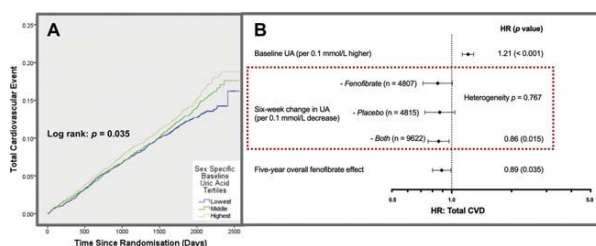

Fig. 1. *(A) Baseline UA and CVD risk; (B) UA differences and CVD risk.*

metabolic syndrome and other classic risk factors (HR = 1.12, 95% CI: 1.04–1.21, $p = 0.002$). Fall in UA level with fenofibrate run-in also predicted lower CVD risk, adjusted for baseline UA and irrespective of long-term treatment allocation (HR = 0.86, 95% CI: 0.76–0.97, $p = 0.015$; Fig. 1B).

Discussion: Baseline and short-term fenofibrate-induced lowering of UA predict cardiovascular risk in patients with T2D, irrespective of long-term trial treatment allocation. The

reduction in total CVD events with fenofibrate was not shown to be mediated through the lowering of UA levels.

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Beta Blocker Use Increases The Risk of Perioperative Cardiac Events in Liver Transplant Patients

B. Cailes[1,*], A. Koshy[1], J. Ko[1], H. Han[1], H. Lim[1], A. Teh[1], L. Weinberg[2], A. Testro[3], P. Gow[3], O. Farouque[1]

[1] *Department of Cardiology, Austin Health and University of Melbourne, Heidelberg, Australia*
[2] *Department of Anaesthetics, Austin Health, Heidelberg, Australia*
[3] *Victorian Liver Transplant Unit, Austin Health, Heidelberg, Australia*

Background: Recent evidence has linked beta blocker (BB) use with perioperative major adverse cardiovascular events (MACE) after non-cardiac surgery. BB are often used for treatment of portal hypertension in liver disease. We sought to determine whether BB use was associated with adverse perioperative outcomes in liver transplantation (LT).

Methods: Consecutive adult patients undergoing LT between 2010 and 2017 in the Victorian Liver Transplantation Unit were evaluated. Beta-blocker use, perioperative 30-day MACE (acute coronary syndrome, cardiac arrest, cardiac failure and ventricular tachycardia), and all-cause mortality were recorded from a prospectively maintained database.

Results: We evaluated 704 patients who underwent workup for LT. Of these, 462 proceeded to transplant (mean age 52 ± 13; 67.5% male). There were 84 (19.8%) patients on BB at the time of surgery. Patients on BB were older (55 ± 10 vs 52 ± 13 years; $p = 0.025$), and more frequently had coronary disease (15.5% vs 6.2%; $p = 0.005$) and atrial fibrillation (22.6% vs 2.6%; $p < 0.001$). There were 51 (11%) MACE and five deaths. BB use was associated with higher MACE (16.7% vs 8.5%; $p = 0.026$), but not all-cause mortality (2.4% vs 0.9%; $p = 0.25$). Multivariable logistic regression was used to adjust for age, Revised Cardiac Risk Index, coronary disease, atrial fibrillation and post-operative bleeding or infection. BB use was independently associated with increased risk of perioperative MACE (OR 2.06, 95%CI 1.14–3.71; $p = 0.017$).

Conclusions: BB use in patients undergoing LT was independently associated with higher perioperative MACE. This study adds to a growing body of evidence suggesting an association of BB use with adverse perioperative cardiac events.

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Burden of Rural Cardiovascular Disease in Remote Populations is Independent of Glycaemic Control

P. Azzi[1,*], H. Kempton[3], J. Suttie[2]

[1] *St George Public Hospital, Kogarah, Australia*
[2] *Wagga Wagga Rural Referral Hospital, Wagga Wagga, Australia*
[3] *St Vincent's Public Hospital, Darlinghurst, Australia*

Background: Our previous research has shown that diabetes and remoteness are independent predictors of cardiovascular disease burden in rural Australia. We aimed to determine whether this burden of disease was specifically associated with glycaemic control in an intermediate cardiovascular risk population in south-west NSW.

Methods: In this prospectively designed and recruited study, we assessed contemporary HbA1c results for 1436 patients undergoing cardiovascular risk stratification using CT coronary angiogram within the last 7 years from thirty-two hospitals. We then divided the patients into 3 groups depending on their distance from the regional centre to approximately correspond with the ARIA remoteness classifications for the Riverina. Three HbA1c results were discarded as outliers. An average HbA1c was then calculated for each group. Average HbA1c for subset of patients with HbA1c greater than 6.5% was also performed which included outliers.

Results: 720 out of 1436 patients had a contemporary HbA1c. The average HbA1c for the 489 patients living within 100 km of the regional centre was 6.11%. For the 204 patients living between 100 km and 200 km from the centre, the average HbA1c was 6.15%. 24 patients more than 200 km away had an average HbA1c of 6.31%. Subset data for 167 diabetic patients demonstrated an average HbA1c of 7.7% for 108 patients within 100 km, 7.6% for 51 patients between 100 and 200 km, and 7.8% for 8 patients more than 200 km from the regional centre.

Conclusion: There was no statistically significant difference between HbA1c scores depending on remoteness in the Riverina within an intermediate cardiovascular risk population including a subset diabetic population.

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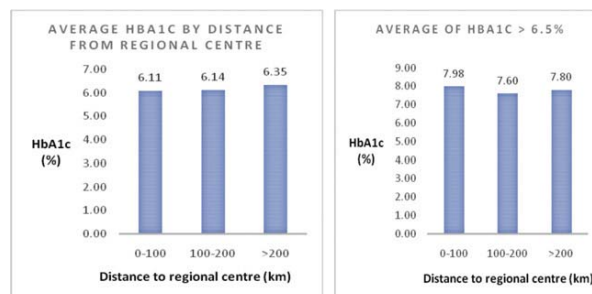
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Cardiac Arrest and Sudden Cardiac Death Registries: A Systematic Review of Global Coverage and Data capture Strategies

E. Paratz [1,2,3,*], L. Rowsell [1], D. Zentner [4], S. Parsons [5], N. Morgan [5], T. Thompson [4], P. James [4], A. Pflaumer [6,7], C. Semsarian [8], K. Smith [9], D. Stub [1,3], A. La Gerche [1,2,3]

[1] Baker Heart & Diabetes Institute, Melbourne, Australia
[2] St Vincent's Hospital, Melbourne, Australia
[3] Alfred Hospital, Melbourne, Australia
[4] Royal Melbourne Hospital, Melbourne, Australia
[5] Victorian Institute of Forensic Medicine, Melbourne, Australia
[6] Royal Children's Hospital, Melbourne, Australia
[7] Murdoch Children's Research Institute, Melbourne, Australia
[8] Centenary Institute, Sydney, Australia
[9] Ambulance Victoria, Melbourne, Australia

Background: Sudden cardiac death (SCD) is a major global health problem, accounting for almost 6% of deaths in the community setting in the United States. Clinical quality registries improve clinical management, reduce variation in care and improve outcomes.

Aim: To identify existing cardiac arrest (CA) and sudden cardiac death (SCD) registries, characterising global coverage and methods of data capture and validation.

Methods: Biomedical and public search engines were searched with the terms 'registry cardio*; 'sudden cardiac death registry', and 'cardiac arrest registry'. Registries were categorised as either CA, SCD registries or 'other' according to whether they primarily assess resuscitation outcomes (CA) or utilise multi-source surveillance to explore overall epidemiology and clinical care (SCD). SCD registry coordinators were contacted and provided contemporaneous data regarding registry details.

Results: Our search strategy identified forty-three cardiac arrest registries, fifteen SCD registries, and eight registries not otherwise categorised. Geographic coverage of contemporary CA and SCD registries is highly variable with registries densely concentrated in North America and Western Europe. Existing SCD registries cover a variety of age ranges and sub-populations. Eight registries enrol surviving patients, and five enrol family members. Nine registries collect genetic data, with seven offering storage in a biorepository indefinitely. Major challenges in creating an SCD registry include maximising case identification and case verification.

Conclusions: Many high-quality CA registries exist globally, albeit with inequitable geographical coverage. High-quality SCD registries are fewer in number, and more challenging to design and maintain. Major challenges identified are maximising case identification and case verification.

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Cardiac Arrest and The Use of Mechanical Compression devices in Patients Presenting for Primary Percutaneous Coronary Intervention

S. Barua [1,*], P. Chandru [1], A. Coggins [1], A. Narayan [1], A. Denniss [1,2,3], A. Ong [1], M. Cooper [1]

[1] Westmead Hospital, Westmead, Australia
[2] University of Sydney, Australia
[3] Western Sydney University, Australia

Background: Cardiac arrest has been associated with poor outcomes in patients presenting for primary percutaneous coronary intervention (PPCI). Mechanical compression devices such as the Lund University Cardiopulmonary Assist System (LUCAS-3) aim to reduce ischaemic time during cardiopulmonary resuscitation.

Methods: We conducted a retrospective review of consecutive patients with ST-elevation myocardial infarction or suspected severe myocardial ischaemia undergoing PPCI at a large tertiary institution between January 2017–December 2018. The study group comprised patients with an out-of-hospital cardiac arrest (OOHCA), in-hospital cardiac arrest (IHCA), or both. Demographic data, downtime (defined as the time from recognised arrest to return of spontaneous circulation (ROSC)), use of the LUCAS-3, and survival to discharge, were collected.

Results: Of 630 patients, 80 (12.7%) were identified as either OOHCA, IHCA, or both; of whom 75 (93.4%) achieved ROSC prior to attempt at PPCI. 7 patients had an on-table IHCA during angiography without obtaining ROSC. 55 patients (68.8%) were discharged alive. Comparison of baseline demographics between survival to discharge and fatality: Age: 59.8 vs 65.7 years ($p = 0.018$), median downtime 4 vs 32 minutes ($p < 0.001$), gender was not significant ($p = 0.32$). ROSC was achieved in all vs 52% ($p < 0.001$) respectively. LUCAS-3 was used in 16 patients, of whom 3 were discharged alive and had achieved ROSC prior to attempt at PPCI.

Conclusions: Younger age, shorter downtime, and ROSC predict survival to discharge in patients with OOHCA, IHCA, or both who present for PPCI. LUCAS-3 did not show utility in our cohort in the absence of ROSC prior to PPCI.

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Cardiac Output in End-Stage Liver Disease Increases Proportional to the Degree of Liver Dysfunction

A. Koshy [1,*], B. Cailes [1], P. Gow [2], A. Testro [2],
H. Han [1], J. Sajeev [1], J. Ko [1], L. Weinberg [3],
P. Srivastava [1], H. Lim [1], A. Teh [1],
O. Farouque [1]

[1] Department of Cardiology, Austin Health and University of Melbourne, Heidelberg, Australia
[2] Victorian Liver Transplant Unit, Austin Health, Heidelberg, Australia
[3] Department of Anaesthetics, Austin Health, Heidelberg, Australia

Background: End-stage liver disease is associated with significant systemic and haemodynamic alterations that affect cardiac function. Cirrhotic cardiomyopathy remains an ill-defined entity among cardiologists. Understanding the complex interplay between liver dysfunction and cardiac function can lead to a better understanding of the compensatory mechanisms of the heart in liver failure.

Methods: Consecutive patients that underwent pre-liver transplant (LT) workup between 2010–2017 were included. All patients underwent a resting echocardiogram. Cardiac output (CO) was prospectively recorded at baseline by pulsed-wave Doppler examination and systemic vascular resistance (SVR) was calculated as $80\times$ (mean arterial pressure (MAP)/CO). Severity of liver disease was characterized by the model of end-stage liver disease (MELD) and Child-Pugh scores.
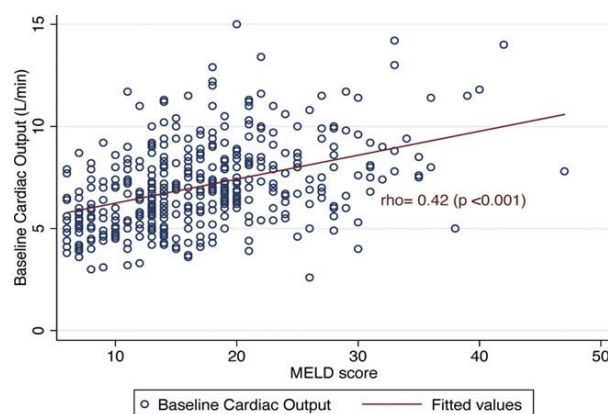
Results: 560 patients were included (mean age 57.5 ± 7.7, 74.8% male). Mean MELD score was 19 ± 7 and Child-Pugh Score was 9 ± 3. There was an inverse linear relationship between the severity of liver disease by MELD score and baseline SVR (rho 0.40, $P < 0.001$). As SVR reduced, there was also a significant rise in baseline CO with a strong inverse correlation between the two variables (rho 0.86, $p < 0.001$). There was a significant linear correlation between the severity of liver disease and baseline CO with both scores (MELD rho 0.42, $p < 0.001$; Child Pugh rho 0.44, $p < 0.001$).

Conclusions: Baseline CO increased with the severity of liver dysfunction due to a reduced afterload. A higher resting

CO may lead to patients encroaching on their cardiac reserve at rest. This may provide a pathophysiological mechanism that supports a limited role for beta-blockers in end-stage liver cirrhosis.

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Cardiovascular Outcomes of Transradial Versus Transfemoral Access Cardiac Catheterization: Insights From the CADOSA Registry

K. Singh [1,*], R. Tavella [2], T. Air [2],
M. Worthley [2], A. Sinhal [3], M. Arstall [2],
C. Zeitz [2], J. Beltrame [2]

[1] Gold Coast University Hospital, Gold Coast, Australia
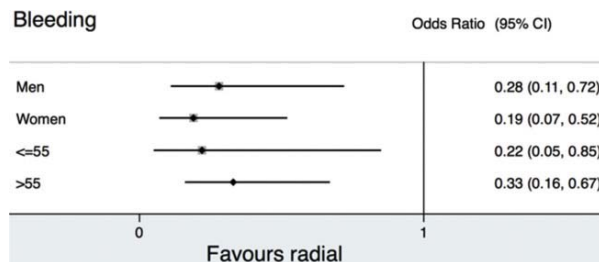[2] University of Adelaide, Adelaide, Australia
[3] Flinders Medical Centre, Bedford Park, Australia

Background: Transradial access (TRA) is effective in reducing vascular complications compared to transfemoral access (TFA), however, older patients and also women, may have more complex vascular anatomy and so radial access may be challenging in these patients. This study compared in-hospital outcomes of TRA and TFA angiography in a real-world setting.

Methods: Consecutive angiography procedures from 2012–2016 for patients with stable angina or acute coronary syndrome were included from CADOSA (Coronary Angiogram Database of South Australia). Using propensity score analysis, we estimated the subgroup effects of gender and age ($\leq$55 yrs vs. >55 yrs) and for in-hospital NACE (composite of death w/n 24 hrs, MI, stroke or major bleeding) between TRA and TFA procedures.

Results: From 13,811 procedures, 28% were TFA, 34% were women, 34% were PCI and 46% were MI. The overall NACE was 1.5%. A reduced NACE was evident in TRA compared to TFA in the overall propensity matched cohort (OR 0.38 95% CI, 0.23–0.63, $p < 0.001$). This was also significant in women (OR, 0.44; 95% CI, 0.23–0.83; $p = 0.012$), in >55 yrs cohort (OR, 0.49; 95% CI, 0.30–0.80; $p = 0.004$) with a trend towards significance in men (OR, 0.62; 95% CI, 0.36–1.06; $p = 0.083$). There was a significant reduction in bleeding risk in all cohorts (see Figure: Propensity Matched Effect of Access Site on Bleeding by Gender and Age).

Bleeding		Odds Ratio (95% CI)
Men		0.28 (0.11, 0.72)
Women		0.19 (0.07, 0.52)
<=55		0.22 (0.05, 0.85)
>55		0.33 (0.16, 0.67)

Favours radial

Conclusion: A reduction in NACE risk with TRA is evident for both young and older patients, and particularly

women, which is driven by the significantly lower bleeding complications.

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Cath Lab Cardiac Physiologists: Ill Defined, Unskilled, Unregistered and Absent. Staffing and Training Concerns in Australia's Cath labs

M. Norman [1,2,*], R. Wilson [1,3]

[1] *Professionals in Cardiac Sciences Australia, Woolloongabba, Australia*
[2] *Royal Hobart Hospital, Hobart, Australia*
[3] *Epworth Healthcare, Richmond, Australia*

Professionals in Cardiac Sciences Australia (PiCSA) is the national representative body for people working in clinical cardiac science positions. In 2015 PiCSA conducted a census of cardiologists, workplaces, and individual workers who perform cardiac science procedures across Australia (this workforce includes nurses and radiographers as well as physiologists/scientists/technologists and other industry professionals). This was the first attempt to collect Australia-wide data about professionals employed in cardiac technology/science and the environments that they work in.

Current cath lab roles are not standardised: The workplace survey indicated that some cath labs now operate entirely without a cardiac physiologist. Additionally, some institutions have cardiac physiologists who scrub, and some have a nurse or physiologist performing the imaging role. Some employers reported that their radiographers were responsible for doing the haemodynamic calculations.

Only 16% of managers reported adequate skills assessment of those filling the cath lab cardiac physiologist role. This contrasted with 77% for echo, 48% for electrophysiology, 25% for cardiac devices, and only 11% for ECG. Some physiologists reported declining skill levels in their own workplaces – for example where machines now do the math and staff cannot identify when automatic calculations are incorrect.

Workforce survey respondents strongly supported the idea of nationally recognised qualifications (77%), registration (70%) and CPD requirements (80%) for the cath lab science role. They also recommended that cath lab competency be required before commencing training in the advanced cardiac physiology professions (very difficult for trainees to obtain if we fail to employ cardiac physiologists in the cath lab).

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Chest Pain Risk Scores Correlates with Initiation of Medical Therapy or Revascularisation Following Rapid Access Chest Pain Clinic Review

K. Cheng [1,2,*], J. Black [1,3], K. Negishi [1,3], G. Plottier [1], T. Marwick [4]

[1] *Department of Cardiology, Royal Hobart Hospital, Hobart, Australia*
[2] *School of Medicine, University of Tasmania, Hobart, Australia*
[3] *Menzies Institute for Medical Research, University of Tasmania, Hobart, Australia*
[4] *Baker Heart and Diabetes Institute, Melbourne, Australia*

Background: In pts with chest pain, timely and efficient exclusion for acute coronary syndrome is crucial. Australian guidelines recommend using risk scores to stratify pts' risks for major adverse cardiac events (MACE), and pts discharged from the emergency department (ED) with low-intermediate risk for coronary artery disease (CAD) may benefit from rapid access chest pain clinics (RACPC) to facilitate prompt cardiologist-led assessment and management. We evaluated the correlation between chest pain risk scores during ED presentation with outcome following RACPC review.

Methods: In this study of consecutive pts presenting to ED and subsequently to RACPC between July 2014 and December 2016 we prospectively recorded investigations and outcome. HEART scores were determined by single investigator using ED documentation. Outcomes recorded were 12-month MACE, planned coronary revascularisation, and initiation of medical therapy for CAD. MACE were defined as acute coronary syndrome (ACS), unplanned percutaneous or surgical revascularisation, or cardiac death.

Results: 1047 pts were analysed (mean age 55 years old, 48% male). No pts suffered MACE prior to, and 12 months after their RACPC assessment. Higher HEART score was associated with higher probability of receiving either medical therapy or revascularisation following their RACPC investigations (*C*-statistics 0.73, 95%CI 0.67–0.79).

Conclusion: Higher HEART score assessed during ED presentation for acute chest pain was associated with increased likelihood of receiving medical therapy or coronary revascularisation following RACPC assessment.

"For patients presented with acute chest pain, higher HEART score assessed in ED was associated with higher likelihood of receiving medical therapy or revascularisation following RACPC assessment."

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Clinical Assessment Compared To Modified HEART Score in the Assessment of Acute Chest Pain

S. Cheruvu *, J. Qin, M. Parkinson, C. Said, P. Bamford, J. Mooney

Gosford Hospital, Rhodes, Australia

Background: The modified HEART score has been validated to accurately risk stratify patients presenting to the Emergency Department (ED) with chest pain, however, its ability to predict outcomes has not been evaluated against standard clinical assessment.

Objective: This study compared standard care by clinical assessment alone to modified HEART score to evaluate which method was superior in predicting cardiovascular events in patients presenting with acute chest pain.

Methodology: A retrospective cohort study of all chest pain presentations was performed over three months. Patients were excluded if they had ST elevation infarct or an alternative cause of chest pain. Major adverse cardiovascular events (MACE) outcomes assessed included acute coronary syndrome (ACS), unplanned revascularisation, readmission for heart failure and cardiovascular death. These were assessed at 12 months, and statistical significance determined by Chi-squared test.

Results: A total of 199 patients were included. Of those, 12 (6%) had ACS at index admission, 16 (8%) at six weeks and 23 (12%) at twelve months. At twelve months, the modified HEART score demonstrated higher sensitivity for predicting MACE compared with standard care alone (96% vs 74%; $p = 0.03$), however, specificity was higher with standard care compared to modified HEART score (74% vs 53%; $p < 0.0001$).

Conclusions: Modified HEART score provided higher sensitivity but lower specificity than clinical assessment alone in predicting cardiovascular events in patients presenting to ED with chest pain. The modified HEART score is of potential use to more accurately exclude ACS in the emergency department compared to standard clinical assessment alone.

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Clinical Outcomes of Out of Hospital Cardiac Arrest and Cardiogenic Shock Patients

R. Harvey *, W. Peverill, P. Garrahy

Princess Alexandra Hospital, Brisbane, Australia

Introduction: Out of hospital cardiac arrest and cardiogenic shock outcomes have been improving dramatically over the past decade. A renewed interest in clinical outcomes has driven the development of multiple shock protocols to be created to try and improve survival in these patients. We sought to quantify our neurological and survival outcomes in a retrospective single center cohort study to compare our outcomes to those published in the literature as well as look at predictors of poor prognosis.

Methods: Utilising the QCOR database we retrospectively searched for all cases of cardiogenic shock and out of hospital arrest undergoing primary PCI between 2016 and 2018. We excluded those who had <5 minutes of CPR if they were not intubated. The electronic medical records for those patients were then accessed to record baseline data. Those patients 30 day and 12 month mortality and neurological outcomes (using the cerebral performance category) were then evaluated.

Results: We identified 43 number of patients who fit our inclusion criteria. The 30 day and 12 month mortality was 41% and 43% respectively. 40% of patients who survived had normal neurological function, while 12% survived with significant neurological impairment. There appeared to be a weak correlation with downtime, presenting pH and glucose with 12 month mortality.

Discussion: In conclusion our outcomes are similar to the published literature, however a larger trial would be required to power correlations of neurological outcomes.

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Clinical Predictors of Acute Total Occlusion of Culprit Vessels in Patients with Non-ST Segment Elevation Myocardial Infarction

S. Kashkavij *, R. Pathy, P. Pati, M. Arstall

Nalhn-lyell Mcewin Hospital, Elizabeth Vale, Australia

Background: Acute total occlusion of culprit vessel in patients with non–ST-segment elevation myocardial infarction (NSTEMI) accounts for third of these cases, who are at higher risk of mortality and morbidity. Earlier interventions in such patients may improve their prognosis. However, there are no specific clinical predictors that can identify this group.

Objectives: We attempted to identify acute total occlusion of culprit vessel in patients with NSTEMI from varied clinical parameters such as symptoms, electrocardiograms, conventional echocardiograms and cardiac biomarkers.

Methods: It was a single centre retrospective study of all NSTEMI patients with acute total occlusion over 9 years from January 2010 to December 2018.

Results: From angiographic data 1700 out of 10800 (15.74%) patients were identified to have NSTEMI. 458 out of 1700 (27%) had acute total occlusion of culprit vessel. Mean time from onset of chest pain to coronary intervention was 33 ± 26 hours longer than STEMI cases (< 90 min). Younger age, BMI>25, higher peak troponin and CPK, ongoing chest pain, dynamic/new ECG changes were all highly significant in patients with acute total occlusion of culprit vessel by univariate analysis. Whereas, ongoing chest pain (p value 0.001, OR 6.1 and CI 3.6 to 10.3), new/dynamic ECG changes (p value: 0.006, OR 2.2, CI 1.3 to 6.7), younger age (p .015) and higher peak cardiac troponin (p .035) are predictive of ATO of culprit vessel.

Conclusion: Ongoing chest pain, new/dynamic ECG changes, younger age and higher peak troponin levels may help identify patients with NSTEMI with occluded culprit vessel and expedite their appropriate timely interventions,

who are disadvantaged by delayed identification and management as in our study.

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This abstract has been withdrawn

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Contrast Induced ECG Changes During Coronary Angiography are More Pronounced in Females

S. Vinod Benyani[2,*], M. Ahmed[2], H. Rashid[1,2], J. Cole[1,2], N. Htun[1,2], M. Premaratne[1,2], R. Sriamareswaran[1], J. Layland[1,2]

[1] *Peninsula Health, Frankston, Australia*
[2] *Monash University, Peninsula Clinical School, Frankston, Australia*

Introduction: Contrast injection during coronary angiography may lead to transient electrocardiographic (ECG) changes. The mechanism for such changes is not fully understood but may relate to the effect of contrast on cardiac membrane potentials, transient hypoxia and stimulation of endothelial pathways. Moreover, the relationship between ECG changes during angiography with sex is unclear and we aimed to explore this further.

Method: Patients presenting for coronary angiography were recruited. Exclusion criteria included history of cardiac bypass surgery, paced rhythm and staged coronary intervention. The right and left coronary artery (RCA & LCA) were infused with 5mls of contrast (Omnipaque) and ECG tracings were recorded. Maximal heart rate, ECG interval (PR, QRS and QT), ST segment and amplitude (R and T) during contrast injection were compared from baseline.

Results: 50 patients were recruited (females = 25), with half of the patients presenting with acute coronary syndrome. Baseline characteristics were similar between both sexes. In females, RCA angiography lead to greater R wave amplitude [1.76 (1.28) vs 1.04 (0.85) mm, $p = 0.02$] and total amplitude (summation of T and R wave) [2.97 (1.70) vs 1.93 (1.38), $p = 0.02$] when compared to males. J point height with RCA infusion was numerically higher in females [0.31 (0.17) vs 0.22 (0.17) mm, $p = 0.07$]. LCA angiography lead to greater QRS interval change in females [32(27.6) vs 17.6(16.6) ms, $p = 0.03$].

Conclusion: We demonstrate greater ECG changes in females than males during coronary angiography. Further studies are warranted to elicit potential mechanisms behind this finding.

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Cost and Quality of Life Analysis of Extracorporeal Cardiopulmonary Resuscitation for Refractory Cardiac Arrest

M. Dennis[1,*], F. Zmudski[2], D. Gattas[1], H. Buscher[3], P. Forrest[1]

[1] *Royal Prince Alfred Hospital, Sydney, Australia*
[2] *Epoque Consulting, Sydney, Australia*
[3] *St Vincent's Hospital, Sydney, Australia*

Aims: The use of extracorporeal membrane oxygenation (ECMO) in refractory cardiac arrest (ECPR) has increased exponentially. ECPR is a resource intensive service and its cost effectiveness has yet to be demonstrated. We sought to complete a cost analysis with modelling of cost effectiveness and quality of life outcomes.

Methods: Using data on all Extracorporeal Cardiopulmonary Resuscitation (ECPR) patients at two ECMO centres in Sydney, Australia; we completed a costing analysis of ECPR patients. A Markov model of cost, quality of life and survival outcomes was developed to examine cost per QALY estimates and incremental cost effectiveness ratios (ICERs). Probabilistic sensitivity analysis (PSA) was completed to assess the probability of cost effectiveness for base case and variations.

Results: Sixty-two ECPR patients were analysed; mean age of 51.9 ± 13.6 years, 38 (61%) were in hospital cardiac arrests (IHCA). Twenty-five patients (40%) survived to hospital discharge; all with a Cerebral Performance Category (CPC) of 1 or 2. The mean cost per ECPR patient was AUD 75,165 (€50,535; ± AUD 75,737). Over 10 years ECPR was estimated to add a mean gain of 3.0 Quality Adjusted Life Years (QALYs) per patient with an incremental cost effectiveness ratio (ICER) of AUD 25,212 (€16,890) per QALY, increasing to 4.0 QALYs and an ICER of AUD 18,829 (€12,614) over a 15-year survival scenario. Mean cost per QALY did not differ significantly by OHCA or IHCA.

Conclusion: ECMO support for refractory cardiac arrests is cost effective and compares favourably to accepted cost effectiveness thresholds.

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Delayed Presentation and Poor Outcomes for Women in an Australian STEMI Cohort

E. Rye[1,*], C. Chow[2,3], G. Sivagangabalan[1,2]

[1] *University of Notre Dame, Sydney, Australia*
[2] *Department of Cardiology, Westmead Hospital, Westmead, Australia*
[3] *Westmead Applied Research Centre, University of Sydney, Westmead, Australia*

Background: Cardiovascular disease is a leading cause of mortality in Australian woman. Gender based differences are known to exist in treatment and outcomes of ischaemic heart disease.

Methods: We conducted an observational cohort study using prospectively collected registry data to examine

whether gender based differences exist in the presentation, treatment, and clinical outcomes of patients with ST-elevation myocardial infarction (STEMI). The study involved 3,665 patients who presented to 12 hospitals between 2004–2018. Outcome measures included time to reperfusion, major complications (death, MI, CVA) and mortality with follow-up to 24 months.

Results: Women ($n = 755$, 20.6%) were older (65 vs 59yr, $p < 0.001$) and more likely to have hypertension (60.4% vs 51.5%, $p < 0.001$) and diabetes (33.6 vs 28.6%, $p = 0.021$). Women had longer overall reperfusion times (S2RT 235 vs 215min, $p = 0.002$), which were driven by pre-hospital delays (S2DT 107 vs 95min, $p = 0.001$). In-hospital treatment times did not differ substantially. Women had lower rates of multi-vessel disease (49 vs 53.2%, $p < 0.001$) but were less likely to undergo stenting (86.7 vs 92.7%, $p < 0.001$). Post discharge, women had lower rates of referral to cardiac rehabilitation (73.3 vs 82.7%, $p = 0.002$) and experienced higher rates of complications and death (24mth major comp: 28 vs 17%, death 27 vs 15%; $p < 0.001$).

Conclusion: Women presenting with STEMI are older, have prolonged reperfusion times and have lower rates of cardiac stenting. Following discharge, women experience nearly twice the rates of major complications and death post STEMI. Factors contributing to these disparities require further investigation.

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Detection of Achilles Tendon Xanthoma in Patients with Phenotypical Familial Hypercholesterolemia: Physical Examination vs Sonography

M. Isa [1,*], P. Coombs [2], J. Cameron [3], S. Mirzaee [3]

[1] Monash University, MonashHEART, Melbourne, Australia
[2] Department of Imaging, Monash Health, Melbourne, Australia
[3] Monash Cardiovascular Research Centre, MonashHEART, Monash University MelbourneMelbourne, Australia

Introduction: Familial hypercholesterolaemia (FH) is a commonly underdiagnosed hereditary lipid disorder characterised by increased low density lipoprotein cholesterol (LDL-C). FH predisposes patients to premature cardiovascular disease (CVD). Achilles tendon (AT) xanthoma is pathognomonic of FH and can be detected via physical examination or ultrasound.

Objectives: Evaluate the accuracy of ultrasound in AT xanthoma detection compared to physical examination in FH patients.

Methods: Forty-two consecutive patients from Monash-HEART lipid clinic with likely FH according to the Dutch Lipid Clinic Network Score were included in the study. On physical examination, patients were categorised as xanthoma (+) and xanthoma (−) based on tendon thickness and/or nodularity. On ultrasound, patients were categorised based on AT thickness or presence of hypoechogenic lesions within the tendon.

Results: Eighty-four AT were investigated in total. Mean age 35.5 ± 14.7 years, mean LDL-C 5.5 ± 1.95 mmol/L and 47.6% were male. Premature CVD was present in 50% of the patients. The frequency of xanthoma was 73.8% by ultrasound and the median antero-posterior diameter was 5.15mm (IQR 4.7–5.7). Physical examination had sensitivity of 38% [95% confidence interval (CI) 24.7–52.8] and specificity of 73.5% [95% CI 55.6–87.1] in AT xanthoma detection. No statistically significant association between age and xanthoma was observed.

Conclusion: This study suggests that ultrasound, used in conjunction with physical examination increases the accuracy of AT xanthoma detection in patients with likely FH.

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This abstract has been withdrawn

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Do Patients Over 85 Years who Present with NSTEMI and Admitted Under General Medical Units Need Cardiology Consultation?

P. Kunniardy *, A. Koshy, G. Meehan, A. Murphy, D. Gayed, J. Ramchand, D. Clark, O. Farouque, M. Yudi

Austin Health, Heidelberg, Australia

Introduction: Elderly patients presenting with Non-ST-elevation myocardial infarction (NSTEMI) are often admitted under a General Medical Unit rather than a Cardiology Unit. The impact of obtaining a cardiology consultation is unknown.

Methods: A single centre retrospective analysis of 763 consecutive patients aged >85 years who presented with a NSTEMI between 2010–2018 was undertaken. Patients were stratified according to whether a cardiology consultation was undertaken. Clinical characteristics, presentation and outcomes were collected through medical records review. The primary outcome was in-hospital mortality

Results: Of the 763 patients included, only 274 (35%) had a cardiology consultation. Those receiving a cardiology consultation were more likely to be male, younger and without cognitive or mobility issues (all $p < 0.001$). Guideline-directed medical therapy (GDMT) with aspirin, statin and beta-blockers was also more likely on patients who had cardiology consultation ($p < 0.001$). On multivariable logistic regression, after adjusting for age, gender, mobility status and cognitive impairment, a cardiology consult was associated with improved in-hospital mortality (OR 0.56, 95%CI 0.36–0.88, $p = 0.01$). However, when the same model was adjusted for GDMT, the association was no longer significant (OR 0.65 95%CI 0.41–1.03, $p = 0.07$).

Conclusion: Very elderly patients presenting with NSTEMI and admitted under a general medicine unit less often

received a cardiology consult. Cardiology input was associated with higher uptake of GDMT and improved outcome. Cardiology input should be sought in the management of very elderly patients with NSTEMI

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Does Severity of Coronary Artery Disease Predict an Abnormal Ankle Brachial Pressure Index (ABPI)?

M. Graieg[1,*], K. Luo[2], W. Ng[1], D. Playford[3], J. Deague[1]

[1] *Joondalup Health Campus, Joondalup, Australia*
[2] *Sir Charles Gairdner Hospital, Perth, Australia*
[3] *University of Notre Dame, Fremantle, Australia*

Introduction: Coronary artery disease (CAD) and peripheral arterial disease (PAD) share the same pathophysiology, but whether the angiographic extent of CAD predicts an abnormal ABPI in a Coronary Care Unit (CCU) setting has not been evaluated.

Objectives: We examined for associations between angiographic CAD severity and abnormal ABPI, suggesting the presence of PAD.

Methods: We performed a prospective consecutive observational series involving patients admitted to CCU and undergoing coronary angiography. Patients with unmeasurable ABPI or pre-existing PAD were excluded. The ABPI was performed by trained clinical staff and an ABPI $\leq$ 0.90 was taken as abnormal, which was analysed against the severity of CAD. Angiographic severity >70% stenosis in any major vessel, or previous coronary revascularisation was taken as significant CAD.

Results: 82 patients were recruited between August and December 2018. The prevalence of an abnormal ABPI was similar in those with normal coronary arteries and those with any degree of coronary disease: 1 of 8 (12.50%) with normal coronaries had abnormal ABPI versus 12 of 74 (16.21%) of those with coronary disease ($p = 0.785$). When assessing for a relationship between significant CAD and abnormal ABPI there was none seen; out of 21 patients with no significant CAD (none or mild disease), 3 had abnormal ABPI (14.28%), compared with 10 of 61 patients with significant CAD (16.39%), ($p = 0.820$). Similarly, there was no association between double and triple vessel CAD and abnormal ABPI.

Conclusion: Despite the shared pathophysiology, severity of CAD does not predict an abnormal ABPI in this clinical setting.

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Does Utilisation of Hospital in the Home Services Reduce the Length of Admission for Patients With Infective Endocarditis

S. Rajapakse[1,*], Y. Wee[1], S. Goh[1,2], S. Smith[1]

[1] *The Prince Charles Hospital, Chermside, Australia*
[2] *The University of Queensland, Brisbane, Australia*

Background: Infective endocarditis (IE) is a common pathology requiring admission to hospital. The length of stay in these patients can often be prolonged due to the need for prolonged courses of intravenous antibiotics. This can be associated with poor outcomes for the patient due to medical complications of prolonged hospital stay as well as increase the costs to the healthcare system. One way of reducing length of stay is utilising hospital in the home (HITH) services for administration of intravenous antibiotics in patients who are otherwise stable and can be discharged home safely, but still require completion of several weeks of antibiotics. The aim of this audit was to assess in what percentage of patients HITH services were utilised and whether this led to a reduction in length of stay.

Methods: A retrospective analysis of patients with a diagnosis of infective endocarditis over a 19-month period (July 2016-January 2018) at our institution was performed.

Data collected: Utilisation of HITH, length of stay, number of readmissions.

Results: A total of 130 patients had a diagnosis of infective endocarditis. Of these 21 (16.1%) patients had a stay >30 days (range 1–62) and 44 patients were readmitted to hospital with 27.3% having no more than 1 readmission. 42 patients (32.3%) were discharged to HITH. The median (and mean $\pm$ SD) LOS for the HITH vs non-HITH patients were 16 (19.5 $\pm$ 13.4) vs 14 (17.0 $\pm$ 12.7) days respectively.

Conclusions: Outcomes following IE are complex. Further investigation of the patient benefit, health service utilisation and barriers of HITH for IE is warranted

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Door-to-Balloon Time (DTBT) and Length of Stay (LOS) in STEMI Patients Undergoing Primary Percutaneous Coronary Intervention (PPCI) at Frankston Hospital

S. Karim[1,2]

[1] *Monash University, Clayton, Australia*
[2] *Frankston Hospital, Frankston, Australia*

Background/Aim: Door-to-balloon time (DTBT) is a key performance quality metric in STEMI management. We aimed to evaluate DTBT and outcomes of STEMI patients undergoing primary percutaneous coronary intervention (PPCI) at Frankston Hospital.

Method: We retrospectively analysed all STEMI patients who underwent PPCI in 2016–2017. Clinical characteristics, DTBT, length of in-hospital stay (LOS), in-hospital cardiovascular outcomes and uptake of secondary prevention medical therapy were compared between the 2016 and 2017 cohorts.

Results: There were a total of 103 and 96 STEMIs undergoing PPCI in 2016 and 2017 respectively. Baseline characteristics were similar between both cohorts, mean age 62 ± 13 years and 77% male. The overall median DTBT was 58 (IQR 36–87) minutes. Median DTBT was significantly shorter in 2017 compared to the previous year [47 (IQR 41–81) minutes vs. 66 (IQR 46–89) minutes, $p = 0.003$]. However, median LOS was longer in the 2017 STEMI cohort [90 (IQR 75–106) hours vs. 85 (IQR 69–98) hours, $p = 0.047$]. In-hospital mortality and recurrent myocardial infarction were low in both cohorts (2% vs. 3%, $p = 0.45$; 0% vs. 1%, $p = 0.30$ respectively). There was an improvement in adherence to guideline-recommended preventative medication prescriptions in 2017 (dual antiplatelet therapy 91% vs. 96%, $p = 0.23$; statin 93% vs. 100%, $p = 0.01$; angiotensin converting enzyme inhibitor 83% vs. 96%, $p = 0.004$; beta blocker 82% vs. 93%, $p = 0.02$).

Conclusion: DTBT in STEMI patients undergoing PPCI at Frankston Hospital continued to decrease over time and was well within the guideline-recommended timeframe of <90 minutes. Adherence to prescribing secondary prevention therapeutics also improved in 2017 compared to the previous year.

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Early Results of the Prince of Wales Hospital Rapid Access Cardiology Clinic (RACC)

L. Back [1,2,*], P. Indraratna [1,2], V. Kushwaha [1,2]

[1] *Prince Of Wales Cardiology, Randwick, Australia*
[2] *University of New South Wales, Randwick, Australia*

Background: Due to low bed availability at the Prince of Wales Hospital, a safe and timely pathway for low-risk cardiology outpatient evaluation was established. Similar clinics have limited their focus to chest pain presentations, whereas the scope of this clinic encompassed all general cardiology presentations. Our objective was to evaluate the implementation and benefit of the first six months of the Rapid Access Cardiology Clinic (RACC).

Methods: Patient, presentation, and clinical outcome data was retrospectively audited between August 2018 and February 2019.

Results: 63 patients were reviewed in the RACC (63% male, mean age 52.7 years). 79% of patients were reviewed within 3 days of referral. 59% of referrals were for assessment of chest pain, with the remainder including AF/flutter, SVT, palpitations, and syncope. Polypharmacy was present in 8% of patients. The predominant investigations performed were rest and stress echocardiography (43% and 49% respec-

tively). 24 patients had subsequent outpatient investigations arranged, with 11 patients having a new medication prescribed. Only 1 patient required direct admission following review, with 33 (52%) being referred for ongoing cardiology follow up, and 25 (40%) being discharged from cardiology services. An estimated 31 inpatient bed days were saved as a result of this clinic

Conclusion: A Rapid Access Cardiology Clinic provides an alternative pathway to inpatient investigation for a subset of low-risk general cardiology presentations, not only chest pain. Results indicate a safe and efficient means of accessing outpatient cardiology investigation.

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Effects of Clopidogrel Versus Ticagrelor on Peripheral Endothelial Function After Non-ST Elevation Acute Coronary Syndrome (NSTE-ACS): a Randomised Trial

J. Xu [1,*], S. Lo [1], C. Mussap [1], J. French [1], R. Rajaratnam [1], K. Kadappu [2], U. Premawardhana [2], P. Nguyen [2], C. Juergens [1], D. Leung [1]

[1] *Liverpool Hospital, Sydney, Australia*
[2] *Campbelltown Hospital, Sydney, Australia*

Background: Ticagrelor has been shown to improve peripheral endothelial function compared to clopidogrel in stable patients. We sought to investigate the effects of clopidogrel versus ticagrelor on peripheral endothelial function in NSTE-ACS patients.

Methods: From Mar 2018-Jan 2019, patients hospitalised for NSTE-ACS were prospectively randomised 1:1 to clopidogrel (300mg loading then 75mg daily) or ticagrelor (180mg loading then 90mg twice-daily). Peripheral endothelial function was assessed in a subset of these patients with flow-mediated vasodilation (FMD) of the brachial artery, performed on admission prior to antiplatelet loading and again before discharge, using a pneumatic cuff and 10MHz linear ultrasound transducer.

Results: 23 patients were included for analysis (9 clopidogrel, 14 ticagrelor). Median age 51(IQR 47–60.5) years, 21(91.3%) were male, 8(34.8%) had diabetes, 9(39.1%) were smokers. Median peak troponin T was 564 (245.5–876)ng/L and median GRACE score 94 (76.5–104.5). Admission median %FMD (change in post-stimulus diameter as a percentage of the baseline diameter) was similar between the 2 groups (clopidogrel 13.2% [10.1–17.6] vs ticagrelor 12.2% [10.2–15.8], $p = 0.41$). There was a trend towards higher median pre-discharge %FMD in the ticagrelor group (12.8% [12.2–18.0]) compared to the clopidogrel group (10.4% [9.5–11.2], $p = 0.09$). There was a trend towards lower pre-discharge %FMD compared to admission in the clopidogrel group (10.4% vs 13.2%, $p = 0.05$) but not the ticagrelor group (12.8% vs 12.2%, $p = 0.43$).

Conclusions: Ticagrelor did not significantly improve peripheral endothelial function compared to clopidogrel in our NSTE-ACS cohort. However, there was a trend towards

beneficial effects with ticagrelor. Further data including longer-term follow-up are awaited.

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Elevated Plasma Angiotensin Converting Enzyme 2 (ACE2) Activity is Associated with Embolic Stroke of Undetermined Source

J. Sajeev [1,*], L. Burrell [2], H. Dewey [1],
J. Kalman [3], B. Chou [1], T. Frost [1], S. Patel [2],
L. Roberts [1], J. Cooke [1], A. Koshy [4],
M. Gould [1], J. Ngoh [1], R. Denver [1], A. Teh [1]

[1] Eastern Health, Box Hill, Australia
[2] University of Melbourne, Melbourne, Australia
[3] Royal Melbourne Hospital, Melbourne, Australia
[4] Austin Health, Heidelberg, Australia

Background: ACE2 activity levels correlate with adverse left atrial remodelling in patients with atrial fibrillation (AF). Several biochemical and structural markers have been associated with embolic stroke of undetermined source (ESUS). We investigated the relationship between ACE2 activity and ESUS.

Methods: This prospective case control study compared patients with ESUS against a control group matched for vascular risk factors. ESUS was diagnosed following cerebral and carotid vascular imaging and 24 hours of cardiac monitoring to exclude AF. Blood samples were collected for measurement of ACE2 activity, D-Dimer and high sensitivity troponin T (hsTnT).

Median ACE2 activity
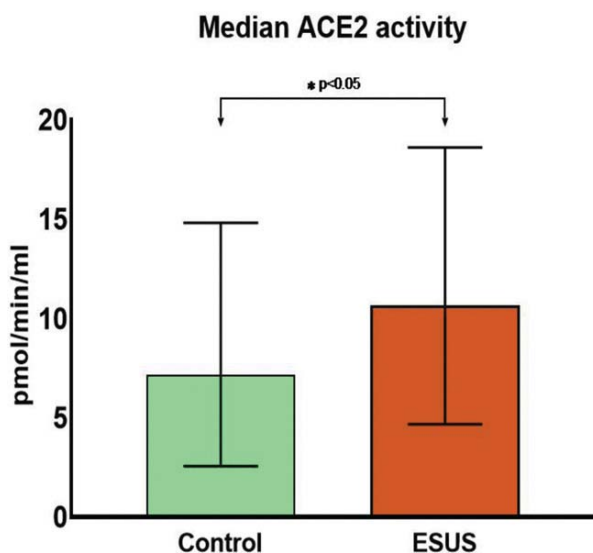
Results: Fifty-one ESUS patients (67 ± 7 years, CHA_2DS_2-VASc score 2) were compared with 47 control patients (66 ± 7 years, CHA_2DS_2-VASc score 2). Median ACE2 activity (10 pmol/min/ml vs. 7 pmol/min/ml, $p < 0.05$) and D-Dimer levels (0.40 mg/L vs 0.35 mg/L, $p < 0.05$) were significantly higher in the ESUS group. There was a significant but weak positive correlation between increased ACE2 activity and

hsTnT ($r = 0.20$, $p < 0.05$). Left atrial volume index (LAVI) on echocardiography was significantly higher in the ESUS group (40 ml/m^2 vs 36 ml/m^2, $p < 0.05$). On regression modelling, adjusting for LAVI, only ACE2 activity (OR 1.04, CI: 1.002–1.09; $p < 0.05$) remained significant for ESUS.

Conclusion: ACE2 activity levels are associated with ESUS, independent of LAVI. Further studies are warranted to investigate whether ACE2 activity can identify ESUS patients that may benefit from oral anticoagulation.

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Establishment of a Cardio-Oncology Service for Assessment and Management of Acute and Late Cardiovascular Conditions

J. Otton [1,2,*], Z. Li [2], E. Koh [2,3], D. Adams [3,4],
K. Mok [2,3], M. Harvey [2,5], S. Ling [2,5],
N. Sungala [5], E. Moylan [3], W. Ng [2,3],
G. Xiong [3], C. Juergens [1], G. Delaney [2,3]

[1] Department of Cardiology, Liverpool Hospital, Sydney, Australia
[2] University of New South Wales, Sydney, Australia
[3] Cancer Therapy Centre, Liverpool and Campbelltown Hospitals, Sydney, Australia
[4] Western Sydney University, Sydney, Australia
[5] Department of Haematology, Liverpool Hospital, Sydney, Australia

Aims: The field of cardio-oncology is gaining prominence due to the rise in cancer survivor population, the prevalence of cardiovascular comorbidity and the range of cancer therapies causing acute and late cardiovascular toxicity. We describe the caseload and benefits of a dedicated cardio-oncology clinic (COC) over the first 16 months of operation since October 2017.

Methods: The oncology EMR was used as a common data platform. Reason for referral, new and follow-up caseload, clinic-demographic and oncology treatment for all patients was recorded and extracted.

Results: A total of 122 ($n = 75$ new and $n = 47$ follow-up) consultations took place. The most common cancer diagnoses were breast cancer ($n = 28$), lung cancer ($n = 12$), lymphoma ($n = 8$), colorectal ($n = 7$), and renal ($n = 5$). Median time from cancer/haematological diagnosis to COC referral was 9.93 months (range 0–275 months) and median time from COC referral to consultation was 10 days. Cancer therapies included chemotherapy with or without immunotherapy ($n = 98$), targeted therapy ($n = 54$), radiotherapy ($n = 52$) and endocrine therapy ($n = 4$). The most common indications for referral included cardiomyopathy/LV dysfunction ($n = 11$), investigation of cardiac symptoms {dyspnoea ($n = 9$), palpitations/arrhythmia ($n = 9$) and chest pain/acute coronary syndrome ($n = 6$)}. Cardiac investigations ordered were echocardiogram ($n = 39$), Holter monitor ($n = 14$), CT coronary angiogram ($n = 10$), gated heart pool scan ($n = 4$) and MRI ($n = 4$). Notably, only 13% of referrals pertained to management of late effects post treatment, cardiovascular surveillance or long-term preventative therapies.

Conclusions: A dedicated cardio-oncology service can facilitate more rapid assessment and management of patients with both acute and late cardiovascular toxicities.

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Evaluation of Haematological and Biochemical Markers as Simple Predictors of In-hospital Mortality in Infective Endocarditis

J. Nguyen [1,*], S. Paleri [2,3], A. Baradi [2,3], Z. Ellis [1], K. Huang [1], R. Navani [1], D. Jin [2,3], A. Newcomb [2,4], J. Darby [2,5], A. Wilson [2,3]

[1] The University Of Melbourne, Melbourne, Australia
[2] St Vincent's Hospital, Melbourne, Australia
[3] Department of Cardiology, St Vincent's Hospital, Melbourne, Australia
[4] Department of Cardiothoracic Surgery, St Vincent's Hospital, Melbourne, Australia
[5] Department of Infectious Diseases, St Vincent's Hospital, Melbourne, Australia

Background: Infective endocarditis (IE) is a serious illness with high morbidity and mortality. There is a need for early recognition of patients at risk of adverse events to guide management decisions and improve outcomes. Recent studies have identified inflammatory biomarkers including C-reactive protein (CRP), neutrophil-to-lymphocyte-ratio (NLR), and platelet-to-lymphocyte ratio (PLR) as prognostic factors in IE. We sought to identify simple laboratory parameters in IE patients as predictors of in-hospital mortality in our centre.

Method: This is a single centre retrospective review of all patients diagnosed with definite IE (using Modified Duke Criteria) at St Vincent's Hospital, Melbourne, between January 1999-December 2012.

Results: 288 patients were identified, 68.06% males and 31.94% females (mean age, 53.58 years). In-hospital mortality was 20.14% (54/288) and surgical management was 30.9%(89/288). Predictors of in-hospital mortality were higher admission levels of white cell count (WCC), neutrophil count, NLR, CRP and bilirubin [$p < 0.001$, $p = 0.004$, $p = 0.010$, $p = 0.017$ and $p = 0.001$ respectively] and lower admission levels of serum albumin and platelet count [$p = 0.003$ and $p = 0.001$ respectively]. On stepwise multiple logistic regression analysis, higher white cell and lower platelet counts were identified as independent predictors of in-hospital mortality when adjusted for age, sex, length of stay, and other inflammatory indices [OR 1.1253, $p = 0.002$ and OR = 0.9944, $p = 0.001$ respectively].

Conclusion: Our findings suggest that higher white cell and lower platelet counts are independently associated with in-hospital mortality in IE patients. These simple and inexpensive inflammatory indices may be useful for early identification of high-risk IE patients.

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Event-Based Discharge Reduces Bed-Hours Post-Elective Angiogram

K. Luthra, V. Pillutla *, C. Blake, D. Kaye, J. Shaw, S. Nanayakkara

Alfred Hospital, Melbourne, Australia

Background: Delays in medical review prior to discharge following elective angiograms can prolong length of stay. Criteria-based discharge protocols have been previously demonstrated in surgical settings to reduce length of stay following simple elective procedures. We aimed to assess whether a similar model would reduce bed-hours within a cardiac day procedure unit without increasing adverse events.

Methods: We implemented an event-based discharge (EBD) model within a tertiary hospital cardiac day procedure unit. In this model, medical staff utilise standardised criteria to assess the patient post-procedurally and determine suitability for EBD. If suitable, nursing staff can enact discharge without further medical review, pending criteria satisfaction. A retrospective analysis was conducted of outcomes in the three months prior to and in the three months after introduction of EBD. A total of 443 patient records were analysed (213 pre-EBD, 230 post-EBD).

Results: EBD was utilised for 89% of discharges post-introduction. Significantly more patients were moved into chair spaces post-introduction of EBD (21% vs. 12%, $p = 0.01$). This led to a decrease in post-procedural bed-hours for day cases (4.51 hours vs. 4.94 hours, $p = 0.03$), and reduced bed-hours for overnight stays (1.24 hours post-7am vs. 1.61 hours, $p = 0.01$). Overall length of stay also reduced for day cases who did not undergo PCI (4.91 hours vs. 4.55 hours, $p = 0.01$). There was no increase in rates of readmission.

Conclusion: Event-based discharge is a viable mechanism to reduce length-of-stay following elective coronary angiograms and improves the efficiency of cardiac day procedure units.

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Examining Sex Inequalities in the Evidence for the Management of Acute Coronary Syndrome (ACS): An Audit of Australian Clinical Guidelines

A. Scovelle, A. O'Neil *

The University of Melbourne, Carlton, Australia

Background: Women's elevated risk of morbidity and mortality following Acute Coronary Syndrome (ACS) may be, at least in part, related to their under-representation in the evidence on which clinical guidelines are based. An audit of US guidelines suggests they may not be sufficiently nuanced for female patients [1]. We sought to conduct a similar audit of the 213 studies on which Australia's clinical guidelines for the management of ACS are based.

Methods: Data were extracted from 200 of the 213 papers included in the Guidelines, (excluding the 13 in the preamble).

Results: Of the 200 papers, 65% were primary sources, 19.5% were secondary sources and 15.5% were other sources. 69.5% mentioned sex/gender. *Representativeness of the sample.* Of those reporting the total number of participants enrolled, 50.5% reported % of women. 78% of studies reported sex ratio/% for the analytic sample. *Representativeness in analytic approach.* Of the papers with primary data sources, <1% included a statement of a priori power to detect sex specific outcomes. Of all papers (including meta analyses), 49.5% reported sex disaggregated data for exposure of interest, 18% reported sex disaggregated data for outcome of interest, and 22.5% used sex used in analytic models.

Conclusion: Fewer than 2 in 10 studies included in the current ACS clinical guidelines reported sex-specific outcome data and less than 1% reported they were powered to do so. The lack of sex-specific evidence illustrates the urgent need for greater investment in CV research and funding, and publication policies that help to address these gaps.

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Existing Models to Assess Perioperative Cardiac Risk Demonstrate Poor Predictive Validity in Patients Undergoing Liver Transplantation

B. Cailes [1,*], A. Koshy [1], J. Ko [1], H. Han [1], H. Lim [1], A. Teh [1], L. Weinberg [3], A. Testro [2], P. Gow [2], O. Farouque [1]

[1] *Department of Cardiology, Austin Health and University of Melbourne, Heidelberg, Australia*
[2] *Victorian Liver Transplant Unit, Austin Health, Heidelberg, Australia*
[3] *Department of Anaesthetics, Austin Health, Heidelberg, Australia*

Background: Liver transplantation (LT) is associated with risk for perioperative cardiovascular events. Although guideline recommended risk scores are well validated in noncardiac surgery, there is uncertainty regarding their utility in LT.

Methods: Consecutive adult patients undergoing LT at the Victorian Liver Transplantation Unit between 2010 and 2017 were evaluated. Perioperative 30-day major adverse cardiovascular events (MACE) and all-cause death were recorded from a prospectively maintained transplantation database and supplemented by electronic medical record review. Perioperative risk for each patient was calculated using the Revised Cardiac Risk Index (RCRI), Charlson Comorbidity Index (CCI) and American Society of Anaesthesiologists Score (ASA) and subsequently assessed for predictive validity.

Results: Among the 704 adult patients that underwent workup for LT, 462 proceeded to transplantation (mean age 52 ± 13, 67.5% male). A total of 51 (11%) patients had perioperative MACE within the 30-day post-operative period. Events included 26 episodes of cardiac failure, 15 resuscitated cardiac arrests, 16 acute coronary syndromes and 10 episodes of ventricular tachycardia. Predictive capability of the assessed scores is reported in Table 1. The risk predictive ability of the RCRI, CCI and ASA scores were low, with all reporting an area under the curve (AUC) <0.60. A high risk score, as defined by guideline recommendations, demonstrated a modest negative predictive value (NPV) and a low positive predictive value (PPV).

Conclusion: Current preoperative risk prediction algorithms have poor predictive ability for cardiac events in a contemporary cohort of LT patients. Better risk prediction algorithms in this group of patients are warranted.

	NPV	PPV	AUC	AUC 95%CI
RCRI ≥3	91%	21%	0.57	0.51-0.64
CCI ≥5	92%	13%	0.56	0.49-0.63
ASA≥4	88%	10%	0.48	0.41-0.55

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Extended Release Oral Milrinone for the Treatment of Heart Failure with Preserved Ejection Fraction

S. Nanayakkara [1,2,3,*], M. Byrne [2], V. Mak [1], K. Carter [1], D. Kaye [1,2,3]

[1] *The Alfred, Melbourne, Australia*
[2] *Baker Heart and Diabetes Institute, Melbourne, Australia*
[3] *Monash University, Melbourne, Australia*

Background: Heart failure with preserved ejection fraction (HFpEF) is an increasingly prevalent form of HF, representing approximately half of the total burden of HF. In contrast to HF with reduced EF, no therapies have been proven effective at improving outcomes and quality of life to date.

Objectives: We hypothesised that modulation of the PDE-III using a novel oral formulation of milrinone might exert favourable effects HFpEF via pulmonary and systemic vasodilation and enhancement of ventricular relaxation. We assessed the safety and efficacy of oral milrinone on quality of life and functional outcomes in patients with HFpEF.

Methods: The MilHFPEF study was a randomised, double blind, placebo-controlled pilot study in patients with symptomatic HFpEF. Efficacy endpoints included changes from baseline in KCCQ summary score and 6-minute walk distance.

Change in KCCQ Overall Summary Score
Milrinone vs. Placebo
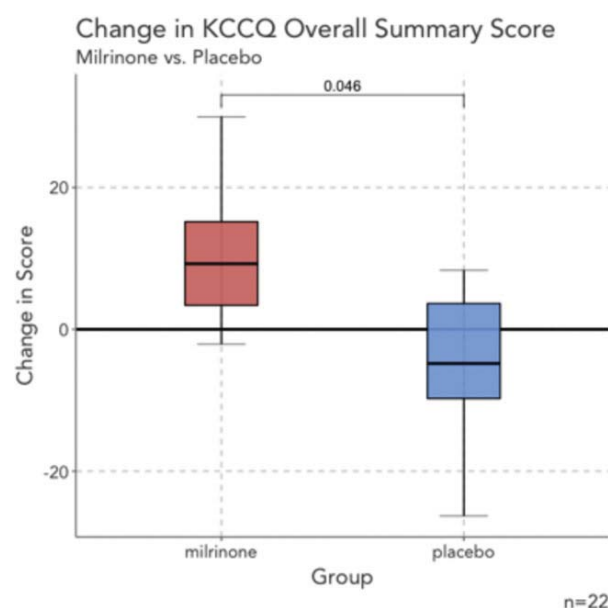
Results: A total of 23 eligible patients completed the study. The KCCQ score improved significantly in milrinone treated patients compared to placebo ($+10 \pm 13$ vs -3 ± 15, $p = 0.046$). 6MWD also tended to improve in the treatment group compared with placebo ($+10 \pm 62$ vs -42 ± 77, $p = 0.092$). Heart rate (-1 ± 5 vs -2 ± 9bpm, $p = 0.9$) and systolic BP (-3 ± 18 vs $+1 \pm 12$mmHg, $p = 0.57$) were unchanged. E/e' (-0.3 ± 3.0 vs. -1.9 ± 4.8, $p = 0.38$) was unchanged. One patient in the placebo arm was hospitalised for HF. Holter monitoring did not demonstrate a pro-arrhythmic effect of milrinone.

Conclusion: In this novel pilot study, extended release oral milrinone was well tolerated and associated with improved quality of life in patients with HFpEF. Further longer-term studies are warranted to establish the role of this therapeutic approach in HFpEF.

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Follow-Up Outcomes of Pre-Hospital Thrombolysis and Primary PCI in Outer Metropolitan Management of STEMI

M. Parkinson [1,*], S. Cheruvu [1],
P. Bamford [1,2], C. Said [1], J. Qin [1],
H. Wadsworth [1], S. Eaves [1], J. Colgan [1],
B. Gunalingam [1,2]

[1] Gosford Hospital, Gosford, Australia
[2] University of Newcastle, Newcastle, Australia

Background: Primary PCI (pPCI) is preferred management with improved outcomes in STEMI [1], however previous reviews demonstrate comparable, in-hospital results for early, pre-hospital thrombolysis in regional centres with large catchment zones [2].

Methods: Retrospective analysis of patients presenting with STEMI at two outer metropolitan centres over a 5-year period (2014–2019), where PCI was available during working hours, with a strategy of pre-hospital thrombolysis other-

wise. Patients were excluded if incomplete data precluded follow-up. The primary outcome was a composite of major adverse cardiac events (MACE) including myocardial infarction (MI), unplanned revascularisation, readmission for heart failure and all-cause mortality. Secondary outcomes included severe bleeding, TIMI-III flow rates and death from any cause. Follow up was conducted to 1-year from the index event.

Results: 450 consecutive patients presented with STEMI, with 425 analysed after exclusions. 117 (27.5%) underwent pPCI while 308 (72.5%) had initial thrombolysis. Average age was 63.9 years and 76.9% were male. Of the thrombolysis group, 56.5% successfully re-perfused while 43.5% required rescue PCI (rPCI) and 296 (96%) underwent coronary angiography. Rates of TIMI-III flow post angiogram were higher in the thrombolysis group 96.0% vs 85.9% ($p = 0.0147$). There were no significant differences in MACE at 1-month or 1-year or all-cause mortality. Major bleeding was higher at 1-month after thrombolysis 4.5% vs 2.6% ($p = 0.36$) but did not reach significance, likely due to inadequate power.

Conclusion: Our experience shows pre-hospital thrombolysis remains a safe alternative to pPCI, especially in regional centres, with no clinically significant differences in 1- and 12-month outcomes.

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Gender Disparities in Safety Outcomes After Pharmaco-Invasive Strategy for ST Elevation Myocardial Infarction: A Four Year Analysis in Two Regional Centres

P. Bamford [1,2,*], L. Zhou [2], S. Eaves [2],
M. Parkinson [2], S. Cheruvu [2], C. Said [2],
J. Coglan [2], R. Spina [2], A. Kull [2]

[1] University Of Newcastle, Newcastle, Australia
[2] Central Coast Local Health District, Wyong and Gosford, Australia

Background: Pharmaco-invasive (thrombolysis) strategy at one year is non-inferior to primary percutaneous coronary intervention (pPCI) in patients with ST elevation myocardial infarction (STEMI) who are unable to undergo pPCI within one hour. In Australia, women with STEMI are less likely to receive invasive management, revascularisation, or preventive medication.

Methods: All patients presenting with STEMI who were thrombolysed or underwent pPCI at two regional centres were included from 2014 to 2018. The co-primary safety outcomes were major bleeding and all-cause mortality at 1 month.

Results: 444 patients presented with STEMI. 73.6% patients were thrombolysed and 26.4% patients underwent pPCI. Males represented 76.3% of thrombolysis and 78.6% of pPCI patients. Post-thrombolysis, there were significantly more major bleeds (11.8% vs 2.8%, RR 4.25, 95% CI 1.64 – 11.0, $p < 0.01$) and higher rates of mortality (10.5% vs 3.6%, RR 2.94, 95% CI 1.17 – 7.34, $p = 0.02$) in women vs men respectively. Post-pPCI, there were no differences in major bleeding (0% vs 3.3%, RR 0.51, 95% CI 0.027 – 9.6, $p = 0.65$) or mortality (4% vs 7.6%, RR 0.52, 95% CI 0.068 – 4.08, $p = 0.54$) in women vs men respectively. In comparing thrombolysis vs pPCI in women using both co-primary outcomes, the number needed to harm is 6.9.

Conclusions: Thrombolysis is less safe in women than men. Primary PCI should be undertaken in women where possible.

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Gender-Neutral Part-Time/Flexible Training Options, Work-Life Balance and Gender Parity in Advanced Cardiology Training: The 2019 Survey of the FRACP Advanced Cardiology Trainees and Recent Graduates

A. Leet [1,*], A. Beale [1,2], L. Segan [3], A. Castles [4], C. Cheshire [8], S. Biswas [1,2], S. Gutman [1,2], S. Mukherjee [5], M. Watts [1], M. Richardson [5], S. Lockwood [6], M. Freeman [7], L. Selkrig [1], S. Zaman [6]

[1] *Heart Centre, Alfred Hospital, Melbourne, Australia*
[2] *Monash University, Clayton, Australia*
[3] *Department of Cardiology, Barwon Health, Geelong, Australia*
[4] *Department of Cardiology, Northern Hospital, Epping, Australia*
[5] *Cabrini Hospital, Malvern, Australia*
[6] *Monash Heart, Monash Health, Clayton, Australia*
[7] *Department of Cardiology, Eastern Health, Box Hill, Australia*
[8] *Department of Cardiology, St Vincent's Hospital, Fitzroy, Australia*

Work-life balance is as a contributor to gender disparity in Cardiology despite equal gender distribution in medical schools [1,2].

Aim: To understand the opinions of the current trainees and recent graduates of the FRACP Cardiology Advanced Training programme regarding gender-neutral part-time, flexible training options, work-life balance and gender parity.

Methods: An anonymous, non-identifiable ten question survey link was emailed to the Victorian, NSW group ($n = 180$), then the remaining group in February and March 2019, respectively. Part-time and flexible training were defined respectively as amount of full-time equivalent/week (eg 0.5 EFT) and block intervals worked (eg alternate 6 months on/off).

Results: Of the 79 (44%) respondents thus far, 64% were male and 78.5% felt gender neutral part-time/flexible training options should be available. While 29% would apply for part-time/flexible training if available, 77% worried about applying due to non-favourable perception by employers and colleagues. Training options favoured were flexible 30%, both 61%, and 76% favoured combined responsibility by the institution and trainees to manage work-flow. Gender imbalance and graduate quality were concerning to 60% and 19% respectively. Significant personal/family sacrifices were made by 82%, and concerningly 44% had experienced mood, depression or anxiety issues due to inflexible training hours.

Conclusion: Part-time/flexible training options during the FRACP Advanced Cardiology training programme should be available as it is favoured by the majority of trainees and may improve work-life balance, depression and anxiety issues and gender imbalance in cardiology.

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Geographically Based Thrombolysis in ST Elevation Myocardial Infarction: A Digitally Integrated Map Software Study

R. Sriamareswaran [1,*], J. Cole [2,3], R. Beare [3,4], T. Phan [6], V. Srikanth [3], M. Premaratne [2,3,5], D. Tong [2], S. Vinod Benyani [3], M. Ahmed [3], J. Layland [2,3]

[1] *Department of Medicine, Peninsula Health, Frankston, Australia*
[2] *Peninsula Health Heart Service, Frankston, Australia*
[3] *Peninsula Clinical School, Monash University, Frankston, Australia*
[4] *Developmental Imaging, Murdoch Children's Research Institute, Parkville, Australia*
[5] *Baker Heart and Diabetes Institute, Melbourne, Australia*
[6] *School of Clinical Sciences, Monash Health, Clayton, Australia*

Pre-hospital thrombolysis (PHT) is an effective reperfusion strategy for patients with ST elevation myocardial infarction (STEMI) in randomised controlled trials. In regional Victoria, STEMI patients have limited access to PCI-centres. There's insufficient data informing clinicians and ambulance staff regarding geographic suitability for PHT over primary-PCI (PPCI). We aimed to graphically represent regions in Victoria according to travel time to the nearest STEMI centre to determine eligibility for PHT.

Using the geocoding function in the Google Maps Application Programming Interface (API), 200 addresses were created per postcode for Victoria, Australia. An estimation of travel times between these addresses and all publicity funded PCI-

centres in Victoria, at varying times of day were calculated using the Google Maps "Distance" API. The ggmap package was modified in-house to specify departure times from each address, a specific Google traffic model and a time of day (representing varying traffic conditions). We divided Victoria into 2 zones (thrombolysis vs. PPCI) based on a predicted travel time of 60 minutes to PCI-centre.
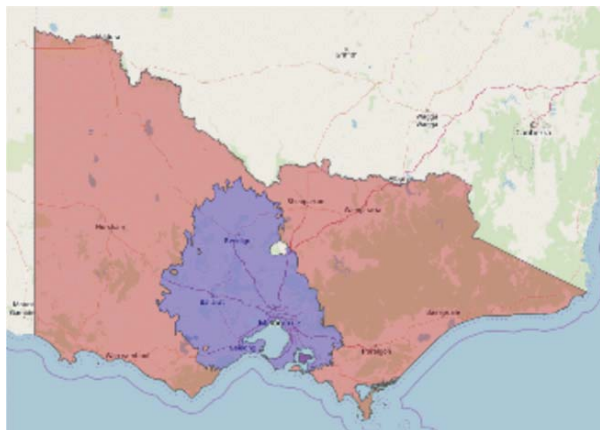
The map generated defines a 60 minute boundary for clinicians and ambulance staff to guide which patients should receive PHT vs PPCI. Approximately 5.1 million people reside within 60 minutes from a STEMI centre with an estimated 2968 STEMI cases. 789,000 people live outside this area, with a predicted 601 (18.2%) STEMI patients. Traffic congestion don't significantly impact on travel times at this 60 minute threshold.

By integrating map software with distance to destination and travel time, predicting the suitability of thrombolysis and PPCI for STEMI patients is possible.

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GRACE Risk Assessment Provides Additional Value to MPS in Prediction of MACE and PCI

F. Zaky *, W. Kan, S. Norman, V. Vijayarajan, R. Cohen, C. Bonin, E. Clingan, B. Elison, P. Shetty

Wollongong Hospital, Wollongong, Australia

Myocardial perfusion scan (MPS) is an established tool for assessing reversible ischaemia in intermediate-risk chest pain patients. The Global Registry of Acute Coronary Events (GRACE) score is a validated tool to assess 6-month mortality post ACS, guiding management and follow up.

	Low risk		High risk	
	MPS-(136)	MPS+(17)	MPS-(176)	MPS+(67)
Male	53.3	64.7	56.8	64.2
Age	60.1	59.7	76.8	76.4
CVA	0.7	0.0	1.1	3.0
AMI	0.7	5.9	1.7	9.0
Death	0.7	0.0	1.7	3.0
MACE	2.2	5.9	4.5	14.9
PCI	4.4	29.4	1.1	22.4

In this retrospective analysis we assessed the utility of using the GRACE risk assessment tool to improve prediction of major adverse cardiac events (MACE) in patients undertaking MPS. Scores were retrospectively calculated for all inpatient MPS studies performed in a tertiary hospital between January and December 2018.

Outcomes assessed included progression to coronary angiography, percutaneous coronary intervention and MACE (composite of myocardial infarction, stroke and death). 396 patients were included in the study, with a mean age 70.3 ± 13.6 years and 57.3% male proportion.

The retrospective application of the GRACE risk stratification tool increased the specificity of MPS in the prediction of MACE and PCI. Prospective randomised controlled studies would be beneficial to confirm the utility of cardiac risk assessment tools prior to myocardial perfusion scanning.

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Health and Lifestyle Modification for Reducing Severity of Cardio-metabolic Risk in Individuals With Metabolic Syndrome: Findings From the MODERN Rrial

M. Carrington [1,*], J. Wiley [2], P. Zimmet [2]

[1] *Baker Heart And Diabetes Institute, Melbourne, Australia*
[2] *Monash University, Melbourne, Australia*

Background: Metabolic syndrome (MetS) predisposes individuals to increased risk of developing type 2 diabetes and/or cardiovascular disease (CVD). Nurse facilitated interventions are effective for the management of chronic disease.

Aim: To determine if nurse-led clinics implementing a health and lifestyle modification program (intervention) are more beneficial than standard care (control) to reduce the concurrence of cardio-metabolic risk factors over 24 months follow up.

Methods: A multi-centre, RCT in regional Victoria was conducted for people aged 40–70 years with MetS and no evidence of CVD or other chronic disease. Presence of ≥3 risk factors including central obesity, low HDL or high triglycerides or high blood pressure (BP) and dysglycaemia were randomised to intervention or control groups. Change in risk

factors were compared and MetS status evaluated using a novel severity score.

Results: Follow up data were available for 241 of 276 (87%) randomised participants. Average age was 57 ± 8 years and 62% were women. BP decreased significantly more among intervention than control participants (by $7/3$ mmHg, $p < .001$). While improvements were seen in body weight, lipids and blood glucose, no significant group differences occurred. MetS prevalence was sharply reduced in 56% (intervention) and 48% (controls; $p = .246$) and MetS severity scores decreased significantly more in the intervention group than control group (-1.07 *vs.* -0.50, $p < .01$).

Conclusion: Independent community nurse clinics can be effective in reducing the aggregate severity of cardio-metabolic risk factors. Determinants of change, cost effective analyses and progression to type 2 diabetes and CVD onset will be reviewed.

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Hepatorenal Syndrome in Patients Undergoing Liver Transplantation is an Independent Risk Factor for Perioperative Cardiac Complications

B. Cailes [1,*], A. Koshy [1], J. Sajeev [1], H. Han [1], J. Ko [1], L. Weinberg [3], P. Gow [2], A. Testro [2], H. Lim [1], A. Teh [1], O. Farouque [1]

[1] *Department of Cardiology, Austin Health Clinical School and University of Melbourne, Heidelberg, Australia*
[2] *Victorial Liver Transplant Unit, Austin Health, Heidelberg, Australia*
[3] *Department of Anaesthetics, Austin Health, Heidelberg, Australia*

Background: Hepatorenal syndrome (HRS) is a serious complication of cirrhosis associated with a poor survival in the absence of liver transplantation (LT). Although HRS confers higher risk of complications due to cirrhosis, it is unclear whether it leads to increased risk of perioperative major adverse cardiovascular events (MACE) following LT.

Methods: Consecutive patients that underwent pre-liver transplant (LT) work-up between 2010–2017 were included. All patients underwent a dobutamine stress echocardiogram (DSE) as part of the work-up. HRS was diagnosed using guideline-based criteria. MACE was recorded from a prospectively maintained transplantation database and supplemented by electronic medical record review.

MACE Outcomes in LT Patients with HRS
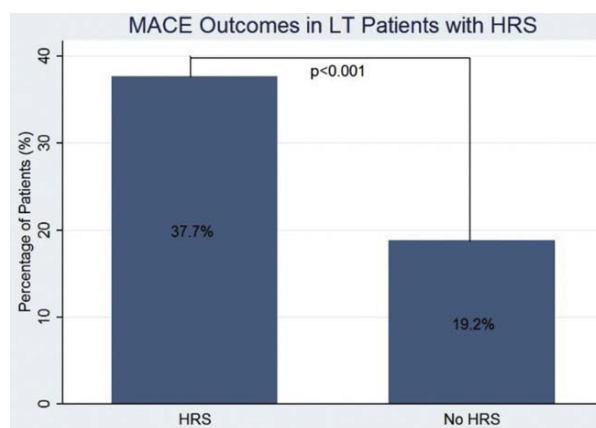
Results: A total of 560 patients (mean age 56 ± 12 years, 75% male) underwent work-up for LT. Among these 319 proceeded to LT with viral hepatitis (37%) being the primary aetiology. Seventy-six (23.8%) MACE events occurred in the 30-day perioperative period. This included 5 deaths, 19 cases of heart failure, 11 cardiac arrests, 9 acute coronary syndromes and 46 arrhythmias (VT/AF). A significantly higher proportion of patients with HRS developed MACE (32/85, 37.7%) compared to those without HRS (44/234, 18.8%) ($p < 0.001$). On multivariable logistical regression, after adjusting for age, gender, diabetes, pre-existing history of AF, NASH, BMI and an abnormal DSE, HRS was strongest predictor of perioperative MACE (OR 2.67, 95%CI 1.27-4.68, $p = 0.008$).

Conclusions: HRS is associated with a higher risk of perioperative MACE when undergoing liver transplantation. This association is maintained after adjustment for comorbid conditions. Incorporating HRS in cardiac risk prediction algorithms may further improve risk stratification of patients undergoing LT.

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High Risk Syncope: Guideline-Based Monitoring and Follow Up

S. Ye [1,*], A. Teh [1], P. Buntine [1], A. Koshy [2], J. Cooke [1], A. Hamer [1], L. Roberts [1], A. Teh [1], J. Sajeev [1]

[1] *Eastern Health, Box Hill, Australia*
[2] *Austin Health, Heidelberg, Australia*

Background: Syncope is a common presentation to the emergency department (ED). Although recent guidelines have established 'red flags' for risk stratification, there is a paucity of data examining adherence to recommendations. We evaluated guideline-based monitoring and cardiology follow-up in patients presenting with syncope.

Methods: We performed a single-centre case-control study among patients presenting with syncope to a tertiary ED. Patients referred to cardiology clinic were age-matched to patients without referral. History, examination, ECG features, monitoring and follow up were collated from retrospective chart review.

Results: 63 patients with syncope were included; 32 patients had cardiology follow-up (mean age 64 ± 20, 39% female) compared with 31 patients without follow up (mean age 61 ± 21, 50% female). There were no significant differences in the age, gender or presence of high-risk features in syncope between the two groups. Lack of ED discharge diagnosis (61% vs 44%, p 0.03) and prior syncopal presentations (59% vs 16%, $p < 0.01$) were significantly associated with outpatient follow up. Among patients with at least one high risk feature, only 50% received inpatient cardiac monitoring. Older age (72 ± 15 vs. 55 ± 24, p 0.03) and high-risk examination findings were significantly associated with monitoring.

High Risk	Discharged	Inpatient Monitoring	P value
History	30.6%	29.6%	0.94
Examination	5.6%	22.2%	<0.05
ECG	11.1%	22.2%	0.30

Conclusion: Patients with syncope do not receive consistent guideline based cardiac monitoring and outpatient review. Future studies investigating clinician and patient factors that can improve guideline adherence are needed to address a potential treatment gap.

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High-Dose Colchicine Therapy for Recurrent Idiopathic Pericarditis

K. Vaidya [1,2,*], I. Wilcox [1,2]

[1] *Department of Cardiology, Royal Prince Alfred Hospital, Camperdown, Australia*
[2] *Central Clinical School, Faculty of Medicine and Health, The University of Sydney, Sydney, Australia*

Background: Recurrences of idiopathic inflammatory pericarditis after an index event can cause substantial patient morbidity, and the need for corticosteroid therapy with its associated toxicities increases the risk of recurrence and harm. The anti-inflammatory medication colchicine is well-established in the treatment of recurrent inflammatory pericarditis at a maintenance dose (0.5 to 1 mg/day) for at least six months, with a favourable safety profile in most patients. However, despite this, recurrence rates remain as high as 30%.

Methods and Results: We report, for the first time, on the use of high-dose colchicine (1.5 to 3 mg/day in divided doses) therapy as a steroid-sparing strategy to further minimise recurrences and treatment-related morbidity. In a series of nine patients, we successfully and significantly reduced steroid requirements over five years without any increase in recurrence rates or colchicine-associated adverse events. Five out of nine patients did not require further corticosteroids after an initial trial of high-dose colchicine therapy, and four only required short periods of moderate doses during an acute flare.

Conclusion: We propose that in carefully selected and monitored patients, escalation to high-dose colchicine therapy, with a subsequent gradual downtitration after achieving durable disease remission, can be safely instituted to minimise recurrences whilst also avoiding, weaning off, or reducing corticosteroid requirements. This novel steroid-sparing approach needs to be further evaluated in an adequately powered, placebo-controlled randomised trial, with the study outcomes evaluating rate of recurrences but also accounting and adjusting for cumulative corticosteroid requirements.

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Impact of Cardiovascular Risk Factors on Survival following Liver Transplantation: Results from the Australian & New Zealand Liver Transplant Registry

A. Koshy [1,*], P. Gow [2], B. Cailes [1], J. Sajeev [1], A. Teh [1], H. Lim [1], H. Han [1], R. Jones [2], A. Testro [2], M. Byrne [2], J. Ko [1], D. Clark [1], M. Yudi [1], O. Farouque [1]

[1] *Austin Health Department of Cardiology & University of Melboure, Heidelberg, Australia*
[2] *Victorian Liver Transplant Unit, Heidelberg, Australia*

Background: Cardiovascular (CV) death is a leading cause of long-term mortality following liver transplantation (LT). Identifying pertinent CV risk factors that impact on long-term survival may allow an opportunity for intervention.

Methods: Outcome data was prospectively collected for all adult LT performed in Australia and New Zealand between 1985–2017, from the Australian and New Zealand Liver Transplant Registry. Risk factors including hypertension, diabetes, age, sex, obesity (body mass index $\geq 30 \, kg/m^2$), pre-existing coronary artery disease (CAD) and non-alcoholic fatty liver disease aetiology were entered in a multivariable Cox model.

Results: Among 4,538 adult LT performed across 6 participating centres, 1433 (31.6%) deaths occurred. This included 240 CV deaths (17%) that occurred over a median follow-up of 10.5 years (IQR: 4.9–17.9 years). On univariate analysis, age ≥ 50 years (log-rank test, $p < 0.001$), diabetes ($p < 0.001$) and obesity ($p = 0.006$) were associated with all-cause mortality (**Figure**). After Cox multivariable adjustment, diabetes (Hazard ratio [HR] 1.4, 95%CI 1.07–1.8, $p = 0.01$) and age ≥ 50 (HR 1.5 95%CI 1.2–1.9, $p < 0.001$) remained as independent predictors for all-cause mortality. Notably, pre-existing CAD did not predict long-term mortality ($p = 0.24$).

Conclusion: Presence of diabetes and age ≥ 50 independently increased the risk of long term mortality following LT. Whether intensive risk factor modification in high-risk populations improves long-term survival after LT remains to be tested.

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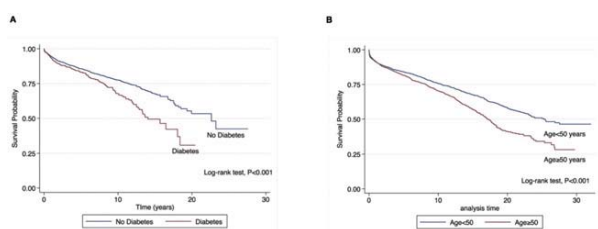
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Impact of Fast Food Outlet Density on Incidence of Acute Myocardial Infarction in the Hunter Region

T. Saluja [1,*], A. Davies [2], C. Oldmeadow [1,3], A. Boyle [1,2,3]

[1] University Of Newcastle, Callaghan, Australia
[2] Department of Cardiovascular Medicine, John Hunter Hospital, Newcastle Australia
[3] Hunter Medical Research Institute, Newcastle, Australia

Background: Changing food-purchasing and consumption patterns have led to a rapid growth in fast-food availability worldwide. There is a well-established association between fast food consumption and metabolic diseases. Some studies also suggest that calorie-dense food promotes a proinflammatory response, which is itself linked with myocardial infarction (MI). Whether increased fast-food availability is a risk factor for MI remains unknown.

Methods: We conducted a retrospective cohort study using a database of all MI events between 1996–2013, extracted from the Hunter Cardiac and Stroke Outcomes unit. Fast food outlet density (FFD) was calculated for each local government area (LGA) of the Hunter region, allowing for a comparative analysis. Stratification by fast food outlet data and LGA resulted in a total of 3,070 cases. Weighted linear regression was used to investigate the role of fast food outlet density on incidence of myocardial infarction in regional and rural Australia.

Results: Fast food outlet density was positively correlated with rates of MI, remaining consistent in both single and multivariate predictor models adjusting for age, obesity, hyperlipidaemia, hypertension, smoking status, and diabetes ($p < 0.001$). An increase of one fast-food outlet per 100,000 people in an LGA corresponded with four additional cases of MI per year (4.12, 95% CI. 3.88–4.35).

Conclusions: Fast food outlet density was positively associated with incidence of myocardial infarction in both rural and metropolitan areas of NSW. This relationship remained consistent after multivariate adjustment for standard cardiovascular risk factors, highlighting the importance of an individual's food environment as a potential contributor towards their health.

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Impact of Lunar Phase on Outcomes following ST-Elevation Myocardial Infarction

L. Segan [1,2,*], N. Andrianopoulos [2,3], A. Brennan [2,3], C. Hiew [1,2], C. Reid [2,3,9], M. Freeman [2,4], E. Oqueli [2,5], A. Ajani [2,6], D. Clarke [2,7], S. Duffy [2,3,8], T. Yip [1,2]

[1] Department of Cardiology, Barwon Health, Melbourne, Australia
[2] Melbourne Intervention Group, Melbourne, Australia
[3] Centre of Cardiovascular Research and Education in Therapeutics, Monash University, Melbourne, Australia
[4] Department of Cardiology, Box Hill Hospital, Melbourne, Australia
[5] Department of Cardiology, Ballarat Base Hospital, Ballarat, Australia
[6] Department of Cardiology, Royal Melbourne Hospital, Melbourne, Australia
[7] Department of Cardiology, Austin Hospital, Melbourne, Australia
[8] Department of Cardiology, Alfred Hospital, Melbourne, Australia
[9] School of Public Health, Curtin University, Perth, Australia

Background: There is a long-held belief in the association between the full moon and extremes of human behaviour and potential adverse health consequences. Small-scale studies are conflicting, however most suggest no clear association between lunar phase and occurrence of acute coronary syndromes.

Methods: This multi-centre retrospective observational study from the Melbourne Intervention Group registry included 7,570 ST-elevation myocardial infarction (STEMI) cases from 6 tertiary centres over a 12-year study period in Victoria, Australia.

Outcome measures: Primary outcomes studied included incidence of STEMI, major adverse cardiac
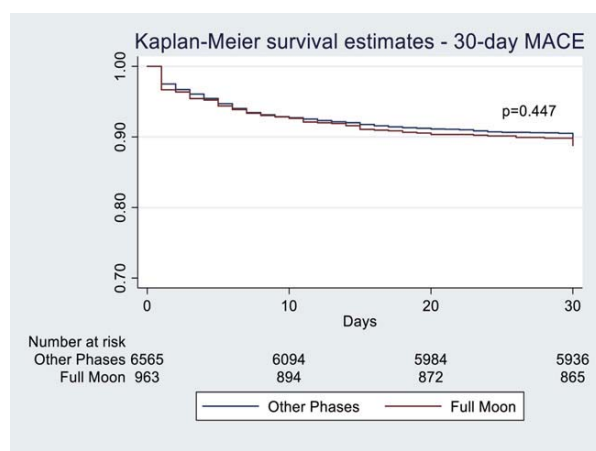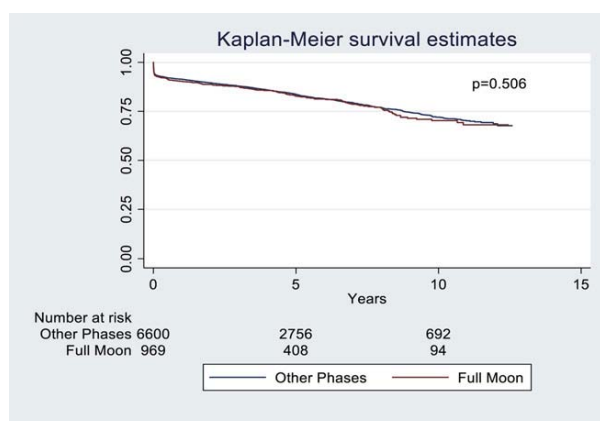

Figure 1. . 30-d MACE.

Figure 2. . *Kaplan Meier survival analysis.*

and cerebrovascular events (MACCE) and mortality at 1 and 5 years in cases of ST-elevation myocardial infarction undergoing primary percutaneous coronary intervention during the full moon between 2005–2017 in Victoria, Australia.

Results: This study demonstrated no significant difference in STEMI incidence ($p = 0.61$) nor of major adverse cardiovascular events across all lunar phases. Subgroup analysis confirmed no difference in outcomes during the full moon phase compared to a composite of other lunar phases.

Kaplan-Meier survival estimates showed similar 30-day outcomes across lunar phases ($p = 0.35$) and when comparing the full moon to a composite of other lunar phases ($p = 0.45$). Similarly, there was no significant difference in survival at 1 and 5 years between lunar phases ($p = 0.68$) or when comparing to the full moon phase ($p = 0.51$).

Conclusions: This study showed no significant difference in incidence, MACCE or survival outcomes in patients with ST-elevation myocardial infarction undergoing primary percutaneous coronary intervention during the lunar phases.

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Impact of Single-Vessel vs Multi-vessel CAD on Long-Term Mortality in Patients with Diabetes Mellitus Undergoing PCI

M. Omair [1,*], D. Dinh [2], A. Brennan [2], O. Farouque [1], S. Duffy [3], A. Ajani [4], C. Reid [2], E. Oqueli [5], A. Hutchinson [6], N. Andrianopoulos [2], A. Koshy [1], M. Yudi [1], D. Clark [1]

[1] *Austin Health, Melbourne, Australia*
[2] *Monash Centre of Cardiovascular Research and Education in Therapeutics (CCRET), Melbourne, Australia*
[3] *Alfred Hospital, Melbourne, Australia*
[4] *Royal Melbourne Hospital, Melbourne, Australia*
[5] *Ballarat Hospital, Ballarat, Australia*
[6] *Geelong Hospital, Geelong, Australia*

Background: Long-term outcomes of percutaneous coronary intervention (PCI) for multi-vessel disease (MVD) with

diabetes mellitus (DM) are inferior to coronary artery bypass grafting (CABG), but the outcomes of PCI in diabetics with single vessel disease (SVD) are less well known. We aimed to assess the long-term mortality of patients with DM with SVD compared to MVD undergoing PCI.

Methods: We included 8,795 consecutive patients with DM undergoing PCI from 34,784 patients in the Melbourne Interventional Group registry (2005–2018). Patients were stratified based on whether they had SVD or MVD. Long-term mortality was assessed via linkage with the National Death Index (NDI).
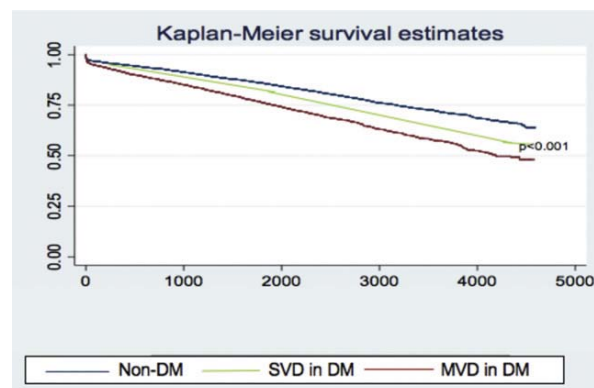
Results: 6,138 (70%) of DM patients had MVD. Compared to SVD, MVD were older (67 ± 11 vs 64 ± 10 years), with higher rates of hypertension, insulin dependence, prior PCI, renal impairment, left ventricular ejection fraction <45%, cardiogenic shock and out-of-hospital cardiac arrest (all $p < 0.001$). Patients with MVD had significantly higher rates of stent thrombosis, unplanned CABG and major bleeding with lower procedural success and 30-day major adverse cardiac events (5.5% vs 2.6%, $p < 0.001$). Long-term mortality (mean 5.4 ± 3 years) was significantly higher in MVD (28% vs 17%, $p < 0.001$). Cox proportional hazard modelling found MVD as an independent predictor of long-term mortality (HR 1.37, 95% CI 1.2–1.5, $p < 0.001$).

Conclusion: Patients with DM and SVD undergoing PCI had a lower long-term mortality compared to MVD. However, the mortality beyond 3 years in SVD increases, mandating aggressive risk factor control and close clinical follow-up.

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Implementation of Simple Algorithms for Glucose and Lipid Lowering Optimisation in Diabetes and Acute Coronary Syndrome (GALLOP-ACS)

N. Lan [1,2,*], G. Fegan [1], J. Rankin [2],
D. Bell [3,4,5], G. Watts [3,4], B. Yeap [1,3]

[1] Department of Endocrinology, Fiona Stanley Hospital, Perth, Australia
[2] Department of Cardiology, Fiona Stanley Hospital, Perth, Australia
[3] Medical School, The University of Western Australia, Perth, Australia
[4] Department of Cardiology, Lipid Disorders Clinic, Cardiometabolic Service, Royal Perth Hospital, Perth, Australia
[5] Department of Clinical Biochemistry, PathWest Laboratory Medicine, Royal Perth and Fiona Stanley Hospitals, Perth, Australia

Introduction: Diabetes mellitus is associated with increased risk of adverse outcomes following an acute coronary syndrome (ACS). We evaluated whether implementing simple algorithms to guide inpatient care improved glycaemic control, and increased the use of sodium-glucose co-transporter 2 inhibitors (SGLT2is) and lipid-lowering medication in a tertiary hospital cardiac unit.

Methods: A 3-month audit (phase 1) was conducted to evaluate hyperglycaemia management, dyslipidaemia management and medication prescriptions. Consecutive patients with diabetes admitted for ACS were prospectively identified. Target blood glucose level (BGL) was defined as 5–10 mmol/L and an adverse glycaemic day as a patient-day where any BGL was <4 mmol/L or >12 mmol/L. A multidisciplinary committee designed and implemented decision-support algorithms plus education. A 3-month post-implementation audit (phase 2) was conducted to assess outcomes.

Results: There were 104 patients in phase 1 and 101 in phase 2, with similar baseline characteristics (glycated haemoglobin 8.0% vs 7.8%). Post-implementation, the incidence of BGL >10mmol/L was lower (Phase 1: 46.4% vs Phase 2: 31.8%, $RR = 0.69$, CI 0.62–0.76, $p < 0.0001$), as were adverse glycaemic days (43.8% vs 32.8%, $RR = 0.75$, CI 0.62–0.90, $p = 0.002$), without a difference in BGL <5 mmol/L (4.9% vs 4.5%). SGLT2i prescriptions increased (baseline to discharge - 12.5% to 15.4% vs 7.9% to 24.8%, $p = 0.005$). There was a trend toward increased high-intensity statin prescriptions (72.1% vs 85.1%), however non-statin lipid-lowering medication prescriptions did not increase.

Conclusions: Implementation of decision-support algorithms for cardiology ward staff was associated with an improvement in inpatient glycaemic control and increased use of cardio-protective therapies in patients with diabetes and ACS.

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Incidence, Clinical Characteristics and In-Hospital Outcomes of MINOCA Patients: A Combined Analysis from 2 Large Registry Datasets

K. Singh [1,2,*], H. Ghataura [2], C. Chen [2],
A. Kishore [2], A. Perera [2], R. Jung [3],
S. Parlow [3], B. Hibbert [3], T. Simard [3]

[1] Gold Coast University Hospital, Southport, Australia
[2] Griffith University, Gold Coast, Australia
[3] Ottawa Heart Institute, Ottawa, Canada

Background: Myocardial infarction with non-obstructive coronary arteries (MINOCA) is frequently encountered but incompletely understood disorder. Our aim was to analyse the clinical characteristics and in-hospital Net Adverse Cardiovascular Events (NACE) of MINOCA and MI secondary to obstructive atherosclerotic coronary disease (OACD-MI).

Methods: In this observational study we combined data from 2 large university hospitals from Canada and Australia. Clinical characteristics and in-hospital outcomes of MINOCA and OACD-MI were analysed by matching these patients in a 1:1 ratio after selecting OACD-MI patients by systematic random sampling. Clinical characteristics associated with MINOCA were identified through multivariate logistic regression. Primary outcome of interest was net adverse cardiovascular events defined as death, heart failure, stroke, and major bleeding.

Results: A total of 6,812 patients underwent angiography for MI over a period of 4 years. Of 839 patients without OACD-MI, 645 (9.5%) were diagnosed with MINOCA. Female sex, absence of traditional cardiac risk factors and ECG changes were independent predictors of MINOCA diagnosis on multivariate analysis. Use of antiplatelet ($p = 0.001$) and beta-blocker ($p = 0.001$) medications was significantly lower in MINOCA at discharge. NACE ($p = 0.0001$), death ($p = 0.019$) stroke, ($p = 0.002$) and heart failure ($p = 0.001$) were significantly lower in patients with MINOCA

Conclusion: The incidence of MINOCA is roughly 9%. Compared to OACD-MI, patients with MINOCA have less cardiac risk factors. In-hospital outcomes of patients diagnosed MINOCA are better than OACD-MI.

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Inducible Left Ventricular Outflow Tract Obstruction is Associated with a Higher Incidence of Perioperative Cardiac Arrest in Liver Transplantation

B. Cailes [1,*], A. Koshy [1], H. Han [1], J. Sajeev [1],
J. Ko [1], L. Weinberg [3], P. Gow [2], A. Testro [2],
P. Srivastava [1], H. Lim [1], A. Teh [1],
O. Farouque [1]

[1] Department of Cardiology, Austin Health and University of Melbourne, Heidelberg, Australia
[2] Victorial Liver Transplant Unit, Austin Health, Heidelberg, Australia
[3] Department of Anaesthetics, Austin Health, Heidelberg, Australia

Background: Inducible left ventricular outflow tract obstruction (LVOTO) is often encountered in liver transplant (LT) candidates during cardiac workup. While the impact of LVOTO on adverse cardiovascular haemodynamics is well reported, it is unclear whether it predisposes to perioperative cardiovascular complications post LT.

Methods: Consecutive patients undergoing dobutamine stress echocardiography were evaluated from a LT centre between 2010–2017. Inducible LVOTO was defined as LVOT gradient $\geq$ 36 mmHg. Perioperative major adverse cardiovascular events (MACE) at 30 days and all-cause death were recorded from a prospectively maintained LT database and supplemented by electronic medical record review.
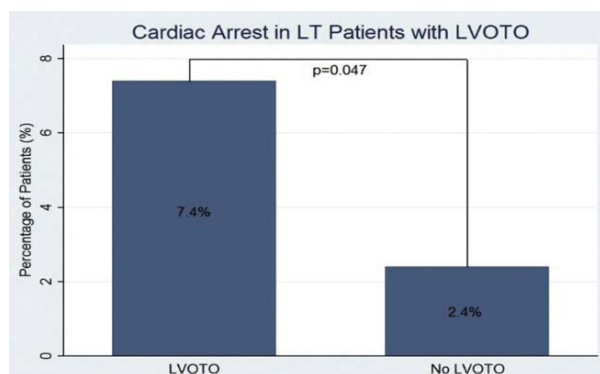
Results: We evaluated 560 patients who underwent DSE during LT workup, 319 of which progressed to transplant. Inducible LVOTO was observed in 68 patients (21.3%). A higher baseline cardiac output (7.7 vs. 7.0 L/min, $p = 0.002$) predicted for development of inducible LVOTO. Seventy-seven patients (4.1%) experienced a MACE including five deaths, 19 cases of heart failure, 11 cardiac arrests, 10 acute coronary syndromes and 46 arrhythmias (VT/AF). Overall MACE occurred in 17/68 patients (25.0%) with LVOTO and 60/251 (23.9%) without ($p = 0.85$). However, there was a significantly increased risk of resuscitated peri-operative cardiac arrest in patients with LVOTO (7.4% vs. 2.4%, $p = 0.04$). Patients with LVOTO also required significantly greater volumes of fluid intra-operatively (8.37L vs. 6.71L, $p = 0.043$).

Conclusions: Inducible LVOTO is a frequent finding occurring in 21.3% of LT candidates. Despite higher intraoperative fluid resuscitation, LVOTO increased the risk of periopera-

tive cardiac arrest. Patients with LVOTO undergoing liver transplantation may benefit from heightened perioperative surveillance.

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Is There a Gender Disparity in Characteristics and Outcomes for Patients Over 85 years Presenting with Non-ST-Elevation Myocardial Infarction (NSTEMI)?

A. Murphy *, A. Koshy, P. Kunniardy,
G. Meehan, J. Ramchand, O. Farouque,
D. Clark, M. Yudi

Austin Health, Melbourne, Australia

Introduction: There is extensive research highlighting gender differences in the clinical presentation and outcomes of those presenting with acute coronary syndromes. Whether this is relevant to patients aged >85 years remains uncertain.

Methods: A retrospective analysis of 956 consecutive patients aged >85 years presenting with NSTEMI between 2010–2018 was undertaken. Patients were stratified by gender. The primary outcome was all-cause long-term mortality as determined by review of electronic medical records.
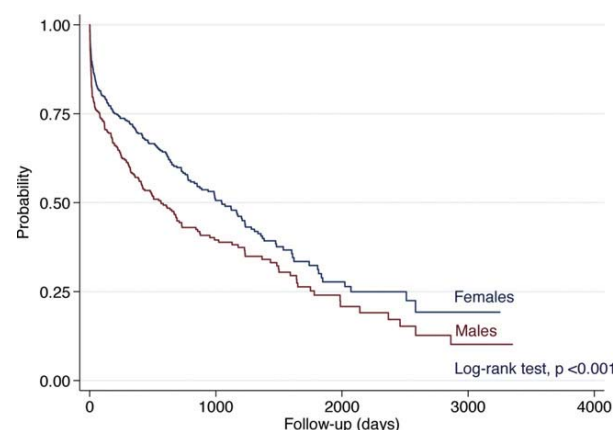
Results: Of the 956 patients included, 537 (56%) were female. Males were more likely to be smokers and have a history of myocardial infarction (both $p < 0.01$) but there was no significant difference in the prevalence of diabetes, hypertension or dyslipidaemia between the groups. Males were more likely to undergo invasive coronary angiography (CA) during hospitalization (13.8% vs 6.5%, $p < 0.001$) and had higher mortality 52.5% vs females 41.7%, (unadjusted HR 1.4, 95% CI 1.1–1.7, $p < 0.001$). On Cox-proportional hazard modelling, after adjusting for age, prior MI, cognitive impairment, AF and invasive CA; male gender was the strongest predictor for long term mortality in this population (adjusted HR 1.7; 95%CI 1.4–2.1, $p < 0.001$).

Conclusion: In this cohort of elderly patients presenting with NSTEMI, women had a lower rate of death despite men receiving more invasive management. This gender discrepancy favouring women is unique to the elderly population.

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This abstract has been withdrawn

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Long Term Outcomes in Patients Aged >85 Years Presenting with Type II Myocardial Infarction (Type II MI)

P. Kunniardy [*], A. Koshy, G. Meehan,
A. Murphy, D. Gayed, J. Ramchand,
D. Clark, O. Farouque, M. Yudi

Austin Health, Heidelberg, Australia

Introduction: There is a paucity of data regarding the presentation, management and the long-term outcomes of very elderly patients who suffer from a type II myocardial infarction.

Methods: A single-centre retrospective analysis of 956 consecutive patients aged >85 years presenting with NSTEMI between 2010–2018 was undertaken. Patients were stratified by type I vs Type II MI as defined by the 4th Universal Definition of MI. The primary outcome was all-cause long-term mortality ascertained by review of electronic medical records.

Results: Mean age of the cohort was 89 ± 3 years and 43.8% were male. Of the 956 patients included, 477 (50%) suffered a type II MI. The predominant presentations of patients presenting with type II MI included delirium (34.3%), sepsis (18.4%), non-cardiac surgery (8.5%) and bleeding/anaemia (6.7%). Those with Type II MI were less likely to undergo invasive coronary angiography (2.5 vs 17.0%, $p < 0.001$) and less likely to be prescribed aspirin (77 vs 84%) although rates of statin use were higher (78 vs 69%, $p < 0.001$). In-hospital mortality was significantly higher in those with type II MI (21.1 vs 13.5%, $p = 0.002$). Over a mean follow-up of 1.3 years, 444 patients died (46.4%). Despite higher in-hospital mortality, on multivariable Cox-regression, Type II MI was not significantly associated with higher long-term mortality (adjusted HR 1.1 95%CI 0.8–1.2, $p = $ ns).

Conclusion: Type II MI is common in elderly patients and confers a high risk of in-hospital mortality. At present, there is a lack of evidence to risk stratify and guide treatment in this population.

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Longer-Term Outcomes in Women Undergoing Percutaneous Coronary Intervention

D. Dinh[1], A. Brennan[1,*], D. Liew[1],
C. Reid[1,3], J. Lefkovits[1,2]

[1] *Monash University, Melbourne, Australia*
[2] *Royal Melbourne Hospital, Melbourne, Australia*
[3] *Curtin University, Perth, Australia*

Background: There have been mixed outcomes for women undergoing Percutaneous Coronary Intervention (PCI). Studies in selected cohorts such as acute coronary syndromes (ACS) have shown poor early outcomes, while other earlier studies showed female gender to be protective for short to medium term (1 year) outcomes. Utilising clinical quality registry data in the contemporary era of PCI, we sought to evaluate the longer-term mortality for women.

Methods: From 2013 to 2017, consecutive patients undergoing PCI from across Victoria were prospectively entered into the Victorian Cardiac Outcomes Registry. The primary endpoint was longer-term mortality (mean+/-SD, 720.6 +/- 444.9 days) via linkage to the National Death Index. Multivariate logistic regression was used to analyse independent predictors of longer-term mortality.

Results: A total of 36,448 patients (23.5% female) underwent PCI, of whom 33.4% presented with stable coronary artery disease and 66.6% with ACS (ST elevation MI 24.2%, non-STEMI 31.4%, unstable angina 11.1%). Females were on average 4.7 years older than males (68.8 vs. 64.1, $p < 0.001$), had more comorbidities such as diabetes (25.9% vs. 22.9%) and cerebrovascular disease (28.3% vs. 23.4%), $p < 0.001$ for both. Predictors of longer-term mortality were previous PCI (HR 1.04, $p < 0.01$) and severe renal impairment (HR 1.22, $p < 0.001$). Presentation type and ejection fraction were not predictors of longer-term mortality. Female gender was independently associated with increased longer-term mortality (HR 1.04, $p = 0.03$).

Conclusions: In this large state wide registry, female gender was associated with an increased likelihood of longer-term mortality.

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Long-Term Outcomes After Delayed Angiograms in Patients with Successfully Thrombolysed ST-Elevation Myocardial Infarctions

C. Said, S. Cheruvu [*], M. Parkinson,
P. Bamford, H. Wadsworth, J. Qin,
M. William

Gosford Hospital, Gosford, Australia

Background: Many outer-metropolitan and rural hospitals rely on thrombolysis to manage patients with ST-elevation myocardial infarction (STEMI) due to patients being 90 minutes away from percutaneous coronary intervention (PCI)

facilities [1]. Current international guidelines recommend coronary angiography occur 2–24 hours after successful thrombolysis [2]. However, after successful reperfusion following thrombolysis, limited resources may delay angiogram in some patients (>24 hours).

Methods: A retrospective analysis was conducted on 308 consecutive patients with STEMI post thrombolysis over 5 years at 2 large outer-metropolitan centres. After patients requiring rescue-PCI were excluded the remaining patients were stratified into 2 groups; those thrombolysed on Friday or Saturday and those thrombolysed on other days of the week. The primary outcome was a composite of major adverse cardiac events including all-cause mortality, myocardial infarction, unplanned revascularisation and readmission for heart failure. Follow-up was conducted to 1 and 12 months after the index event.

Results: Of 308 consecutive patients receiving thrombolysis over a 5-year period, 174 (56%) patients did not require rescue PCI and were included in our final statistical analysis. Of these patients, 115 (66%) presented on Sunday - Thursday and 58 (33%) presented on Friday or Saturday. There was no statistical difference in the primary outcome at 1-month (RR 1.80, $p = 0.28$, 95% CI 0.62 - 5.21) or 12-months (RR 0.96, $p = 0.92$, 95% CI 0.43 - 2.14) for patients presenting on Friday or Saturday compared to other days of the week.

Conclusion: Our study supports the notion that patients can safely wait until the next business day (>24 hours) for PCI after successful thrombolysis for STEMI at hospitals without after-hours PCI facilities.

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Obesity is Only a Risk Number for Secondary Prevention – Failure of Randomised Weight Loss Trials

S. Jenkins [1], N. Sowden [5], D. Colquhoun [1,2,3,4,*], A. Ferreira-Jardim [1]

[1] University Of Queensland, Auchenflower, Australia
[2] Wesley Hospital, Brisbane, Australia
[3] Greenslopes Private Hospital, Brisbane, Australia
[4] Sunnybank Private Hospital, Brisbane, Australia
[5] Royal Brisbane and Women's Hospital, Brisbane, Australia

Introduction: Obesity is linked to a number of metabolic conditions which are risk factors for cardiovascular disease.

An increasing number of weight loss medications have become available as an adjunct treatment of obesity along with recommendations for diet and exercise. None have been shown to have effect on mortality or cardiovascular outcomes. Overweight and obesity are increasing and correlated with first but not necessarily recurrent cardiovascular events (CVE). This study assesses the safety and efficacy of weight loss as measured in the large prospective randomised weight loss trials for secondary prevention.

Methods: PubMed search for trials measuring the specific effect of obesity reduction on cardiovascular events up to March 2019.

Results:

Trial	LOOK-AHEAD	SCOUT	CRESCENDO	LIGHT	CONVENE	CAMELLIA	SOS	SLEEVE-PASS
Number	5100	10744	18695	8910	8800	12000	4047	264
Outcome	CVE	CVE	CVE	CVE	CVE	CVE	CVE	CV Risk
HR	0.95 p = 0.5	1.16 p = 0.02	0.97 p = 0.68	0.88	n/a	0.97 p = 0.55	0.76 p = 0.01	n/a
Duration	10 yrs	3.4 yrs	13.8 mths	2.9 yrs	5 mths	3.3 yrs	15 yrs	5 yrs
Status	Terminated	Withdrawn	Terminated	Terminated	Terminated	No effect on CVE	Primary objective successful Secondary underpowered	Weight loss benefit shown with decrease in comorbidities.

Conclusion: Deliberate weight loss in patients with baseline CVD do not prevent recurrent CVD and in fact may increase risk. Current guidelines need revision.

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Outcomes of Patients Admitted to the Intensive Care Unit Following Out of Hospital Cardiac Arrest with Shockable Rhythms (Ventricular Fibrillation or Ventricular Tachycardia): A Single Centre Experience

A. Ahmad Nizar *, V. Shaw, V. Pera

Waikato Hospital, Hamilton City, New Zealand

Background: Survival to hospital discharge rates for Out of Hospital Cardiac Arrest (OHCA) is poor, with outcomes for shockable rhythms (ventricular fibrillation/tachycardia (VF/VT)) between 27% to 33%.

Objective: We aim to evaluate outcomes and predictors of survival in patients admitted to the Intensive Care Unit (ICU) following OHCA with shockable rhythms (VF/VT).

Methods: We performed a retrospective analysis of data collected from Waikato Hospital ICU database and medical records from January 2013 to December 2017. Inter-hospital transfers were excluded. Survival rates at discharge and at 30 days were assessed.

Results: A total of 117 patients were admitted to Waikato Hospital ICU following OHCA with shockable rhythms. Of those, 74 received coronary angiography with 42 patients (57%) having severe obstructive coronary artery disease (CAD). Thirty-five patients received immediate angiography (within 6hrs of admission) and 39 patients beyond 6hrs. Sur-

vival at discharge and at 30 days were 60% versus 97.4% and 57.1% versus 97.4% respectively. In patients who survived at discharge versus those who did not, mean arterial pH, mean lactate level, mean estimated time to Return of Spontaneous Circulation (ROSC) and mean age were 7.19 versus 7.09 ($p = 0.009$), 5.3mmol/L versus 7.8mmol/L ($p = 0.0009$), 17.7 minutes versus 37 minutes ($p = 0.0002$) and 56 years versus 64 years ($p = 0.0004$) respectively.

Conclusion: In patients admitted to ICU following OHCA with shockable rhythms, increasing age, prolonged time to ROSC and severe lactic acidosis were associated with increasing mortality. Increased survival rates in the patient group who had delayed angiography might reflect selection bias.

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Outcomes of Patients Presenting to the Emergency Department Undergoing High Sensitivity Troponin T Testing, Based on the 4th Universal Definition of MI

A. Etaher [1,*], Y. Saad [1], I. Ferguson [1], W. Alazrag [1], T. Nguyen [1], C. Juergens [1], D. Chew [2], J. French [1]

[1] *Unsw, Liverpool, Australia*
[2] *Flinders University, Adelaide, Australia*

Background: Among patients who attend emergency departments (ED) with symptoms potentially due to an acute coronary syndrome (ACS) ~25–30% have myocardial infarction (MI) neither ruled-out nor ruled-in after paired HsTn levels and ECGs, though most patients have MI ruled-out, and 5–20% have MI ruled-in, and need further assessment. Thus these patients are aptly called in the grey zone, and have similar 1-year risks of death and MI to those diagnosed with MI.

Methods: We determined 5 year outcomes of all patients with qualifying HsTnT levels who attended to ED over a 4 month period, according to adjudicated diagnoses based on the 4th Universal definition of MI; rates of coronary angiography and revascularisation were also determined.

Results: Of 2738 patients, 1355 (49%) had at least 2 qualifying Hs-TnT levels (upper reference limit 14ng/L), and 718 (26%) had at least one level >14ng/L. Frequencies of diagnoses of type 1 MI, type 2 MI, acute myocardial injury (Acute Inj) chronic myocardial injury and other diagnoses were 91(6.7%), 127(9.3%), 44(3.2%), 450(33%), 643(47%) and rates of angiography according to these diagnoses were 81(89%), 40(31%), 5(11%), 66(14.6%), 49(7.6%) respectively. Kaplan-Meier analysis (Figure) shows the late mortality rates among those 5 patient groups; ($p < 0.001$). Patients with type 2 MI had the highest unadjusted mortality.

Conclusion: Among unselected patients with suspected ACS undergoing hs-TnT assays, the mortality rate was higher among patients who had type 2 MI followed by chronic and acute myocardial injury, where patients with type 1 MI had lower mortality.

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Outcomes of ST Elevation Myocardial Infarctions in those with and without Standard Modifiable Cardiovascular Risk Factors (SMuRFs)

S. Cheruvu *, M. Parkinson, C. Said, P. Bamford, J. Qin, H. Wadsworth, J. Colgan

Gosford Hospital, Gosford, Australia

Background & Objective: Recent studies have suggested that an increasing proportion of patients presenting with acute ST elevation myocardial infarction (STEMI) have no standard modifiable risk factors (SMuRFs) [1]; specifically, hypercholesterolaemia, hypertension, diabetes mellitus and smoking. This study aims to evaluate the incidence of statin use and major adverse cardiovascular events (MACE) post-STEMI in those patients with- and without-SMuRFs.

Methodology: We performed a two centre, retrospective analysis of all STEMI presentations over a 5-year period. Patients were divided into groups according to whether they had at least one of the SMuRFs or none.

Results: A total of 342 patients were included in the analysis. Of these, 313 (91.5%) had at least one SMuRF and 29 (8.5%) had none. There were no statistically significant differences between the most common non-modifiable risk factors of advanced age and male sex between the two groups. In those without-SMuRFs, only 75.9% of patients received secondary prophylaxis statin therapy, whilst in those with-SMuRFs, 88.2% received statin therapy ($p = 0.05$). Both one-month (6.9% vs 11.2%; $p = 0.47$) and twelve month (10.3% vs 16.0%; $p = 0.41$) MACE outcomes were proportionately lower, but not statistically significantly so, in the without-SMuRF compared to the with-SMuRF group.

Conclusion: Our study suggests that a substantial percentage of patients (8.5%) present with STEMI in whom no SMuRFs are present. This group overall received less aggressive statin therapy, but despite this, had a non-statistically significant trend to lower one-month and twelve-month MACE outcomes.

Reference

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Patients with ST elevation myocardial infarction: long-term term outcomes post thrombolysis in patients found to have non-obstructive coronary artery disease

C. Said, M. Parkinson, S. Cheruvu *,
H. Wadsworth, J. Qin, P. Bamford,
M. William

Gosford Hospital, Gosford, Australia

Background: Despite an increasing availability of primary angiography, due to the large geographic area of many outer metropolitan and rural health districts in Australia, a vast proportion of patients with ST-elevation myocardial infarction (STEMI) are further than 90 minutes away from a site with percutaneous coronary intervention capabilities (PCI) (1). Thrombolysis therefore remains the gold standard, immediate reperfusion treatment strategy for these patients [1,2].

Method: We performed a single centre, retrospective study of all patients with suspected STEMI undergoing thrombolysis or primary PCI over a 5-year period. All patients underwent angiography to document a culprit lesion. The primary outcome was a composite of major adverse cardiac events (MACE) including all-cause mortality, myocardial infarction, unplanned revascularization and readmission for heart failure. Follow-up was conducted to 1 and 12 months after the index event.

Results: A total of 458 consecutive patients presented with ECG diagnosed STEMI over 5-years to a single tertiary hospital with a business-hours cardiac catheter laboratory capable of primary PCI. 341 patients (74.5%) underwent thrombolysis and 117 (25.5%) underwent immediate angiography. Of the patients thrombolysed, 33 (9.6%) were found to have no obstructive lesions on angiography. These patients had a relative risk of 3.2 for the primary outcome at 1 year compared to patients found to have obstructive lesions on angiography (RR 3.20, $p < 0.00001$, 95% CI 1.85-5.54). Of 117 patients undergoing primary angiography, only 1 patient (0.01%) had no obstructive lesion identified however, this patient subsequently achieved the primary outcome (100%) (RR 8.92, $P < 0.0001$, CI 5.35-14.89).

Conclusion: Patients with a presumed diagnosis of STEMI undergoing thrombolysis who are subsequently found to have no obstructive lesion angiography had significantly worse outcomes at 1 year compared to patients in whom obstructive lesion(s) identified. Our findings suggest.

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Pharmaceutical Use and Costs in Patients with Coronary Artery Disease, Using Australian Observational Data

V. McCreanor [1,2], W. Parsonage [1,3,*],
D. Whiteman [4,5], C. Olsen [4,5], A. Barnett [1],
N. Graves [1]

[1] *Australian Centre for Health Services Innovation (AusHSI), Institute of Health and Biomedical Innovation, Queensland University of Technology, Brisbane, Australia*
[2] *Capital Markets Cooperative Research Centre, Sydney, Australia*
[3] *Royal Brisbane & Women's Hospital, Herston, Australia*
[4] *QIMR Berghofer Medical Research Institute, Herston, Australia*
[5] *Faculty of Medicine, University of Queensland, Brisbane, Australia*

Aim: To estimate the annual pharmaceutical costs for patients with stable coronary artery disease, using Australian administrative data, comparing patients who had undergone interventional treatment with those who had not. To compare the duration of dual antiplatelet therapy prescription in the real-world, with what is recommended in guidelines.

Methods: We used data from the *QSkin* study, a population-based prospective study assessing skin cancer risk. Participants were invited from the Queensland population, not based on skin cancer risk. We calculated 12-month costs of pharmaceutical therapy for coronary artery disease patients in three groups: medical therapy only, following stent implantation, and following bypass graft surgery. We also measured the duration of dual antiplatelet therapy following stent implantation and duration of dual antiplatelet therapy, if prescribed, in the medical therapy group.

Results: Estimated annual pharmaceutical costs were highest in the stent group at AUD$1,920, compared with AUD$1,481 in the medical therapy group, and AUD$881 following surgery. There were similar rates of prescriptions of symptom relief drugs following stent insertion and in the medical therapy only group. The median duration of dual antiplatelet therapy in the stent group was 16 months and 31 months in the medical therapy group.

Discussion: Our results suggest that despite the common expectation that the burden of medical therapy is reduced following stent insertion for stable coronary artery disease, this does not occur in practice. Many patients also appear to continue dual antiplatelet therapy longer than guidelines recommend, which may put them at unnecessarily elevated risk of bleeding events.

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Plasma Endothelin-1 and Adrenomedullin are Associated with Coronary Artery Function and Cardiovascular Outcomes in Humans

J. Theuerle [1,*], O. Farouque [1,2],
S. Vasanthakumar [1], S. Patel [2], L. Burrell [1,2],
D. Clark [1,2], A. Al-Fiadh [1,2]

[1] Austin Health, Heidelberg, Australia
[2] The University of Melbourne, Parkville, Australia

Background: Endothelin-1 (ET-1) is a vasoconstrictor associated with cardiovascular disease, whereas adrenomedullin (ADM) is a vasorelaxant with cardioprotective properties. ET-1 is further associated with coronary microvascular function, and ADM with coronary conduit vessel function. We sought to determine the relationship between plasma ET-1, ADM and coronary vascular reactivity measurements with long-term major adverse cardiovascular events (MACE).

Methods: Thirty-two patients undergoing coronary angiography for chest pain and/or a positive functional study were recruited. The index of microcirculatory resistance (IMR), coronary flow mediated dilatation (cFMD) and coronary flow reserve (CFR) were measured in a non-obstructed coronary artery. Baseline plasma ET-1 and ADM levels were measured. Patients were assessed for MACE over a median period of 8.8 years.

Results: A MACE rate of 50% was observed in the cohort with an average time to first event of 3.1 years. Patients without MACE, had a higher mean cFMD (9.3 ± 7.6 vs. $2.8 \pm 5.0\%$; $p = 0.01$), along with a trend towards increased plasma ADM levels (7.6 ± 5.3 vs. 4.0 ± 1.9 pmol/L; $p = 0.07$). Patient with MACE, had a trend towards increased IMR (17.9 ± 5.3 vs. 13.1 ± 6.0 units; $p = 0.14$). No significant relationship was demonstrated amongst MACE subgroups for either plasma ET-1 concentration or CFR.

Conclusions: Elevated IMR was associated with increased long-term MACE. Increased cFMD and elevated plasma ADM were associated with a cardioprotective effect.

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Precision Cost Effectiveness of Lipid Therapies in Real World Individual Response Analysis – a Paradigm Shift

D. Colquhoun [1,2,3,4,*], N. Sowden [5],
A. Connelly [6], A. Ferreira-Jardim [1]

[1] University Of Queensland, Auchenflower, Australia
[2] Wesley Hospital, Brisbane, Australia
[3] Greenslopes Private Hospital, Brisbane, Australia
[4] Sunnybank Private Hospital, Brisbane, Australia
[5] Royal Brisbane and Women's Hospital, Brisbane, Australia
[6] Griffith University, Brisbane, Australia

Introduction: Acute Coronary Syndromes cost Australian governments $1930.2 million per year and individual families a further $4830.90 per year. The cornerstone of prevention is lowering LDL-C. Using classic cost effective methods, the new extremely effective PCSK-9 inhibitor therapy has been restricted on the PBS to those with on treatment LDL greater than 3.3mmol/L and a Dutch Lipid Score greater than or equal to 6. Using a different individual response approach, many more patients can be identified where PCSK-9 inhibitor therapy would be very cost-effective.

Methods: Comparison of current and future unit cost of lipid therapy compared to relative therapeutic effectiveness.

Results: For an individual who achieves more than 5 mmol/L reduction of LDL-C and has an on treatment LDL of less than 0.5mmol/L, the CHD event rate over 5 years may decrease from 30–50% to less than 5%. In other words the gains made from event reduction may be cost-saving based on current drug prices - where PCSK-9 inhibitors are expected to fall even further. Current cost-benefit analysis based on 1mmol reduction is flawed and assumes that costs are inelastic. The historical price of Lipitor is instructive - it has fallen by more than 70% in the last 10 years.

Drug	mmol/L Reduction	Displayed price for maximum quality per month (PBS)
Questran	0–2	$80.75
Ezetimibe	0.2–1.5	$42.98
Lipitor	0.5–2.5	$15.80
Evolocumab	1–7	$630

Conclusion: A particular individual's cost effectiveness of uptaking an apparently expensive therapy can be dramatically different to the average response in an average risk patient. Subsidy based on actual response to a drug and assessment of global risk is rational and likely to be far more cost effective and equitable than the current rationing approach.

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Prevalence and Types of Anomalous Coronary Anatomy and Future Utilisation of Such Cohorts to Investigate Cause

A. Chew [1,*], Y. Malaiapan [1], M. Ramialison [2], A. White [1,2]

[1] Monash Heart, Monash Health, Clayton, Australia
[2] Australian Regenerative Medicine Institute, Monash University, Clayton, Australia

Background: The incidence of anomalous coronary anatomy is about 1%. The embryonic cause is unknown.

Method: We searched cardiac catheterisation cases over 5 years (2013–2017) for the words "anomaly", "anomalous", "aberrant", and common spelling mistake variations. For duplicates, only a patient's earliest procedure was included. A cardiologist reviewed the report and angiogram of each potential case to confirm coronary anomaly. We excluded cases of high take-off anterior right coronary origin, separate origin of LAD and circumflex, and coronary artery fistulae, because our methodology was unlikely to detect all such cases.

Results: The incidence was 0.8% (109 of 14295) including: (1) Circumflex origin from right cusp or as proximal branch of right coronary ($n = 61$, 56%), (2) Right coronary origin from left cusp ($n = 36$, 33%), (3) Left coronary origin from right cusp ($n = 8$, 7.3%), and single cases ($n = 1$, 0.9%) of (4) single coronary from right cusp, (5) single coronary from left cusp, (6) right, circumflex and LAD coronaries with separate ostia from right cusp, and (7) LAD origin from right cusp. There was no difference between cases and non-cases regarding age, procedure duration, screening time, height, weight or gender.

Conclusions: 0.8% proportion with coronary anomaly is similar to previous series. The commonest anomaly is circumflex arising from the right cusp or as a branch of the right coronary. Our cohort could be leveraged to perform GWAS or whole genome sequencing to investigate genetic contributions to anomalous coronary anatomy. Genetic studies of this phenotype do not yet appear to have been conducted.

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Prognosis of Myocardial Infarction with Non-Obstructive Coronary Arteries – A Systematic Review

P. Litwin [1,*], S. Pasupathy [3,4], B. Lindahl [9], R. Tavella [3,4], M. Williams [10], T. Air [3], R. Marfella [11], K. Bainey [5], K. Alzuhairi [7], H. Reynolds [8], N. Johnston [9], A. Kerr [6], J. Beltrame [1,2,3,4], MINOCA Global Collaboration O

[1] Royal Adelaide Hospital, Adelaide, Australia
[2] The Queen Elizabeth Hospital, Woodville, Australia
[3] The Bazil Hetzel Institute, Woodville, Australia
[4] The University of Adelaide, Adelaide, Australia
[5] University of Alberta, Alberta, Canada
[6] University of Auckland, Auckland, New Zealand
[7] Blekinge Hospital, Sweden
[8] NYU Cardiology Associatees, New York, USA
[9] Department of Cardiology, Uppsala University, Uppsala, Sweden
[10] Dunedin School of Medicine, University of Otago, Dunedin, New Zealand
[11] Università degli Studi della Campania "Luigi Vanvitelli", Napoli, Italy

Introduction: Myocardial Infarction with Non-Obstructive Coronary Arteries (MINOCA) is now established as a clinically relevant presentation. MINOCA compromises of both angiographically completely smooth coronaries (0% stenosis) and those with mild coronary artery disease (CAD). This systematic review compares 1-year all-cause mortality and 1-year re-infarction rates in these MINOCA subsets.

Methods: An unrestricted literature search was conducted on the terms 'Myocardial Infarction (MI)', 'non-obstructive', 'angiography' and 'prognosis' using PubMed and Embase. Publications with non-consecutive recruitment, less than 100 MINOCA patients or selection bias were excluded. MINOCA was defined as MI (as per the universal criteria) in the absence of obstructive CAD (i.e. no epicardial stenosis $\geq 50\%$ at angiography). Unpublished data were accumulated via the MINOCA Global Collaboration. Data from the included studies were pooled and analysed using DerSimonian-Laird random-effects meta-analysis. Heterogeneity was assessed using Cochran's Q and I2 statistics.

Results: Literature auditing identified 27 prognostic MINOCA publications, of which 4 compared 1-year all cause mortality ($n = 5004$) and 3 compared 1-year re-infarction ($n = 4279$) rates between smooth and mild CAD subsets. In regard to 1-year mortality, there was no statistical difference between those with smooth and mild CAD (3.5% [2.4–4.5] vs 3.5% [2.7–4.2], $p > 0.05$), respectively. However, the 1-year re-infarction rate was significantly higher in those with mild-CAD (2.9% [0.7–5.0] vs 4.6% [1.8–7.5], $p < 0.05$).

Conclusion: These findings flag clinical concern regarding the relative non-culprit nature of the coronary arteries in MINOCA presentations. Efforts towards improved medical management are need to eliminate further infarct presentations.

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Q Fever Endocarditis: A Review of 135 Reported Cases

B. Jaltotage[1,*], U. Ali[2], A. Dorai-Raj[1], F. Sanfilippo[3], J. Rankin[1], G. Dwivedi[1]

[1] Department Of Cardiology, Fiona Stanley Hospital, Perth, Australia
[2] Department of Cardiothoracic Surgery, Fiona Stanley Hospital, Perth, Australia
[3] University of Western Australia, Perth, Australia

Background: Q fever infection by *Coxiella Burnetii* was discovered in Australia in 1935. Q fever endocarditis is rare and usually affects patients with native valve abnormalities or those with valve replacements. Diagnosis is difficult as infection is often culture negative. We investigated reported cases of Q fever endocarditis in the literature from 1967 to 2017.

Methods: A literature search for detailed case reports and case series of patients with Q fever endocarditis was performed. Papers were included if cases had positive PCR, valve culture or serology (antiphase IgG titre >1:800 or total complement fixation test total phase 1 antibodies of more than 512). A total of 31 studies from 15 countries were included.

Results: The data show that 78% of patients were male with an average age of 51 years. Native valve abnormalities or the presence of prosthetic cardiac material was present in 84% of patients. Over 76% of patients had a documented history of significant contact with animals or travel. Only 6.5% cases demonstrated positive blood culture for *Coxiella Burnetii* with 99% of cases confirmed with serology. Doxycycline and Hydroxychloroquine was the most common antibiotic treatment regimen with an average length of treatment of 36 months, 71% of patients required surgery and 23 (17%) deaths were documented.

Conclusions: Our study highlights the importance of serological diagnosis and possible risk factors such as the male gender, pre-existing valvular conditions including prosthetic cardiac material and contact with animals or travel.

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Qualifying Event Proximity, Cardiovascular Risk, and Benefit of Empagliflozin in Patients with Type 2 Diabetes and Stable Atherosclerosis in the EMPA-REG OUTCOME Trial

M. D'Emden[8,*], J. Udell[1,2,*], B. Zinman[1,3], C. Wanner[4], M. von Eynatten[5], J. George[5], I. Zwiener[6], S. Lund[5], S. Hantel[5], D. Fitchett[1,7]

[1] University of Toronto, Toronto, Canada
[2] Cardiovascular Division, Women's College Hospital and Peter Munk Cardiac Centre, University Health Network, Toronto, Canada
[3] Lunenfeld-Tanenbaum Research Institute, Mount Sinai Hospital, Toronto, Canada
[4] Department of Internal Medicine I, Nephrology, University Hospital Würzburg, Würzburg, Germany
[5] Boehringer Ingelheim International GmbH, Ingelheim, Germany
[6] Boehringer Ingelheim Pharma GmbH &Co.KG, Ingelheim, Germany
[7] St. Michael's Hospital, Division of Cardiology, Toronto, Canada
[8] Department of Endocrinology, Royal Brisbane and Women's Hospital, Brisbane, Australia

Background: In type 2 diabetes, the temporal proximity of an atherosclerotic cardiovascular (CV) event can impact prognosis, but whether timing influences sodium glucose co-transporter 2 inhibitor effects is unknown. We explored the association of time from last qualifying CV event before randomization (myocardial infarction [MI], stroke, coronary artery disease or peripheral arterial disease) with CV outcomes and benefit of empagliflozin (EMPA) in EMPA-REG OUTCOME.

Methods: Patients (pts) were randomised to EMPA 10 mg, 25 mg or placebo and followed for 3.1 years (median). Risk of major adverse CV events (3P MACE: CV death, MI, stroke), CV death or hospitalisation for heart failure (HHF) were evaluated using Cox regression in subgroups of $\leq 1/>1$ year since last qualifying CV event. Qualifying event stratification was possible in 6796 (97%) pts.

Results: In the overall population, $N = 6796$ (4547 EMPA and 2249 placebo pts), median (Q1, Q3) time from last CV event was 3.8 (1.5–7.6) years. Overall, 1214 (EMPA 841; placebo 373) and 5582 (EMPA 3706; placebo 1876) pts had a last qualifying CV event ≤ 1 and >1 year, respectively. Pts with more recent events had similar risk for CV outcomes compared with pts >1 year from qualifying event. Moreover, the benefit of EMPA on CV outcomes was consistent between pts enrolled ≤ 1 or >1 year from the qualifying CV event (all p-interaction >0.05).

Conclusion: Although most pts had a qualifying CV event >1 year before randomisation in EMPA-REG OUTCOME, the benefits of EMPA appear to extend to pts with more recent CV events.

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Rapid Access Chest Pain Clinics: An Australian Cost-Benefit Study

R. Kozor [1,*], J. Mooney [2], H. Lowe [3],
L. Kritharides [3], S. Patel [4], D. Celermajer [4],
A. Thiagalingam [5], G. Figtree [1], C. Chow [5]

[1] *Royal North Shore Hospital, St Leonards, Australia*
[2] *The George Institute, Sydney, Australia*
[3] *Concord Repatriation General Hospital, Concord, Australia*
[4] *Royal Prince Alfred Hospital, Camperdown, Australia*
[5] *Westmead Hospital, Westmead, Australia*

Chest pain hospital presentations are a large healthcare burden in Australia and around the world. Its management requires specialist assessment and diagnostic tests, which can be costly and often lead to unnecessary hospital admissions. There is a growing unmet clinical need to improve the efficiency and management of chest pain. This study aims to evaluate the cost-benefit of a rapid access chest pain clinic (RACC) model of care.

Methods: Firstly, 4 Sydney hospitals were retrospectively reviewed over 12 months (2016) for number of chest pain presentations and their admission/discharge rates. Secondly, 3 of the 4 hospitals implemented a RACC and the related costs were estimated using data from 2017–18.

Results: A total of 16,588 chest pain presentations were recorded. Hospitals A, B and C admitted 52%, 66% and 66%, respectively, of these patients, and hospital D admitted significantly less at 34%. Hospitals A, C and D implemented RACCs but each operating with slightly different staffing/diagnostic services. All RACCs had similar average costs per patient of $461.20, $435.27 and $461.20 (hospitals A C and D respectively), and similar cost-benefits per patient of $1162.80, $1188.73 and $1178.98, respectively, assuming that all RACC patients would have otherwise been admitted.

Conclusions: This study shows that a RACC model of care is cost-beneficial in the state of NSW as an alternative to inpatient care for managing chest pain. Scaling up to a national level could represent an even larger benefit for the Australian health system, but further research is required.

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Rate Pressure Product Versus Age Predicted Maximum Heart Rate as Predictors Of Cardiovascular Events in Intermediate Risk Patients During Exercise Stress Echocardiography

M. Whitman [1,2,3,*], C. Jenkins [1],
S. Sabapathy [2,4], L. Adams [2,4]

[1] *Logan Hospital, Yatala, Australia*
[2] *Menzies Health Institute, Gold Coast, Australia*
[3] *University of Queensland, Brisbane, Australia*
[4] *Griffith University, Gold Coast, Australia*

Background: Exercise stress echocardiograms (ESE) are a functional cardiovascular (CV) test typically used for the investigation of coronary artery disease (CAD). ESEs are often terminated at a pre-determined age-predicted maximum heart rate (APMHR) to facilitate timely acquisition of ultrasound images at peak exercise. While an APMHR of 85% is often used, this has not been validated as a suitable termination endpoint. Rate pressure product (RPP) as an established measure of myocardial work may provide a more reliable assessment of cardiac workload. The aim of this study was to assess maximal RPP (MRPP) and APMHR as markers of cardiac workload during ESE, using CV events during follow-up as the outcome variable.

Methods: Following exclusions, 715 patients being investigated for ischeamic heart disease, performed an ESE to volitional fatigue using the standard Bruce protocol. Patient demographics and test data were collected and patients followed up (4.4 ± 2.1 years) by reference to medical records or contact with the patients' general practitioners.

Results: From receiver operating characteristic analyses, MRPP (cut point 25060) (AUC 0.725) outperformed APMHR (cut point 99.4%) (AUC 0.605) ($p = 0.009$ for difference) as a predictor of CV events during follow-up. Furthermore, those achieving an APMHR >85% but MRPP <25060 had significantly more CV events then achieving an MRPP >25060 regardless of APMHR ($p < 0.05$).

Conclusion: The current study demonstrates the superior prognostic power of RPP over APMHR alone for the prediction of future CV events in patients performing an ESE for the detection of CAD.

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Reconciling Acute Coronary Syndrome Diagnoses Between Linked Administrative Data and Hospital Medical Records in Medical Research

K. Hyun [1,*], J. Redfern [1,2], T. Briffa [3], D. Chew [4], J. French [5], D. Brieger [6]

[1] University of Sydney, Sydney Medical School, Westmead Applied Research Centre, Sydney, Australia
[2] University of New South Wales, The George Institute for Global Health, Sydney, Australia
[3] University of Western Australia, School of Population Health, Perth, Australia
[4] Flinders University, Department of Cardiovascular Medicine, Adelaide, Australia
[5] Liverpool Hospital, Department of Cardiology, Sydney, Australia
[6] Concord Repatriation General Hospital, Department of Cardiology, Sydney, Australia

Aim: To assess the agreement between the acute coronary syndrome (ACS) diagnoses according to linked data and those extracted from hospital medical records.

Methods: The rate of ST elevation myocardial infarction (STEMI), non-STEMI (NSTEMI) and unstable angina (UA) obtained from the medical records for the nationwide SNAP-SHOT ACS audit in 2012 were compared to the corresponding International Classification of Diseases 10th Revision (ICD-10-AM) codes using linked data from all states/territories. The proportions of the overall agreement (OA), the positive agreement (PA) and the Cohen's weighted kappa and the 95% confidence interval (CI) were derived using both data sources for STEMI/NSTEMI/UA (kappa≥0.8: strong agreement; 0.6≤kappa<0.8: moderate agreement). The factors associated with diagnostic disagreement were explored using multilevel multivariable logistic regression (backward selection).

Results: Both medical records and linked data were available for 3130 patients. The agreement was greatest for STEMI and lowest for UA (STEMI: OA = 97%, PA = 85%, kappa (95% CI)=0.84 (0.81, 0.87); NSTEMI: OA = 91%, PA = 81%, kappa (95% CI)=0.76 (0.73,0.79); UA: OA = 81%, PA = 53%, kappa (95% CI)=0.41 (0.38, 0.45)). Further, the independent factors associated with disagreement between the two sources were the diagnosis of UA (UA vs. STEMI (odds ratio (95% CI)): 6.85 (4.12, 11.40)), not receiving revascularisation (2.27 (1.69, 3.03)), and the state where the ICD-10-AM was coded ($p = 0.007$).

Conclusion: Agreement between linked data diagnosis and clinical assessment was greater in patients who received revascularisation and poorer in those with UA. In addition, the agreement varied between states suggesting systematic differences in coding practice.

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Remote Monitoring Alert Burden from Implantable Cardioverter Defibrillators: An Analysis of >4000 Patients

C. O'Shea [1,2,3,*], K. Campbell [1], J. Hendriks [1,3], A. Brooks [1], D. Lau [1,2,3], P. Sanders [1,2,3]

[1] Centre for Heart Rhythm Disorders, University Of Adelaide, Adelaide, Australia
[2] Royal Adelaide Hospital, Adelaide, Australia
[3] South Australian Health & Medical Research Institute, Adelaide, Australia

Background: Remote monitoring (RM) has been demonstrated to improve outcomes and mortality in patients with implantable cardioverter defibrillators (ICD) with and without cardiac resynchronisation therapy (CRT-D). However, the RM burden of monitoring ICDs is not well characterised.

Objective: To assess alert burden and type in a large cohort of ICD patients undergoing managed RM.

Methods: We retrospectively analysed all patients with a standard ICD, CRT-D or subcutaneous ICDs (S-ICD), from a large multi-centre cohort undergoing RM over a six-month time period. Analysis included specific device type, and all alerts according to type.

Results: Of the 12,521 RM patients in our cohort, 4385 (35%) had an ICD in situ, comprised of 2202 standard ICDs (50.2% of the ICD cohort), 2079 (47.4%) CRT-Ds, and 104 (2.4%) S-ICDs. 1477 ICDs (33.7% of the ICD cohort) transmitted at least one alert. ICD alerts accounted for 17.4% (3110) of all alerts (17,839), transmitting 399 (58.3% of all) red alerts, and 2711 (15.8% of all) yellow alerts.

988 alerts for ventricular tachycardia (VT) and ventricular fibrillation (VF) were transmitted by 7% (306) of ICD patients, and 212 alerts for shock, transmitted by 2.6% (115) of ICD patients. There were 1403 alerts for atrial tachycardia/atrial fibrillation.

Conclusion: In this large cohort of ICD patients undergoing managed RM, ICDs represented 35% of the RM cohort but contributed only 17.4% of all alerts, with only one-third of ICD patients transmitting an alert. Despite transmitting the majority of red alerts (58.3%), ICDs are generally under-represented in RM alert burden.

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Remote Monitoring Via an Automated Vendor-Neutral Software System: A Retrospective Analysis of >12,000 Patients

C. O'Shea [1,2,*], A. Brooks [1], K. Campbell [1], J. Hendriks [1,2], D. Lau [1,2], P. Sanders [1,2]

[1] Centre for Heart Rhythm Disorders, University Of Adelaide, Adelaide, Australia
[2] Royal Adelaide Hospital, Adelaide, Australia,
[3] South Australian Health & Medical Research Institute, Adelaide, Australia

Background: Remote monitoring (RM) of cardiac implantable electronic devices (CIEDs) allows for timely recognition of patient and device events, however involves burdensome manual workflow. Automated software may reduce such burden, facilitating RM of large patient groups.

Purpose: To assess the quantity and nature of CIED alerts in a large patient cohort, from multiple centres, remote monitored via an automated vendor-neutral software system with 24/7 processing of CIED alerts by IBHRE-certified technicians.

Methods: We performed a retrospective analysis of 12,521 consecutive patients who underwent RM utilizing an automated software system between May and November 2018. Analysis included CIED type and all alerts according to gravity.

Results: 12,521 patients received RM, 5405 with permanent pacemaker (PPM), 4385 with implantable cardioverter defibrillator (ICD), and 2731 with implantable loop recorder (ILR). 37.3% of patients transmitted at least one alert, totalling 17,839 alerts. ICDs were responsible for 3110 (17.4%) alerts, PPMs for 2970 (16.6%) alerts, and ILRs for 11,759 (65.9%) [$p < 0.001$] alerts. 684 (3.8%) alerts were red (urgent), and 17,155 (96.1%) were yellow (non-urgent). 399 (58.3%) red alerts were transmitted by ICDs, 179 (26.2%) by PPMs, and 106 (15.5%) by ILRs.

Conclusion: In a large RM patient cohort, over 17,000 alerts occurred during a 6-month period. ILRs were over-represented (65.9% of alerts), despite accounting for only one-fifth of all devices. Most red alerts (63.9%) were transmitted by ICDs. The huge number of transmissions, and the growing alerts from use of ILR, highlight the need for a new approach to management of RM.

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Retrospective Non-Randomised Study of STEMI Management Pre and Post Participation in the Victorian Cardiac Outcome Registry

P. Kadalayil[*], J. Senior, C. Stevents

Mulgrave Private Hospital, Mulgrave, Australia

Introduction: This is a retrospective, non-randomised study to evaluate improvement in quality of care due to participation in the Victorian Cardiac Outcome Registry (VCOR) at Mulgrave Private Hospital, Victoria.

We compared data from all STEMI presentations in 2015 (pre VCOR) and 2018 (during VCOR). International guidelines benchmark 90 minutes for best practice door-to-balloontime (DTBT).

Results: Close auditing of each interval was initiated during the 2018 VCOR era. Average door to cathlab time was +9.1 min (2015) and −8.2 min (2018), with the negative value denoting lab activation prior to arrival. For Ambulance Victoria pre-hospital notification patients, the comparison was 21.5 min (2015) and 14.6 min (2018). Average Door to cathlab activation also improved by 8 minutes (2015: 20.3 min; 2018: 12.5 min). Mean DTBT was longer in 2018 (106 mins) compared to 2015 (73.5 mins) but can be attributed to clinical complexity. Median DTBT was improved by 7 minutes (59 mins). Door to triage time also improved (2015: 9.75 mins; 2018: <2 mins).

Conclusion: Closer auditing as a direct involvement with VCOR can identify where resources are required to achieve a DTBT <90 minutes. Cathlab is now activated earlier and DT to triage has reduced in 2018. While achieving DTBT 75% <90 minutes in both 2015 and 2018, increased visibility during VCOR involvement points to heightened proactivity in reducing DTBT aiming for improved outcomes for STEMI patients.

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Review of Campylobacter Species Related Cardiac Disease

A. Elford [1,2], H. Thakkar [1,*], P. MacIntyre [1]

[1] Royal Hobart Hospital, Hobart, Australia
[2] University of Tasmania, Hobart, Australia

Background: *Campylobacter species* are a common cause of food borne illness in developed countries. There have been a small but increasing number reports of *Campylobacter* illness associated with cardiac disease.

Aim: To review the literature and describe *Campylobacter species* related cardiac disease.

Method: A PubMed search was conducted. Keywords included "*Campylobacter*", "pericarditis", "myocarditis" and "cardiomyopathy." Only articles in English language were included and articles published from the year 2000 onwards.

Results and discussion: 31 studies found *Campylobacter* food borne illnesses have been associated with pericarditis, myocarditis, perimyocarditis, cardiomyopathy and arrythmias. 29 of these articles were case reports or case series. Most published literature involve *C. jejuni* however there have been case reports linking *C. fetus* and more recently *C. coli* to perimyocarditis. The exact mechanism is currently unknown - probably an immunological phenomenon similar to *Campylobacter* associated Guillain Barre Syndrome or direct cardiac myocyte toxicity from the bacteria. Typically, young males are affected. There is a wide spectrum from mild disease to severe biventricular failure. No established guidelines on treatments. If antibiotics are used, then Macrolides/Fluoroquinones are preferred. Prognosis is good.

Conclusion: *Campylobacter* infections are common; we need to be aware of its potential cardiac involvement. Prognosis is generally good with most patients making a full recovery, however some patients have persistent heart failure or ventricular arrythmias.

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Review of Statin-Associated Symptoms, Definition and Diagnosis, and Treatment Strategies. An Australian Lipid Clinic experience

C. Kao [1,*], D. Jin [1,2], A. Baradi [1,2], A. Wilson [1,2]

[1] *St Vincent's Hospital Melbourne, Fitzroy, Australia*
[2] *University of Melbourne, Parkville, Australia*

Background: Statins are one of the most frequently prescribed medications in the reduction of cardiovascular disease. Although they are well-tolerated, there are known statin associated symptoms (SAS) that often result in discontinuation. The purpose of this article is to share an Australian lipid clinic experience with SAS, discuss possible management strategies and compare it with the existing literature.

Method: A set of 306 patients were selected as a sample of the cohort that attended the lipid clinic at St Vincent's Hospital Melbourne from January 1995 to May 2014. Major journal articles, reviews and meta-analysis were identified in multiple databases from 1990 to 2017.

Results: Seventy-eight patients (47.4%, 36 male, median age 73) referred with SAS were reviewed. Among SAS, SAMS was the most common ($n = 42$, 55.2%) followed by elevated creatinine kinase level ($n = 19$, 25.0%), then by hepatic enzymes derangement ($n = 5$, 6.6%). Management of SAS includes dose reduction and/or switching to a different statin, utilisation of alternate dosing regimens, and non-statin therapy. Following rechallenge, 68.4% ($n = 52$) of patients with SAS reported symptomatic improvement. 71.1% ($n = 54$) of patients could remain on regular statin therapy. There was a significant improvement in fasting lipid profiles with mean reduction in LDL-C by 38.7% (-1.28 mmol/L, $p < 0.0001$) with 27.6% ($n = 21$) of patients achieved target LDL-C levels (<2.6 mmol/L).

Conclusion: Symptoms of statin intolerance are variable, however the most common were SAMS and CK elevation. Multiple statin treatment strategies exist and are effective in reducing SAS to improve both statin adherence and LDL-C profile.

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Rise in Proportional Early Cardiovascular Mortality Following Liver Transplantation: Temporal Trends from the Australian & New Zealand Liver Transplant Registry

A. Koshy [1,*], P. Gow [2], J. Sajeev [1], B. Cailes [1], J. Ko [1], J. Ramchand [1], H. Lim [1], A. Teh [1], H. Han [1], R. Jones [2], A. Testro [2], M. Byrne [2], D. Clark [1], M. Yudi [1], O. Farouque [1]

[1] *Department of Cardiology, Austin Health and University of Melbourne, Heidelberg, Australia*
[2] *Victorian Liver Transplant Unit, Austin Health, Heidelberg, Australia*

Background: Liver transplantation (LT) surgery poses a significant cardiovascular (CV) risk. Given the rising prevalence of non-alcoholic fatty liver disease and advancing age of LT candidates, delineating CV risk is increasingly important. We sought to characterise the incidence and modes of intraoperative and early ($\leq$30days) CV death post-LT.

Methods: Prospectively recorded outcome data were collected for all adult LTs in Australia and New Zealand between 1985–2017. Data was collected from six participating centres and compared between Era 1(1985–95), Era 2(1996–2006) and Era 3(2007–17).

Results: Among, 4538 adult LTs, 201(4.4%) deaths including 38 (19%) CV deaths occurred in 30-days. All-cause mortality fell across the 3 Eras (10.4%, 5.1%, 2.2%, $p < 0.001$, Era 1–3, respectively). A reduction in overall early CV death was also noted (1.1%-1.2%-0.6%, $p < 0.001$). However, CV death as a proportion of all-cause 30-day mortality increased significantly (10.5%-21.8%-23.2%, $p < 0.001$). CV events were the leading cause of intra-operative mortality (40%) and second leading cause of overall early death (19%). Most common modes of CV death were cardiac arrest and congestive heart failure (44.7% and 23.7%, respectively, of CV deaths).

Conclusion: CV events are a leading cause of operative and early mortality following LT. Despite reductions in absolute all-cause mortality over 30 years, the proportion of deaths due to CV causes continues to rise. Improvements in preoperative risk stratification are needed.

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Risk Assessment in Acute Coronary Syndromes (ACS) and the West Australian Cardiac Outcomes Registry (WACOR)

C. Winnall[1,*], T. Briffa[2], C. Reid[3],
F. Sanfilippo[2], I. Li[2], E. Geelhoed[2],
J. Spiro[1], N. Stoyanov[1], I. Sheikh[1],
A. Rajwani[1], R. Alcock[1], A. Powell[1],
M. Best[1], G. Hillis[1,2], C. Schultz[1,2]

[1] Dept of Cardiology, Royal Perth Hospital,
Perth, Australia
[2] University of Western Australia, Nedlands,
Australia
[3] Curtin University, Bentley, Australia

Aims: The treatment of ACS aims to reduce the risk of future ischaemic events but may increase the risk of bleeding and contrast induced nephropathy (CIN), which can have an impact on length of hospitalisation (LOS), survival and health care costs. There are risk scores that are validated for predicting the above complications, however to calculate each of these scores individually would be time consuming and impractical. We have developed a tool that can calculate ischaemic risk, bleeding risk and CIN risk simultaneously, at the time of ACS diagnosis. We aim to use this information to identify ACS patients at high risk for poor outcomes and long LOS.

Methods: 276 sequential ACS patients had individual risk stratification performed. This included the risk of ischaemic events (GRACE score) and the risk of bleeding events (CRUSADE score).

Table 1. *GRACE Score.*

Risk Category	No. of admissions	Ave. LOS(days)	% Readmission rate
Low risk	51	2.41	11.76
Medium risk	97	3.08	21.65
High risk	128	4.12	19.53

Table 2. *Crusade Score.*

Risk Category	No. of admissions	Average LOS (days)	% Readmission rate
Very low risk	127	2.98	13.39
Low risk	63	2.89	14.29
Medium risk	27	4.11	22.22
High risk	23	3.48	47.83
Very high risk	24	6.92	33.33

Findings: We will present our unique risk score calculator as well as risk-adjusted data on length of stay and readmission rates after acute coronary syndromes for 276 sequential patients (Tables 1 and 2). Increasing risk appears to predict a longer length of stay and higher readmission rate. These data provide an important foundation for further research into whether or not early identification of high risk patients can result in improved clinical care, reduced LOS and reduced readmission rates.

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Role of soluble sST2 Levels in Predicting Major Adverse Cardiovascular Events (MACE) Hospital Readmissions Within 30 Days

D. Chen[1,*], R. Untaru[1], G. Stavropoulou[1],
A. Nesbitt[1], C. Kelly[1], A. Croft[1], A. May[2],
A. Boyle[1], N. Collin[2], J. Leitch[2], S. Sugito[2],
D. Baker[2], D.T.M. Ngo[1], A.L. Sverdlov[1]

[1] The University Of Newcastle, Callaghan,
Australia
[2] John Hunter Hospital, New Lambton Heights,
Australia

Introduction: Increased soluble suppression of tumorigenicity 2 (sST2) levels have been shown to predict MACE in patients with acute coronary syndromes (ACS) at 180 days and after 1 year. In this study, we assessed the prognostic value of sST2 levels in predicting hospital readmissions due to MACE within 30 days.

Methods and Results: $n = 146$ patients (mean age: 67 ± 13 yrs) admitted to cardiology unit at John Hunter Hospital for acute coronary syndromes were recruited. sST2 levels were quantitated in plasma, using commercially available ELISA (R&D systems). Occurrences of MACE such as unstable angina/NSTEMI, stroke, recurrent MI, rehospitalisation and death were recorded after 30 days of first admission. Patients with concomitant hypertension, diabetes or dyslipidaemia did not have elevated sST2 levels. Patients with atrial fibrillation (AF) ($p < 0.001$) or heart failure ($p < 0.01$) had significantly higher sST2 levels vs. those who did not. On univariate analysis, patients with 30-day MACE ($n = 30$, 20.5%) tended to have higher sST2 levels vs. those without ($p = 0.07$). There was a significant correlation between high sST2 levels vs age ($\beta = 0.3$, $p < 0.001$) and CRP ($\beta = 0.5$, $p < 0.001$). On multivariate analysis: 30-day MACE was not associated with high sST2 levels. Older age, high CRP, and presence of AF are associated with elevated sST2 levels.

Conclusions: In this patient cohort, elevated sST2 levels were not found to predict 30-day MACE in patients with ACS, but is associated with presence of AF. Larger population studies over longer period of time is required to fully elucidate the prognostic role of sST2 in predicting MACE.

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Scientist Led Exercise Stress Testing is Safe with the Equivalent Diagnostic Interpretation as a Cardiologist in Low to Intermediate Risk Patients

M. Whitman, C. Manolis*, C. Padayachee, P. Tilley, C. Sear, S. Elhinawi H, S. Rosanoff, C. Hughes, P. Challa

Logan Hospital, Meadowbrook, Australia

Background: The implementation of non-physician led exercise stress testing (EST) has increased over the last 30 years, with endorsement by many cardiovascular societies around the world. The comparable safety of non-physician led EST to physician led studies has been demonstrated, with some studies also showing agreement in diagnostic preliminary interpretations. The study aim was to firstly confirm the safety of non-physician led EST in a large cohort and secondly compare the diagnostic accuracy of cardiac scientist and junior medical officer (JMO) led EST reports to cardiology consultant overreads.

Methods: All ESTs performed between 1/7/2010 and 30/6/2013 were included in the study for JMO led tests ($n = 1332$). ESTs performed for the investigation of coronary artery disease between 1/7/2013 and 30/6/2016 were included for scientist led testing ($n = 1904$). Preliminary findings by the JMO and the senior cardiac scientist were compared to the cardiology consultant overread to establish diagnostic accuracy.

Results: There was one adverse event, an ST segment myocardial infarction during the recovery phase of a JMO led EST. Disease prevalence was similar in the JMO and scientist led groups ($p = 0.77$). Sensitivity for JMO led tests differed from the cardiologist overread (86.96% vs 96.77%, $p = 0.03$). There were no other significant differences between the cardiologist overread and the JMO or scientist led interpretation.

Conclusion: Scientist led EST is safe in low/intermediate risk patients and their preliminary reports are equally diagnostic as cardiologist overreads. While JMO led ESTs are just as safe, the preliminary reports differ significantly from cardiologist overread with respect to sensitivity.

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Selectively Intensifying P2Y12 Inhibition in Poor Responders to Clopidogrel Decreases Thrombotic Events Without Increasing Bleeding Risk Following Percutaneous Coronary Intervention: A Systematic Review

D. Drak

NHMRC Clinical Trials Centre, Sydney, Australia

Background: Response to clopidogrel following percutaneous coronary intervention (PCI) varies, with a third of patients continuing to have high on-treatment platelet reactivity (HPR) with clopidogrel, increasing the risk of thrombotic events. Newer P2Y$_{12}$ inhibitors reduce thrombotic event rates, but at the cost of increased bleeding risk. Selectively intensifying P2Y$_{12}$ inhibition in patients with HPR on clopidogrel may be a superior approach.

Aim: To systematically review current evidence regarding selective intensification of P2Y$_{12}$ inhibition in patients with HPR on clopidogrel, identified around the time of PCI.

Methods: Medline, Embase and the Cochrane Library databases were searched for studies published between 2012 and 2016. Inclusion criteria were a primary outcome of thrombotic events and three patient groups: no-HPR, HPR on intensified therapy (HPR$_{int}$) and HPR on standard therapy (HPR$_{std}$). Studies with multiple dose adjustments within the first month of therapy were excluded.

Results: This review included four studies, encompassing 1080 patients with no-HPR, 289 with HPR$_{int}$ and 263 with HRP$_{std}$. Primary outcomes were composites of thrombotic events, with follow-up periods between six months and two years. No differences in the primary event rates between no-HPR and HPR$_{int}$ patients were found. HPR$_{std}$ event rates were 1.9 to 7.3-fold higher than the respective no-HPR group. Major bleeding did not significantly differ between treatment groups in all studies.

Conclusion: Selective intensification of P2Y$_{12}$ inhibition in patients with HPR on clopidogrel, identified around the time of PCI, dosing mitigates the increased risk of thrombotic events without increasing major bleeding risk.

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Serum Midkine Rapidly Increases by Three Hundred-fold Following Heparin Administration During Coronary Angiography

S. Sugito [1,2,3], S. Hall [2,3,4], M. Al-Omary [1,2,3,*], T. De Malmanche [1,2,3,4], G. Robertson [5], A. Boyle [1,2,3]

[1] *John Hunter Hospital, Newcastle, Australia*
[2] *University of Newcastle, Newcastle, Australia*
[3] *Hunter Medical Research Institute, Newcastle, Australia*
[4] *NSW Health Pathology, Newcastle, Australia*
[5] *Cellmid Ltd, Sydney, Australia*

Background: Midkine (MK) is a heparin binding growth factor, which has been shown to exert cardio protection against ischaemia/reperfusion injury, reduce infarct size and inhibit cardiac remodelling in animal models through angiogenesis and its anti-apoptotic effects. Its role in human cardiovascular disease is not well understood.

Aims: To quantify serial MK levels in patients during coronary angiography (CA) and to identify any association with heparin, diagnosis, medications, comorbidities, and percutaneous coronary intervention (PCI).

Methods: Forty-nine patients undergoing CA at John Hunter Hospital in 2018 were studied. Arterial blood samples were collected at baseline, then at 10 and 20 minutes post heparin administration. Serum MK levels were assessed using a commercially available kit (Cellmid Ltd, Sydney).

Results: Median MK level at baseline was 234 pg/ml (IQR: 0–647, normal range <750 pg/ml). Median MK at 10 minutes was 80,682 pg/ml (IQR: 52,395–122,425). Median MK remained elevated at 20 minutes at 92,949 pg/ml (IQR: 63,905–162,142). The magnitude of MK elevation increased with the dose of heparin administered (R-squared 0.29, $p < 0.001$). The degree of increase in MK level did not correlate with diagnosis, other medications, comorbidities or PCI.

Conclusions: Serum MK levels increased following heparin administration during CA in a dose dependent manner. The role of MK as a potential biomarker and therapeutic target in cardiovascular disease warrants further investigation.

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Sex-Based Differences in Net Adverse Cardiovascular Events (NACE) Among MINOCA Patients

H. Ghataura[1,*], C. Chen[1], A. Kishore[1], A. Perera[1], T. Simard[2], R. Jung[2], S. Parlow[2], I. Hughes[1], B. Hibbert[2], K. Singh[1]

[1] *Gold Coast University Hospital, Gold Coast, Australia*
[2] *Ottawa Heart Institute, Ottawa, Canada*

Background: The ratio of women diagnosed with myocardial infarction with non-obstructive coronary arteries (MINOCA) is higher than women diagnosed with atherosclerotic MI. Among MI cohort, women tend to have relatively worse prognosis. It remains unknown if in the MINOCA group, underlying clinical characteristics and clinical outcomes vary according to sex of the patient. Our aim was to compare the net adverse cardiovascular events (NACE) between men and women diagnosed with MINOCA.

Methods: This observational two-centre cross-section study from Australia and Canada included consecutive MINOCA patients who fulfilled the European Society of Cardiology diagnostic criteria over a 4-year period. Demographic, clinical, and inhospital outcome data were evaluated. NACE was defined as a death, stroke, heart failure and major bleeding. Categorical data were compared by Chi Square or Fisher's exact tests and continuous variables by ANOVA with post-hoc tests.

Results: Out of 645 patients were diagnosed with MINOCA there were 299 women (46%). Compared to men, women diagnosed with MINOCA were older (61 ± 12 vs. 64 ± 12 yrs, $p = 0.0001$) and tend to present less commonly as ST elevation MI (13% vs. 5.9%, $p = 0.002$). There was no statistical difference in cardiac risk factors, prevalence of atrial fibrillation, cancer and non-cardiac illness. There was no difference in NACE (2.9% vs. 2.9%, $p = 0.82$), death (0.3% vs. 0.3%, $p = 0.91$), stroke (0.3% vs. 0%, $p = 0.35$), or heart failure (2.9% vs. 2.4%, $p = 0.67$). Women had higher access site bleeding ($p = 0.03$).

Conclusion: There is no gender variability in NACE outcomes among patients diagnosed with MINOCA.

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Simple Indices of Infarct Size Post ST-Elevation Myocardial Infarction (STEMI) Provides Similar Risk Stratification to Cardiac MRI

L. Sharma[1,2,*], A. Faour[1,2], T. Nguyen[1,2], L. Holmes[1], O. Gibbs[1,2], H. Dimitri[1,2,3], C. Juergens[1,2,3], D. Richards[1,2], L. Thomas[1,2], J. French[1,2,3]

[1] *South Western Sydney Clinical School, University of New South Wales, Liverpool, Australia*
[2] *Cardiology Department, Liverpool Hospital, Liverpool, Australia*
[3] *Ingham Health Research Institute, Liverpool, Australia*

Introduction: Myocardial Infarct Size (IS) evaluated soon after ST segment elevation myocardial infarction (STEMI) has prognostic significance, and can be assessed by cardiac magnetic resonance imaging (CMRI), biomarker levels and electrocardiogram (ECG) parameters.

Objectives and Methods: We aimed to determine whether readily available (and less expensive) methods of IS assessment, Selvester QRS scores from the 12-lead ECG and high-sensitivity Troponin T (hsTnT) levels measured $\geq$48h (plateau phase of hsTnT elevation), provide similar information to CMRI. We prospectively assessed these in STEMI patients treated with percutaneous coronary intervention (PCI) during index hospitalisation. The associations between IS, as assessed by these methods, and clinical outcomes at 24-months, a hierarchical composite of major adverse cardiac events (MACE) of death, re-MI, stroke and hospitalisation for heart failure, were determined.

Results: A cohort of 195 (86% male) first-time STEMI patients (54% anterior) with a median age 56 years [50–64] treated by either primary PCI (79%) or pharmaco-invasive PCI (21%) were studied. Plateau phase hsTnT levels, QRS scoring and CMRI-determined IS post-STEMI were significantly correlated (for anterior MI all comparisons r>0.5, $p < 0.01$); associations between these parameters for non-anterior MI were $p > 0.10$. QRS scoring provided higher estimates of IS than CMRI. We performed binary logistic regression analysis to identify factors contributing to discordant scores (difference between acute and follow-up QRS IS of $\geq$6% myocardium) and MACE.

Conclusion: Post-PCI treatment of STEMI, hsTnT levels measured $\geq$48h and Selvester QRS scoring were strongly correlated with CMRI-determined IS. These parameters predicted MACE at 24 months, and so should be routinely assessed for post-STEMI risk stratification.

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Suboptimal Use of Cardioprotective Drugs in Patients with a History of Cancer

R. Untaru[1,2,3,*], A. Nesbitt[3], C. Kelly[3],
A. Croft[2,3], D. Chen[1], B. Assadi-Khansari[3],
N. Collins[2], A. Boyle[1,2,3], J. Leitch[2],
D. Baker[2], S. Sugito[2], A. May[2],
A. Sverdlov[1,2,3], D. Ngo[1,3]

[1] *University Of Newcastle, New Lambton Heights, Australia*
[2] *John Hunter Hospital, Lambton, Australia*
[3] *HMRI, Lambton, Australia*

Introduction: Success of modern cancer therapy leads to a decline in death rates for cancer patients. Cardiovascular disease (CVD) is now a leading cause of long-term morbidity and mortality among cancer survivors. There is increasing need to be more vigilant in the use of cardioprotective therapies for primary and secondary prevention of cardiovascular diseases in patients living with cancer. This study aims to examine the use of cardioprotective therapies in patients with or without previous history of cancer admitted to cardiology.

Methods and Results: Patients ($n = 333$, mean age: 65 ± 13 yrs) who were admitted to cardiology unit at John Hunter Hospital for either acute or chronic CVD from July to November 2018. $N = 76$ (23%) of patients had a history of cancer (Hx Ca) as documented in case notes at the time of admission. There was no difference in the prevalence of cardiac ischaemia, hypertension, dyslipidaemia, diabetes, or heart failure, but significantly higher atrial fibrillation in patients with Hx Ca (26%) vs. those without (16%). There was under-use of cardiovascular medications in patients with Hx Ca vs those without: antiplatelets (53% vs. 73%, $p < 0.01$); β-blockers (61% vs 70%, $p = 0.17$), ACEi/ARB (50% vs 61%, $p = 0.1$), and statins (59% vs 78%, $p < 0.01$). On multivariate analysis, patients with Hx of Ca had significantly lower usage of statins adjusted for age, BMI, gender, and cardiovascular risk factors.

Conclusions: Cardioprotective therapies appear to be under-utilised in patients with previous history of cancer with comparable CV risk factors. Strategies are required to increase cardioprotective pharmacotherapies in these patients.

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The 2CHEER Study: (Mechanical CPR, Hypothermia, ECMO and Early Re-Perfusion) for Refractory Cardiac arrest

M. Dennis[1,*], P. Forrest[1], P. Bannon[1],
S. Scott[2], D. Lowe[2], C. Reynolds[3],
B. Burns[3], K. Habig[3], P. Nair[2], D. Gattas[1],
H. Buscher[2]

[1] *Royal Prince Alfred Hospital, Sydney, Australia*
[2] *St Vincent's Hospital, Sydney, Australia*
[3] *NSW Ambulance Service, Sydney, Australia*

Aims: Retrospective studies have suggested improved survival outcomes with the use of Extracorporeal membrane oxygenation (ECMO) in refractory cardiac arrest (ECPR). We sought to prospectively assess outcomes in refractory cardiac arrest treated with ECPR.

Methods: The 2CHEER trial (mechanical CPR, Hypothermia, ECMO and Early Reperfusion) is a multi-centre, prospective cohort study conducted at Royal Prince Alfred and St Vincent's Hospitals, Sydney, NSW with the NSW Ambulance service. Patients aged 12–70 years with refractory cardiac arrest were enrolled into the 2CHEER treatment bundle.

Results: From 2016 to 2018, 25 patients were eligible for the 2CHEER protocol (13 (52%) OHCA, 12 (48%) IHCA; 17 (68%) males. Median age was 57 (IQR 39–65) years and all patients received bystander CPR. VT/VF was initial rhythm in 17 (68%) of patients. ECMO flow was established in all patients; median time from collapse until initiation of ECMO 57 (IQR 38–73) min. Percutaneous coronary intervention was performed in 18 (72%) patients. Median duration of ECMO support was 52 (IQR 24 –108) hours. Survival to hospital discharge was 64% (7) for IHCA and (36% (4) for OHCA. Survival with favourable neurological outcome (CPC 1 or 2) occurred in all survivors; (11/25) (44%) of total patients. Time to ECMO flow was significantly associated with survival $p < 0.001$. Initial rhythm and percutaneous intervention were not.

Conclusion: Treatment of refractory cardiac arrest with ECMO is feasible and associated with very good neurologically intact survival.

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The Impact of Living Situation on Management and Outcomes of Patients Aged >85 Years Presenting with NSTEMI

A. Murphy[*], A. Koshy, G. Meehan,
P. Kunniardy, J. Ramchand, O. Farouque,
D. Clark, M. Yudi

Austin Health, Melbourne, Australia

Introduction: Living situation is an important part of the assessment of functional status and is often used as a surrogate marker of frailty. Little is known about the impact of living situation on management and outcomes of elderly patients presenting with NSTEMI.

Methods: A retrospective analysis of 956 consecutive patients aged >85 years presenting with NSTEMI between 2010–2018 were included. Home status was defined as independent, low-level care (LLC) or high-level care (HLC). Guideline-directed medical therapy (GDMT) included aspirin, beta-blockers and statins. The primary outcome was all-cause mortality.

Results: Of the 956 patients included, 575 (60.1%) lived independently, 252 (26.4%) in LLC and 129 (13.5%) in HLC. Those in LLC and HLC were significantly less likely to be prescribed GDMT ($p < 0.001$). These patients were also less likely to undergo invasive coronary angiography (15% in independent living, vs 2% in LLC, 0 in HLC, $p < 0.001$). Over a mean follow-up of 1.3 years, 444 patients died (46.4). Independent living was associated with improved survival (HR 0.66 95%CI 0.55–0.81, $p < 0.001$). LLC living was not an independent predictor of mortality (HR 1.2

0.95–1.45, $p = 0.12$) but HLC was (HR 1.7 1.3–2.25, $p < 0.001$). This relationship remained consistent on Cox multivariable regression analysis after adjusting for age, gender and risk factors significant on univariate analysis.
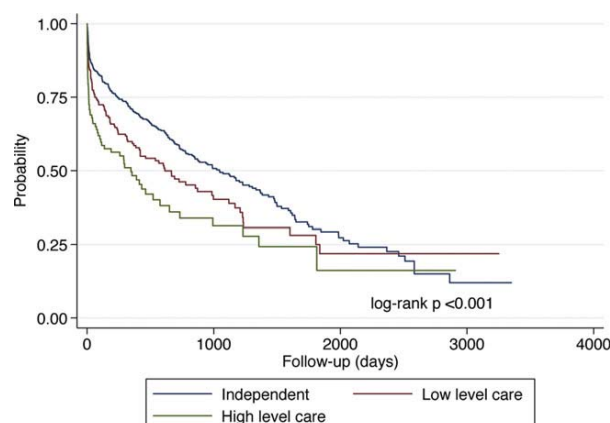
Conclusion: Home status greatly influences the management of elderly patients with NSTEMI. Patients living in HLC but not those in LLC had higher mortality. Those patients living in LLC should not be undertreated on the basis of their living situation alone.

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The Low Dose Colchicine After Myocardial Infarction (LoDoCo-MI) Study: A Pilot Randomised Placebo Controlled Trial of Colchicine Following Acute Myocardial Infarction

T. Hennessy [1], M. Bowman [1], L. Soh [1], R. Kurup [2], C. Schultz [1], S. Patel [2], G. Hillis [1,*]

[1] The Department of Cardiology, Royal Perth Hospital, Perth, Australia
[2] The Heart Research Institute, Sydney, Australia

Background: Following acute myocardial infarction (MI), patients with persistently elevated high-sensitivity C-reactive protein (hsCRP), are at increased risk of recurrent cardiovascular events. Colchicine is a unique anti-inflammatory medication that might reduce this risk. This study tested the ability of low-dose colchicine to reduce hsCRP levels at 30-days after acute MI, a key marker of outcome, and its safety and tolerability in this setting.

Methods: We conducted a randomised, double-blind, trial of colchicine 0.5mg daily or placebo in 237 patients admitted with acute MI. The primary end-point was the proportion of patients with hsCRP levels ≥ 2 mg/L after 30 days of treatment, a threshold associated with a worse prognosis.

Results: At 30-days, 44% of patients treated with colchicine had hsCRP levels ≥ 2 mg/L compared to 50% of those randomised to placebo ($p = 0.35$). The median hsCRP in patients randomised to colchicine was 1.6 mg/L (interquartile range [IQR] 0.7–3.5) versus 2.0 mg/L (IQR 0.9–4.0) in patients randomised to placebo ($p = 0.11$). The median absolute reduc-

tion in hsCRP levels was -4.3 mg/L (IQR -1.1 to -14.1) among colchicine-treated patients and -3.3 mg/L (IQR -0.9 to -14.4, $p = 0.44$) in placebo-treated patients. The relative reduction was 78% versus 64% ($p = 0.09$). Low-dose colchicine was well-tolerated and did not reduce compliance with other medications.

Conclusion: Low-dose colchicine was not significantly associated with achieving a hsCRP level <2mg/L or lower absolute levels 30 days after acute MI; beneficial trends were, however, observed and treatment was safe and well-tolerated. A large-scale outcome trial is required and these data suggest that this will be both safe and feasible.

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The Management Conundrum of Chronic Left Ventricular Pseudoaneurysms: A Review of the Literature

C. Brooks*, H. Cooke

John Hunter Hospital, Newcastle, Australia

Objective: Left ventricular pseudoaneurysms, a complication of ST elevation myocardial infarction, are becoming increasingly rare in the era of rapid reperfusion. Whilst surgical intervention is indicated for acute aneurysms (those detected within 2 weeks post infarct), less is known about the management of chronic pseudoaneurysms. A review of the literature was conducted to explore management options of chronic pseudoaneurysms.

Method: A search of several databases including PubMed and EMBASE was performed. Literature pertaining to both acute and chronic left ventricular pseudoaneurysms was reviewed.

Results: Whilst there was extensive literature on acute left ventricular pseudoaneurysms, there were only a select few papers that discussed chronic pseudoaneuryms, with limited recommendations for management.

Discussion: Whilst the prevalence of left ventricular pseudoaneurysms post infarction is low, acute pseudoaneurysms have a high propensity to rupture, necessitating surgical intervention. A proportion of patients are asymptomatic, with pseudoaneurysms often detected on routine follow-up investigation several months to years following infarct. For these chronic pseudoaneurysms, the propensity for rupture appears to be much lower, and the risk of surgical intervention may outweigh the benefit.

Conclusion: Whilst specific recommendations were limited, if chronic pseudoaneurysms were small in size, not rapidly expanding on serial imaging and patients were asymptomatic without significant valvular or coronary artery disease necessitating surgical intervention, medical management with ongoing follow-up would appear appropriate.

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The Peguero-Lo Presti Criteria Improve the Sensitivity of the Electrocardiogram to Diagnose Left Ventricular Hypertrophy in Patients with End-Stage Kidney Disease

T. Sampaio Rodrigues[1,*], M. Azraai[1],
A. Crosthwaite[1], S. Patel[1], O. Farouque[1],
J. Ramchand[1], R. Lim[1], M. Roberts[2],
F. Ierino[3], L. Burrell[1]

[1] *Austin Health- University of Melbourne, Melbourne, Australia*
[2] *Eastern Health- University of Melbourne, Melbourne, Australia*
[3] *St Vincent's Hospital- University of Melbourne, Melbourne, Australia*

Background: Left ventricular hypertrophy (LVH) is common in end-stage kidney disease (ESKD) and associated with adverse outcomes. The Peguero-Lo Presti [PLP] electrocardiographic (ECG) criteria for LVH [1] improve the sensitivity and accuracy of the ECG. We examined the utility of PLP criteria to diagnose LVH compared to cardiac magnetic resonance imaging (cMRI) and echocardiography (ECHO) in ESKD.

Methods: Patients with ESKD ($n = 33$) were prospectively recruited for an ECG, cMRI and ECHO. The PLP-criteria for LVH was met when the sum of the deepest S wave in any lead (SD) and S wave in V4 was ≥ 2.3 mV (female) or ≥ 2.8 mV (male). Results were compared with other ECG-LVH criteria [Cornell, Sokolow-Lyon (SL)], and reviewed by 3 investigators blinded to other imaging results.

Results: The mean age of cohort was 49 ± 14 years and GFR was <10 mL/min/1.73 m^2. cMRI-LVH occurred in 11 patients (33%). The PLP-ECG criteria had nominally the best sensitivity to detect cMRI-LVH and ECHO-LVH compared to other ECG criteria. For cMRI-LVH, sensitivity of PLP-LVH criteria was 55% (95% confidence interval, 24–82%), Cornell 46% [18–75%] and SL 18% [3–52%], all $p < 0.001$. Sensitivity of PLP-LVH criteria to detect ECHO-LVH was 50% [22–78%] Cornell 42% [16–71%] and SL 8% [4–40%], all $p < 0.001$. Specificity of all ECG criteria was $\geq 90\%$.

Conclusion: One third of ESKD patients had LVH on cMRI. The PLP criteria were more sensitive than existing ECG criteria to diagnose cMRI-LVH and ECHO-LVH in patients with ESKD. The PLP-LVH ECG criteria are a useful addition to our diagnostic strategies for LVH.

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The Prevalence and Distribution of Multivessel Disease in Non-ST Elevation Myocardial Infarction

A. Baumann[1,*], R. Tavella[1,2,3], T. Air[2,3],
A. Mishra[6], M. Arstall[2,5], C. Zeitz[1,2],
M. Worthley[1,2], J. Beltrame[1,2,3],
P. Psaltis[1,2,4]

[1] *Central Adelaide Local Health Network (CALHN), Adelaide, Australia*
[2] *The University of Adelaide, Adelaide, Australia*
[3] *Basil Hetzel Institute for translational health research (BHI), Adelaide, Australia*
[4] *South Australian Health and Medical Research Institute (SAHMRI), Adelaide, Australia*
[5] *Northern Adelaide Local Health Network (NALHN), Adelaide, Australia*
[6] *Flinders University, Adelaide, Australia*

Introduction: Non-ST Elevation Myocardial Infarction (NSTEMI) remains a common problem with an unacceptably high contribution to mortality beyond discharge. Patients with unrevascularised multi-vessel disease (MVD) are at particular risk but data on the prevalence and distribution of MVD in the NSTEMI cohort is limited. Using the Coronary Angiogram Database of South Australia (CADOSA), consecutive NSTEMI patients presenting to 3 tertiary hospitals between 2012 and 2016 were assessed in prevalence, distribution and key predictors of MVD.

Methods: MVD was defined as the presence of significant lesions in ≥ 2 major epicardial vessels ($\geq 50\%$ stenosis in the left main or $\geq 70\%$ stenosis in the other vessels by visual angiographic assessment). Patients with previous CABG and lesions defined only qualitatively were excluded.

Results: Of 3,722 patients, 1,524 (40.9%) were found to have MVD, 20.7% with 2-vessel disease (2-VD) and 20.2% with 3-vessel disease (3-VD). Disease distribution is shown in Table 1.

Table 1. *Prevalence and Distribution of $\geq 70\%$ lesions in MVD in NSTEMI.*

	N = 3,722	LM ($\geq 70\%$)	LAD ($\geq 70\%$)	LCx ($\geq 70\%$)	RCA ($\geq 70\%$)
2-VD	772 (20.7%)	12 (1.6%)	559 (72.4%)	472 (61.1%)	463 (60.0%)
3-VD	752 (20.2%)	139 (18.5%)	711 (94.6%)	683 (90.8%)	688 (91.5%)

LAD involvement was most common. The prevalence of LM disease increased when 3-VD was present. Age, male gender, smoking and diabetes were significant predictors of MVD ($p < 0.001$).

Conclusions: Multivessel coronary disease affects approximately two in five patients presenting with NSTEMI. Further analysis will determine how the presence of MVD impacts on management strategy and outcomes.

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The Treatment of Infective Endocarditis in Hospital in the Home in Australia 2011–2017

S. Montalto [1,*], P. McElduff [3], K. Hardy [4], M. Montalto [2]

[1] Royal Melbourne Hospital, Parkville, Australia
[2] Epworth Healthcare, Richmond, Australia
[3] University of Newcastle, Newcastle, Australia
[4] Baxter Healthcare, Old Toongabbie, Australia

Introduction: Hospital in the Home (HITH) plays an important role in the treatment of infective endocarditis (IE) in Australia. To date, there are no published data on the current activity and outcomes of HITH in IE.

Methods: Data was collected on all hospital inpatient admissions in 19 Australian public principal referrer hospitals that submit inpatient activity data to the Health Round Table. All cases involving a diagnosis of IE (DRG F61) between 2011 and 2017 were extracted for analysis.

Results: Of the 1,657 total cases of IE, 496 (29.9%) involved a HITH admission. There was no significant difference between HITH and non-HITH groups in baseline characteristics such as age and gender. Average total length of stay (LOS) was longer in HITH 31.8 days vs. non-HITH 11.4 days ($p < 0.01$). Average in-hospital LOS was shorter in HITH 6.7 days vs 11.4 days ($p < 0.01$). In-hospital mortality was lower in HITH 1.4% vs 7.0% ($p < 0.01$). There was no difference in 28-day readmissions; HITH 3.2% vs non-HITH 2.1%, $p = 0.16$. There were less patients deemed high complexity in HITH 53% vs non-HITH 65%, $p < 0.01$. Over the time period, the proportion of total episodes of IE involving HITH admission has risen from 15% (2011) to 39.5% (2017).

Conclusion: HITH admissions for IE have seen a considerable and steady rise over the past 7 years. In-hospital LOS is reduced when HITH is utilised. HITH admissions reflect selection criteria for lower complexity. HITH is now a recognised provider of acute care for IE.

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Three-Point Rapid Rule Out for Acute Chest Pain in the Emergency Department

S. Cheruvu *, J. Qin, M. Parksinon, C. Said, P. Bamford, J. Mooney

Gosford Hospital, Rhodes, Australia

Background & Objective: Assessment of cardiac related chest pain conventionally relies on clinical assessment and troponin measurement. We compared a simplified three-point rule out strategy to standard care, to identify those at low risk for subsequent cardiac events.

Methodology: A retrospective cohort study was performed on all chest pain presentations over a three month period. Patients were excluded if they had ST elevation infarct or an alternative cause of chest pain. Comparison was made between conventional clinical assessment versus a combination of: 1) a normal high sensitivity troponin level after 3 hours; 2) a normal ECG and 3) absence of known coronary disease. Outcomes assessed were freedom from major adverse cardiovascular events (MACE) at 12-months; defined as a composite of subsequent acute coronary syndrome (ACS), revascularisation, readmission or cardiovascular death. Significance was determined using Chi-squared test.

Results: A total of 199 patients were included. At 12-months, 23 patients (12%) had MACE, all of whom had at least one of the following: elevated troponin, abnormal ECG and/or a history of known coronary disease. The three-point rule out strategy had higher specificity (100% vs 58%; $p < 0.0001$) for predicting safety for discharge and freedom from MACE in comparison to standard care; which resulted in 16 (20%) patients inappropriately admitted under cardiology and 25 (32%) having unnecessary coronary investigation.

Conclusion: In our study, a simple three-point rule out strategy was able to identify with high specificity (100%), those patients at very low risk of MACE, independent of history, risk factors or clinical suspicion.

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Traditional Risk Factors Among Young Male and Female Adults with Acute Coronary Syndrome in Regional Queensland

M. Riess *, M. Musameh, S. Vaidya, M. Zhang, M. Paymard

Mackay Base Hospital, West Mackay, Australia

Objective: Acute coronary syndrome (ACS) in young adults is a major burden on the health system worldwide. The aim of this study is to compare the prevalence of coronary artery disease risk factors (CAD RFs) between male and female patients aged ≤ 45 years diagnosed with ACS.

Method: We retrospectively analysed all patients aged ≤ 45 years presented ACS (either NSTEMI or STEMI) to our institution in regional Queensland between January 2015 and February 2019 using their digital records. The data included demographics, CAD RFs and type of ACS.

Results: Out of 51 consecutive patients, 74.5% (38) were males and 25.5% (13) were females. The mean ages on admission were 41.6 years old (male) and 41.8 years old (female). NSTEMI was the dominant type of ACS in both cohorts (63% in males vs 69.2% in females). In males, the most common RFs included active smoking (63.1%) followed by obesity (BMI>30) (57.8%) and systemic hypertension (44.7%). Likewise, in female cohort active smoking was the most frequent RF (76.9%) followed by obesity (46.1%) and systemic hypertension (46.1%). Family history of premature CAD noted 38.4% in females versus 28.9% in males.

Conclusion: We demonstrated that active smoking, obesity, and systemic hypertension are the three most common RFs among young male and female patients (≤ 45 years old) with ACS in our region. We strongly encourage young adults to quit smoking, to lose weight if applicable and to have HTN

effectively treated in order to reduce the risk of premature CAD.

	Aborigin-al	Current Smoker	Ex-smoker	Obesity (BMI >30)	HTN	Diabetes Mellitis	Dyslip-idemia	FHx of premature CAD
Male	15.7%	63.1%	26.3%	57.8%	44.7%	7.8%	26.3%	28.9%
Female	15.3%	76.9%	15.3%	46.1%	46.1%	30.7%	23%	38.4%

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Trends in Management of Dyslipidaemia in Australia Over the Last 5 Years

D. Pol*, J. Yao, E. Deutscher, L. Dawson, M. Brooks

The Royal Melbourne Hospital, Parkville, Australia

Objectives: Dyslipidaemia is one of the most prevalent chronic conditions in Australia. While statins have long been the first line treatment for dyslipidaemia, several new medications have been introduced in recent years. We examined the trends in prescription of lipid lowering medications in Australia over the past 5 years.

Methods: Data was extracted from the Pharmaceutical Benefits Scheme (PBS). We assessed total number of scripts and costs of statins including Atorvastatin, Fluvastatin, Pravastatin, Rosuvastatin and Simvastatin, as well as Ezetimibe, Fenofibrate, Gemfibrozil, Colestyramine and Evolocumab from December 2013- December 2018. Linear trend modelling was used to analyse trends.

Results: Statins continue to be the most commonly prescribed lipid lowering therapy, with Atorvastatin remaining the most popular across all states in Australia (44.1%). Rosuvastatin use increased by 265% from April to December 2018 (40.9%), surpassing Simvastatin (11.6%) as the 2nd most commonly prescribed statin. Of all non-statin drugs, Ezetimibe was the most popular followed closely by fibrates. Since their introduction in December 2016, uptake of Evolocumab has been steady and linear but slow. In December 2018, Evolocumab represented only 0.04% of all scripts but 2.58% of total cost of lipid lowering medications. Queensland had the highest uptake of Evolocumab followed closely by Victoria and New South Wales.

Conclusions: Statins continue to be the mainstay treatment for dyslipidaemia in cardiovascular disease with recent increase in use of Rosuvastatin. Despite significant benefits of Proprotein convertase subtilisin/kexin type 9 (PCSK9) inhibitors, uptake of Evolocumab appears slow in Australia.

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Troponin Assay (cTnI) in the Real World: Is it Always a Diagnosis of Acute Myocardial Infarction?

A. Yu*, J. Nguyen, A. Brown

Royal Brisbane & Women's Hospital, Herston, Australia

Background: The soon to be implemented state-wide introduction of high-sensitivity troponin assays (hscTn) will allow the use of a lower threshold in identifying patients with acute myocardial infarction (AMI). Whether this assay will be too sensitive and therefore produce increased false positive results is still unclear. We aim to investigate whether a significantly elevated cardiac troponin using the current troponin assay (cTnI) will result in a clinical diagnosis of AMI.

Methods: A retrospective study was performed at a Queensland Hospital with all cTnI ordered across a single month reviewed. Patients who were diagnosed with NSTEMI or STEMI were labelled as having an AMI.

Results: In total, 944 investigations were ordered for 628 patients. Using the hospital laboratory cutoff of >0.040 μg/L (>99th percentile) for significance, a positive result was obtained in 105 patients (16.7%) and a negative result in 523 patients (83.3%). The positive troponin results were attributed to AMI (20%), congestive heart failure (20%), sepsis (19%), tachyarrhythmias (16.2%), renal failure (8.6%), airway disease (8.6%), pulmonary embolism (3.8%) and others - pericarditis, post angioplasty etc (3.8%). cTnI was found to be highly sensitive (100%, 95%CI 84–100%) and specific (86%, 95%CI 83–89%) for AMI. However, only 21 (3.3%) of 628 patients investigated received a diagnosis of AMI. The positive predictive value was poor (20%,95%CI 13–29%), with the negative predictive value absolute (100%, 95%CI 99–100%).

Conclusion: Current troponin assays (cTnI) were found to be highly sensitive and specific in diagnosing AMI. However, its poor positive predictive value may be contributed by inappropriate requests.

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Two-Year Mortality in Patients with New-Onset Atrial Fibrillation in Hospital: A Comparison Analysis with Pre-Existing Atrial Fibrillation

P. Thein, E. Wong*, S. Mirzaee, S. Nicholls, J. Cameron, A. Nasis

MonashHeart and Monash Cardiovascular Research Centre, Monash Health and Monash University, Melbourne, Australia

Background: Mortality rate of atrial fibrillation(AF) is high in hospitalised populations. Medical Emergency Team (MET) response is frequently activated in the context of care for patients with AF with rapid ventricular response (AFRVR). Incidence of long-term mortality and predictors of mortality

in patients with either pre-existing or new-onset AF have not been extensively compared.

Aim: To study long-term mortality in patients with new-onset AF diagnosed from MET response cohort compared to those with pre-existing AF

Methods: Between 2015 and 2016, consecutive patients with new ($n = 137$) and pre-existing AFRVR ($n = 137$) defined by ventricular rate of >130 beats per minute were identified from the MET database. New AF was confirmed by a cardiologist on electrocardiogram and the primary outcome was defined as all-cause mortality at 2-year follow-up.

Results: New-onset AF group were younger (74 ± 12 vs. 78 ± 11 years, $p = 0.003$), with comparable gender distribution (Male:Female = 0.53:0.47 vs. 0.45:0.55, $p = 0.23$) and lower prevalence of hypertension (63% vs.76%, $p = 0.02$) and diabetes (28% vs.32%, $p = 0.41$) compared to those with pre-existing AF. Between new and pre-existing AF groups, there were no difference in mean temperature(36.8 ± 0.8 vs. 36.8 ± 0.9, $p = 0.71$) and systolic blood pressure (130 ± 25 vs. 128 ± 23, $p = 0.63$). Two-year mortality was high in both new and pre-existing AF group (27% vs.19%, $p = 0.11$). On multivariable analysis, anticoagulant therapy commenced after MET response, but not new AF (OR = 1.8, 0.96–3.4, $p = 0.069$) was associated with 50% mortality reduction (OR = 0.51, 95%CI = 0.27–0.97, $p = 0.04$) whereas patients requiring a medical unit admission were 3.8 times more likely to die (OR = 3.8, 1.87–7.7, $p < 0.0001$).

Conclusion: Amongst patients meeting MET team response for AFRVR, all-cause mortality at 2-year follow-up is high. Furthermore, anticoagulation therapy associates with a reduced risk, regardless of time of AF onset. Further prospective controlled trials are required to support the evidence.

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Type-II MI and Chronic Myocardial Injury Rates, Invasive Management and 4 Year Mortality Among Consecutive Patients Undergoing High Sensitivity Troponin T Testing in the Emergency Department

A. Etaher[1,*], O. Gibbs[1], Y. Saad[1], S. Frost[1], T. Nguyen[1], I. Ferguson[1], C. Juergens[1], D. Chew[2], J. French[1]

[1] UNSW, Liverpool, Australia
[2] Flinders University, Adelaide, Australia

Background: In emergency departments (EDs), assessment of patients with suspected acute coronary syndromes (ACS) represents a major workload and high sensitivity troponin (HsTn) T&I levels are frequently measured, though only 5–15% of patients have a diagnosis of myocardial infarction (MI).

Methods: Consecutive patients with suspected ACS presenting to ED at Liverpool Hospital, Australia, March-June 2014 (inclusive), we determined the relative frequencies of 3 patient groups: type-I MI, type-II MI, chronic myocardial injury (CMI), and assessed the use of invasive and pharmacological therapies and 4-year outcomes. Adjudication was as

follows: 1) type-I MI; 2) type-II MI (including acute myocardial injury), and 3) CMI.

Results: Among 2738 patients 995 (36%), median age 76 years [IQR 65–83], with at least 2 HsTnT measurements and one >14 ng/l, 727 (73%) had CMI, 171 (17%) had type-II MI; and 97 (9.7%) had type-I MI. Patients with type-I MI were aged 63 years (mean) whereas those with type-II MI or CMI were 12 and 14 years older, respectively. In-hospital angiography rates were 95% for patients with type-I MI (62% had PCI), 24% (7% PCI) for those with type-II MI and 3.4% for CMI. Late mortality was 55% for type-II MI, 44% for CMI and 18% for type-1 MI ($P < 0.001$; see Figure).

Conclusion: Among unselected patients type-II MI was more common than type-I MI, though CMI occurred in 3/4 of patients. While patients with type-II MI acute myocardial injury had higher late mortality rates than type-I MI, after multivariable analyses mortality rates were not different.

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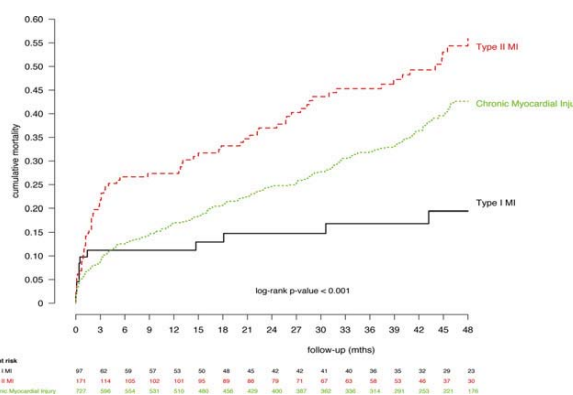
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Underuse of Risk Assessment Scores and Overuse of Computed Tomography Pulmonary Angiography (CTPA) in the Investigation for Pulmonary Embolism in an Emergency Department (ED) in Victoria

A. Dina[1,2,*], Y. Wang[2]

[1] Princess Alexandra Hospital, Woolloongabba, Australia
[2] Northern Hospital, Epping, Australia

Background: Inappropriate use of CT pulmonary angiography (CTPA) imposes significant burden on health care system. Clinical guidelines recommend using Well's score, Pulmonary Embolism Rule Out Criteria (PERC) score and d-dimer in the clinical decision making to reduce number of unnecessary CTPA.

Methods: We conducted a retrospective cohort study of adult ED patients who underwent CTPA for suspected pulmonary embolism (PE) between June and October 2017. We aimed to determine the percentage of CTPA that could have been avoided when the Well's score was combined with PERC score and/or D-dimer.

Results: A total of 360 patients were available for analysis. The mean age was 60.1 ± 16.9 years, 193 (53.6%) were females. The diagnostic yield of CTPA was 7.2% (26 of 360). Accord-

ing to guidelines, 68 (18.9%) CTPA investigations could have been avoided. This includes patients with: (1) a low-risk Wells score (<2), PERC (−) and/or D-dimer negative 52 (14.4%); (2) PERC (+) and D-dimer negative 12(3.4%); (3) Intermediate Wells score (2–6) and D-dimer negative 4 (1.1%). 137(58.3%) patients with low Wells score and PERC (+), and 58 (69.0%) patients with intermediate risk well score should have had D-dimer testing as part of their PE evaluation but did not.

Conclusion: Almost 20% of patients with suspected pulmonary embolism were subjected to unwarranted CTPA when risk assessment scores were not adhered to.

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Using the LACE Index to Predict 30-day All-cause Unplanned Readmission and Mortality in Acute Myocardial Infarction Patients: Insights from the CADOSA Registry

C. Labrosciano [1,2,*], R. Tavella [1,2,3], T. Air [1,2], C. Zeitz [1,2,3], M. Worthley [2,3], J. Beltrame [1,2,3]

[1] Basil Hetzel Institute for Translational Research, Woodville, Australia
[2] Adelaide Medical School, University of Adelaide, Adelaide, Australia
[3] Department of Cardiology, Central Adelaide Local Health Network, SA Health, Adelaide, Australia

Background: Improving outcomes following acute myocardial infarction (AMI) may be aided by identifying patients at high risk of adverse events before hospital discharge. The LACE index (Length of stay, Acuity, Comorbidities, Emergency presentations within prior six months) has varied success in predicting readmission and mortality. We evaluated the accuracy of the LACE index to predict 30-day all-cause unplanned readmission and mortality following hospitalisation for AMI in patients undergoing angiography.

Methods: All consecutive AMI patients enrolled in the CADOSA (Coronary Angiogram Database of South Australia) Registry at two major tertiary hospitals and discharged alive between July 2016 to June 2017 were included. Patients discharged to a nursing home, hospice or rehabilitation were excluded. Readmissions and mortality at 30-days were obtained via hospital administrative datasets. A LACE score was calculated for each patient and receiver operating characteristic (ROC) curve analysis was performed.

Results: Among 226 patients (31% female, mean age 64 ± 13 years, 32% STEMI), 29 (12.8%) patients suffered an all-cause unplanned readmission (62% cardiac, 38% non-cardiac) and four (1.8%) patients died within 30 days of discharge. The C-statistic (AUC) was 0.64 and the ROC values for various LACE cut-points are shown in the Table.

LACE Cutpoint	Sensitivity (%)	Specificity (%)	Correctly classified (%)
≥9	67	52	54
≥10	52	63	62
≥11	49	72	69

Conclusion: The LACE index shows moderate discriminatory capacity to predict 30-day readmissions and mortality. A cut off score of nine to optimise sensitivity may assist clinicians in identifying patients at high risk of adverse outcomes.

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This abstract has been withdrawn

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What is the Prognosis for Patients with the Coronary Slow Flow Phenomenon?

D. Jones [1,*], R. Tavella [1,2], L. Khor [3], J. Beltrame [1,2]

[1] Adelaide Medical School, The University Of Adelaide, Adelaide, Australia
[2] Department of Cardiology, Central Adelaide Local Health Network, SA Health, Adelaide, Australia
[3] New South Wales Health, Sydney, Australia

Background: The Coronary Slow Flow Phenomenon (CSFP) is an under-recognised coronary microvascular disorder characterised by delayed angiographic distal vessel opacification of contrast, in the absence of significant epicardial coronary stenosis. Although CSFP patients suffer from recurrent chest pain, their prognosis is often considered benign despite a lack of data assessing long term outcomes.

Methods: A retrospective medical record review of CSFP patients diagnosed at two tertiary facilities in South Australia between 1987–2014 was conducted to define their long-term clinical outcomes via interrogation of hospital administrative databases and medical record abstraction. Patients were followed up for a minimum of one year from the date of index angiography where CSFP was diagnosed.

Results: There were 218 CSFP patients assessed (68% male, 52 ± 12 years). The average follow-up was 12 ± 6 years which was available in 96% of patients ($n = 209$)

Outcome	Prevalence in CSFP
Repeat Angiography	51 (24%)
Acute Myocardial Infarction	11 (5.2%)
Re-hospitalisation for Chest Pain	103 (49%)
All-Cause Mortality 5 years	8 (3.8%)
Cardiovascular Mortality 5 years	3 (1.4%)
All-Cause Mortality 10 years	19 (9.7%)
Cardiovascular Mortality 10 years	4 (2.1%)

Conclusion: Despite their young age, CSFP patients are at considerable risk for myocardial infarction and suffer significant morbidity with re-hospitalisation for chest pain and repeat angiography common. Since standard treatment strategies have not been established, management approaches are warranted in this population to improve adverse events.

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Workforce Views on Training Pathways, Registration, Accreditation and Ongoing CPD Requirements for Each of the 5 Cardiac Physiology Professions

M. Norman [1,2,*], R. Wilson [1,3]

[1] *Professionals in Cardiac Sciences Australia, Woolloongabba, Australia*
[2] *Royal Hobart Hospital, Hobart, Australia*
[3] *Epworth Healthcare, Richmond, Australia*

Professionals in Cardiac Sciences Australia (PiCSA) is the national representative body for people working in clinical cardiac science professions. In 2015 PiCSA conducted a census of individual workers who perform cardiac science procedures across Australia, including ECG, cath lab, echo, cardiac devices and electrophysiology (EP). This was the first attempt to collect Australia-wide data about cardiac science professionals. One of the topics surveyed was workforce views on training pathways.

A background degree was considered desirable prior to commencing training in ECG 56%, cath lab 90%, echo 93%, cardiac devices 88%, and EP 89%. Whilst there was support for TAFE/VET based training for ECG, there was strong disapproval for advancement from ECG to the other cardiac science professions without a degree.

ECG experience was considered a prerequisite for training in cath lab 89%, echo 87%, cardiac devices 91%, and EP 94%. Similarly, cath lab experience was considered a prerequisite to training in Echo 41%, cardiac devices 62% and EP 80%.

There are well recognised nationally accredited courses in echo and electrophysiology. There was strong support for making similar courses available in the other cardiac science vocations (cardiac devices 89%, cath lab 81% and ECG 67%). There was also strong support for a national registry, for-mal accreditation and ongoing CPD requirements across all 5 cardiac physiology professions.

The above workforce views are not reflected in current policy. Currently only echo is regulated, and does not require a vocational foundation in cardiac physiology (i.e. ECG/cath lab) as per the UK or New Zealand.

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Cardiovascular Genetics (452–456)

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Eukaryotic Elongation Factor 2 Kinase (eEF2k) Regulates Cholesterol Uptake by Macrophages via CD36 Scavenger Receptor Expression

S. Fernando [1,2,*], N. Schwarz [1,2], L. Sandeman [1], T. Skoumbourdis [1], J. Zareh [1], A. Williamson [1,2], C. Dimasi [1], D. Toledo [1], J. Tan [1], B. Diartolo B [1], C. Bursill [1,2], S. Nicholls [1], C. Proud [1,2], P. Psaltis [1,2]

[1] *SAHMRI, Adelaide, Australia*
[2] *The University of Adelaide, Adelaide, Australia*

Background: Eukaryotic elongation factor 2 kinase (eEF2k) is a unique enzyme that controls protein synthesis and promotes cell survival under stress conditions. Previous studies suggest a role for eEF2k in formation of atherosclerotic plaques, yet cellular mechanisms are still unclear. Here we investigated how eEF2k regulates macrophage handling of atherogenic lipoproteins.

Methods: Bone marrow-derived macrophages (BMDMs) were prepared from eEF2k knockout ($Eef2k^{-/-}$) and wild-type (WT) mice and exposed to different stimuli, including oxidised low-density lipoprotein (ox-LDL). Parallel experiments were performed using BMDMs from C57BL/6 mice and human peripheral blood monocyte-derived macrophages (MDMs) that were treated with a highly selective eEF2k inhibitor, JAN-384. *In vivo, Eef2k-Ldlr^{DKO}* and *WT-Ldlr^{KO}* mice were fed an atherogenic diet for 16 weeks.

Results: Despite no differences in viability, proliferation, differentiation or polarisation, $Eef2k^{-/-}$ BMDMs had reduced ability to form oil red-O$^+$ foam cells when incubated with ox-LDL (WT 32.3% $\pm$ 2.0% vs. $Eef2k^{-/-}$ 12.5% $\pm$ 2.3%, $p < 0.01$). Similar observations were made for JAN-384 treated C57BL/6 BMDMs and human MDMs ($p < 0.05$). Mechanistic evaluation revealed 70% lower levels of the CD36 surface marker in $Eef2k^{-/-}$ BMDMs, with eEF2k inhibition having a similar effect. Both eEF2k deficiency and inhibition significantly increased total cholesterol efflux capacity in BMDM-derived foam cells ($p < 0.01$). In comparison to *WT-Ldlr^{KO}* mice, *Eef2k-Ldlr^{DKO}* mice had lower CD36 expression in circulating monocytes and macrophages after an atherogenic diet ($p < 0.01$), while foam cell formation was also lower from their BMDMs and peritoneal macrophages ($p < 0.01$).

Conclusion: eEF2k regulates foam cell formation from macrophages, likely through actions on CD36 expression and cholesterol efflux.

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Familial Clustering of Spontaneous Coronary Artery Dissection

L. McGrath-Cadell[1,*], S. Hesselson[2],
S. Iismaa[2], K. Mishra[2], C. Wong[2],
D. Fatkin[2], S. Dunwoodie[2], R. Harvey[2],
C. Holloway[1,2,3], D. Muller[1,2],
E. Giannoulatou[2], R. Graham[2]

[1] St Vincent's Hospital, Sydney, Sydney,
Australia
[2] Victor Chang Cardiac Research Institute,
Sydney, Australia
[3] University of New South Wales, Sydney,
Australia

Background: We recently reported the first risk allele for SCAD, a variant (rs9349379-A) in the PHACTR1/EDN1 genetic locus (Adlam et al J Amer Coll Cardiol 73:58–66, 2019).

Purpose: We sought to determine the clinical characteristics and initial genetic data for 11 families, in which more than one member has had an episode of SCAD.

Methods: Participants were recruited via social media. Informed consent was obtained for whole genome sequencing and collection of clinical information. SCAD was confirmed by review of coronary angiograms and clinical data collected by phone interview and review of specialist letters.

Results: Of 235 participants recruited to date, 23 cases showed familial clustering involving sister-sister pairs in six families, three first-degree cousins in one family (picture), two first-degree cousins in two families, a mother-son pair, and a family with concordant monozygotic twins, that is both twins having had SCAD. In an additional family, SCAD is discordant in monozygotic twins. A comparison of symptoms, age at SCAD, clinical syndrome, cardiovascular risk factors, SCAD risk factors, environmental triggers, SCAD location, acute management, left ventricular function and recurrent SCAD events in these families versus isolated cases, will be presented. Three sister-sister pairs have undergone whole genome sequencing and these data sets are undergoing segregation analysis to identify rare variants that are present exclusively in affected family members.

Conclusions: To our knowledge, this is the largest assembly of SCAD cases with familial clustering reported to date. It provides strong evidence supporting an underlying genetic basis for SCAD, which most likely is a multi-genic disorder that also involves important gene-environment interactions.

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Postnatal Mouse Aorta Contains Yolk Sac-Derived Haemangioblasts with Myeloid and Endothelial Plasticity and Vasculogenic Capacity

A. Williamson[1,*], D. Toledo[1], N. Schwarz[1],
S. Fernando[1,2], C. Dimasi[1], S. Liyanage[1,2],
T. Skoumbourdis[1], V. Chandrakanthan[3],
J. Tan[1,2], C. Bonder[4], B. Di Bartolo[1],
S. Nicholls[1,2], C. Bursill[1,2], P. Psaltis[1,2]

[1] Vascular Research Centre, Heart Health Theme,
South Australian Health and Medical Research
Institute, Adelaide, Australia
[2] Adelaide Medical School, University of
Adelaide, Adelaide, Australia
[3] Lowy Cancer Research Centre, Department of
Pathology, Stem Cell Development and Tissue
Regeneration Laboratory, School of Medical
Sciences, Faculty of Medicine, UNSW University
of New South Wales, Sydney, Australia
[4] Centre for Cancer Biology, University of South
Australia & SA Pathology, Adelaide, Australia

Background: Vasa vasorum cellular origins are ill-defined, however their development involves local expansion of adventitial macrophages. We previously identified a novel population of progenitor cells in postnatal murine arteries capable of producing macrophages. Here we investigated their vasculogenic capacity as a potential source of vasa vasorum.

Methods and Results: Aortic adventitial cells from C57BL/6J mice selectively generated macrophage colonies (CFU-M) which contained a phenotypically homogenous population of progenitor cells that were >95% positive for expression of CD45, Sca-1, c-Kit, CX3CR1 and CSF1R, but negative for mature monocyte/macrophage (CD11b, F4/80) and endothelial (CD144) markers. CFU-M prevalence in C57BL/6J aortas was highest in neonatal mice and diminished progressively with increasing age ($\sim$100 per 10^5 cells at P1, $\sim$15 at 12w, $\sim$5 at 52w, $P < 0.01$, n>4/gp,), consistent with prenatal seeding. Embryonic profiling determined that CFU-M progenitors first appeared in extra-embryonic yolk sac around E9.5 and in aorta-gonad-mesonephros at E10.5, before the emergence of definitive haematopoietic stem cells. Inducible fate-mapping then confirmed that aortic CFU-M progenitors originated from CX3CR1+ and CSF1R+ cells in E9.5 yolk sac. Aortic CFU-M progenitors generated vascular-like networks when cultured in Matrigel in vitro, containing M2-like macrophages (CD11b+F4/80+CD206+) and endothelial cells (CD31+CD144+). Adoptive transfer of CFU-M progenitors into a mouse model of hindlimb ischaemia resulted in 80% augmentation in hindlimb perfusion compared to cell-free control, with de novo transformation of donor cells into macrophages, endothelial cells and perfused neovessels ($n = 6$).

Conclusion: Postnatal mouse aorta contains clonogenic, self-renewing progenitor cells that have bipotent haemangioblast properties. These cells may be a source of vasculogenesis in the arterial wall and contribute to the development of vasa vasorum.

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Prevalence of Atrial Fibrillation in Patients with Inherited Heart Disease

A. Butters [1,*], C. Medi [2,3], R. Sy [2,3], C. Semsarian [1,2,3], J. Ingles [1,2,3]

[1] Agnes Ginges Centre for Molecular Cardiology at Centenary Institute, The University of Sydney, Sydney, Australia
[2] Faculty of Medicine and Health, The University of Sydney, Sydney, Australia
[3] Department of Cardiology, Royal Prince Alfred Hospital, Sydney, Australia

Background: The prevalence of atrial fibrillation (AF) has not been well described in young patients with inherited heart diseases such as the inherited cardiomyopathies: hypertrophic cardiomyopathy (HCM), familial dilated cardiomyopathy (DCM), arrhythmogenic right ventricular cardiomyopathy (ARVC), left ventricular non-compaction (LVNC); or inherited arrhythmia syndromes including long QT syndrome (LQTS), Brugada syndrome (BrS) or catecholaminergic polymorphic ventricular tachycardia (CPVT).

Objectives: We examined the prevalence and clinical characteristics of AF in patients with inherited heart diseases.

Methods and results: This retrospective cohort study included probands seen in a specialised multidisciplinary clinic between 2002–2018. Overall, AF was most prevalent in patients with HCM ($n = 257/907$, 28.3%) patients. The prevalence in the other inherited cardiomyopathies was: LVNC ($n = 9/49$, 18.4%), ARVC ($n = 3/21$, 14.3%) and DCM ($n = 8/48$, 16.7%). Amongst inherited arrhythmia syndromes AF was most prevalent in CPVT ($n = 4/19$, 21.1%), with an overall young mean age at AF onset of 25.2 ± 22.2 (range 5–57 years). The AF prevalence for other sub-groups was BrS ($n = 8/96$, 8.3%) and LQTS ($n = 4/80$, 5%). AF-positive patients were statistically older at diagnosis compared to AF-negative patients in the HCM ($p < 0.0001$), LQTS ($p = 0.02$) and BrS ($p = 0.01$) sub-groups. Adverse outcomes (stroke, transient ischaemic attack) were reported in 0%-12.5% across the disease sub-groups, while 0%-62.5% underwent therapies (AF ablation, cardioversion).

Conclusion: AF occurs frequently in patients with inherited heart dieases with a prevalence between 5–28%, with some sub-groups (CPVT) showing young age of AF onset (25.2 ± 22.2).

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Prevalence, Clinical Course and Development of Atrial Fibrillation in Sarcomere-Positive Hypertrophic Cardiomyopathy

A. Butters [1,*], C. Medi [2,3], R. Sy [2,3], C. Semsarian [1,2,3], J. Ingles [1,2,3]

[1] Agnes Ginges Centre for Molecular Cardiology at Centenary Institute, The University of Sydney, Sydney, Australia
[2] Faculty of Medicine and Health, The University of Sydney, Sydney, Australia
[3] Department of Cardiology, Royal Prince Alfred Hospital, Sydney, Australia

Background: Atrial fibrillation (AF) in patients with hypertrophic cardiomyopathy (HCM) occurs in ∼25% of cases, often at a younger age than in the general population. New research suggests HCM comprises clinically distinct disease sub-groups, with those who have sarcomere gene mutations being considered familial HCM.

Objective: We describe the prevalence, clinical course and development of AF in patients with sarcomere positive HCM.

Methods and results: There were 906 unrelated HCM probands reviewed at a specialised HCM clinic between 2002–2018 with complete AF history in this retrospective cohort study. Of those, 304 were sarcomere positive ($n = 88$ [28.9%] with AF). Kaplan-meier survivial analysis showed time to AF development occurs at a younger age in those with a sarcomere gene mutation compared to those without (i.e non-familial HCM; log rank $p = 0.0004$, Figure). After adjusting for body mass index, maxiumum left ventricular (LV) wall thickness and LV systolic diameter, independent predictors of AF in sarcomere-positive HCM were older age (OR 1.05; 95%CI 1.03–1.08; p-value, 0.0016), and left atrial (LA) area (OR 1.15; 95%CI 1.09–1.21; p-value, <.0001).

Product-Limit Survival Estimates
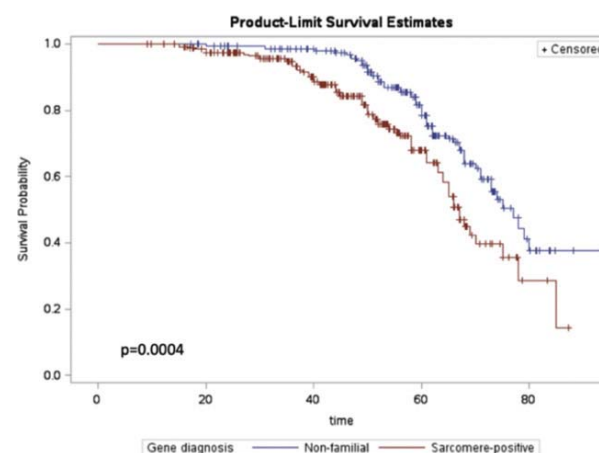
Conclusions: HCM patients with sarcomere gene mutations develop AF at a younger age. Age and LA area are independent predictors of AF in these patients. Sub-typing HCM may in future allow more precision-based patient management.

Cardiac Surgery (457–476)

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A Comparison of the Demographics and Surgical Risk Scores of Patients Undergoing Isolated Surgical and Trans-Catheter Aortic Valve Replacements at Royal Prince Alfred Hospital

D. Elder[1,*], M. Ng[1], R. Morton[2],
A. Keech[1,3], M. Seco[4], K. Shah[2], L. Turner[1],
M. Nguyen[3], K. Woldendorp[1], M. Doyle[1],
J. Wu[1], D. Watson[1]

[1] Royal Prince Alfred Hospital, Sydney, Australia
[2] The University of Sydney, Sydney, Australia
[3] National Health and Medical Research Council, Sydney, Australia
[4] Royal North Shore Hospital, Sydney, Australia

Introduction: Definitive management of severe aortic stenosis has evolved rapidly. Indications for trans-catheter procedures have progressed from patients deemed inoperable to high risk and now to patients representing intermediate surgical risk. Health resource availability also are determinants on treatment received. Advanced age and high surgical risk impact resource use through higher costs and length of stay.

This study examines and compares the demographics and surgical risk scores of patients undergoing isolated surgical and trans-catheter aortic valve replacements at Royal Prince Alfred Hospital in Sydney.

Method: This retrospective cohort analysis examined 124 consecutive patients undergoing isolated aortic valve replacements at Royal Prince Alfred Hospital between October 2016 and January 2018. Patients were identified from a database of cardiothoracic and transcatheter procedures with additional demographics recorded from hospital medical records. Surgical risk scores were calculated using the Society of Thoracic Surgeons risk calculator.

Results: 124 consecutive patients between October 2016 and Jan 2018.

	Procedure Number	Age –Range	Age – Mean	Age – Median	Age >80	STS Mortality - Mean	STS M&M - Mean
SAVR	62	27–90	68.7	71	10	2.2%	11.5%
TAVI	62	61–96	82.7	85	44	6.2%	23.7%
Combined	124	27–96	74.6	75.5	54	4.2%	17.6%

Conclusion: Between October 2016 and January 2018 equal numbers of patients underwent TAVI and SAVR at RPAH. There were differences in the age and surgical risk scores of these groups, those undergoing TAVI being older and more comorbid.

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A Comparison of the Number and Demographics of Patients Undergoing Either Isolated Surgical or a Trans-Catheter Aortic Valve Replacement Following the Introduction of a TAVI Program

D. Elder[1,*], M. Ng[1], R. Morton[2],
A. Keech[1,3], M. Seco[4], K. Shah[2], L. Turner[1],
M. Nguyen[3], K. Woldendorp[1], M. Doyle[1],
J. Wu[1], D. Watson[1]

[1] Royal Prince Alfred Hospital, Sydney, Australia
[2] The University of Sydney, Sydney, Australia
[3] National Health and Medical Research Council, Australia
[4] Royal North Shore Hospital, Sydney, Australia

Introduction: Trans-catheter aortic valve implantations have been performed in Australia since 2008 and numbers have been steadily increasing. Royal Prince Alfred Hospital was one of the first Australian centres to run a TAVI program. This study analyses the evolving numbers and demographics of patients undergoing TAVI and SAVR following introduction of the TAVI program in 2009.

Methods: Retrospective cohort analysis of patients undergoing TAVI and SAVR at RPAH between 2009 and 2018. Patients classified from a database of cardiothoracic and transcatheter procedures with additional information from hospital medical records.

Results: Between 2009 and 2018, 737 patients underwent isolated AVR at RPAH.
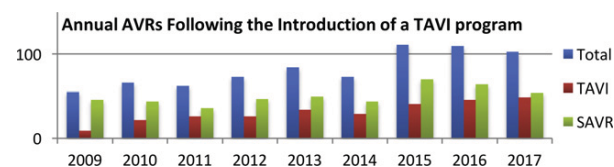
Age Mean	2009	2010	2011	2012	2013	2014	2015	2016	2017
Combined	74	72.3	75.1	73.8	73.1	71.2	72.9	74.4	74.6
TAVI	82	82	83.1	82.1	81.6	81.6	83.6	82	82.8
SAVR	72.5	67.4	69.3	69.2	67.3	64.4	66.7	68.9	67.1

Conclusion: Between 2009 and 2018 the overall number of isolated aortic valve replacements has increased. This has been driven by an increase in TAVI while SAVR have remained stable. Overall mean patient age has not significantly changed. Patients undergoing TAVI are older while mean age of those undergoing SAVR has decreased.

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A Meta-Analysis of Cognitive Outcomes Including Delirium in Coronary Artery Bypass Grafting Patients

D. Greaves [1,*], P. Psaltis [2], T. Ross [1], D. Davis [3], A. Smith [4], M. Boord [1], H. Keage [1]

[1] Cognitive Ageing and Impairment Neurosciences Laboratory, The University Of South Australia, Adelaide, Australia
[2] Vascular Research Centre, Heart Health Theme, South Australian Health and Medical Research Institute, Adelaide, Australia
[3] MRC Unit for Lifelong Health and Ageing at University College London, London, United Kingdom
[4] Alliance for Research in Exercise, Nutrition and Activity, University of South Australia, Adelaide, Australia

Background: Increasing numbers of adults are undergoing invasive cardiothoracic surgeries, such as coronary artery bypass grafting (CABG). CABG is known to improve cardiac vascularisation and mortality, however cognitive impairments including delirium are common after CABG. Our aim was to pool estimates across the literature for the first time, relative to diagnosis (cognitive impairment and delirium) and time (from pre- to post-CABG).

Methods: A systematic search of four databases was undertaken. 213 studies incorporating data from 86,390 patients were used to estimate the prevalence of cognitive impairments pre- and post-CABG, including delirium post-CABG, using random effects meta-analyses.

Results: Pre-surgical cognitive impairment was seen in 19% of patients. Post-operatively, cognitive impairment was seen in around 43% of patients acutely; this resolved to 19% at 4–6 months and then increased to 25% of patients between 6-months to 1-year post-operatively. In the long term, between 1 and 5-years post-operatively, cognitive impairment increased and was seen in nearly 40% of patients. Post-operative delirium was apparent in 18% of CABG patients which increased to 24% when a diagnostic instrument was utilised alongside clinical criteria.

Conclusion: Cognitive impairment and delirium are major issues in CABG patients. One in five patients have a cognitive impairment prior to CABG, which raises questions regarding informed consent. One in four patients have a delirium episode after CABG, which is associated with poor long term outcomes. These data emphasise the importance of using appropriate methods to investigate for cognitive impairment and screen for delirium in both the pre-and post-CABG settings.

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Adult and Paediatric Cardiac Intervention in Timor-Leste: Disease Burden, Demographics and Clinical Outcomes

E. Paratz [1,*], N. Mock [2], A. Cochrane [3], R. Harper [3], M. Larobina [4], W. Wilson [4], A. Appelbe [5], V. Kushwaha [6], I. da Silva Almeida [7], A. Monteiro [7], N. Bayley [2]

[1] Baker Heart & Diabetes Institute, Melbourne, Australia
[2] East Timor Hearts Fund, Melbourne, Australia
[3] Monash Medical Centre, Melbourne, Australia
[4] Royal Melbourne Hospital, Melbourne, Australia
[5] Geelong Hospital, Geelong, Australia
[6] Prince of Wales Hospital, Sydney, Australia
[7] Hospital Nacional Guido Valadares, Dili, Timor Leste

Background: The East Timor Hearts Fund (ETHF) is a charitable organisation involving Australian cardiologists who provide outreach screening in Timor-Leste, and cardiac interventions in Australia/New Zealand.

Methods: The ETHF database was utilised to identify patients with disease warranting surgical or percutaneous intervention. Overall demographics and pre- and post-operative factors were assessed, with sub-group analysis of adult and paediatric patients to identify any differences in care.

Results: Of 221 patients requiring intervention, 101 patients received intervention. Patients were predominantly young (median age 17.5 years) and female (64.7%), with rheumatic heart disease (63.8%). 24 (33.3%) women aged 15–45yo were documented as pregnant with severe cardiac disease. Of patients not proceeding to intervention, adults were more likely to be lost to follow-up (42.4% vs 18.5%) while paediatric patients were more likely to experience progression of disease (18.5% vs 7.5%, $p = 0.005$). Median waitlist time was 5 months, with no difference between adults and children, correlating with pre-operative mortality of 5.4%. Post-procedure mortality was extremely low (0.9%) and attendance of at least one post-procedure review excellent (99.0%). 11 (10.9%) patients have required repeat intervention, with no difference in rates between adult and paediatric patients.

Conclusions: The Timor-Leste interventional cohort are predominantly a young female population with rheumatic and congenital cardiac disease. Delayed access to intervention may result in pre-operative adverse events and mortality, and is a key target for improvement. Patients who undergo surgery have very low post-procedural mortality, excellent adherence to medical follow-up and good long-term outcomes.

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Clinical Characteristics of Patients with Low-Flow Low-Gradient Aortic Stenosis Undergoing Aortic Valve Replacement

B. Wong [1,*], D. Wei [2], K. Lee [1], A. Coverdale [3]

[1] North Shore Hospital, Auckland, New Zealand
[2] Middlemore Hospital, Auckland, New Zealand
[3] Auckland Hospital, Auckland, New Zealand

Background: Criteria for aortic stenosis (AS) severity can be challenging. Classical low-flow, low-gradient (LF-LG) AS is an entity accompanied by reduced left ventricular ejection fraction (LVEF). We present the characteristics of these patients undergoing aortic valve replacement (AVR) in our region.

Method: All patients undergoing isolated AVR for severe native AS at Auckland City Hospital over a 48-month period between 2016–2017 were included. Patients with LF-LG AS were identified and defined as mean pressure gradient <40 mmHg or maximum velocity <4 m/s, and LVEF <50% on echocardiogram. Patients with surgical coronary artery disease were excluded.

Results: Fifty-three (16%) of the 322 patients undergoing AVR during this period were identified to have LF-LG AS (75% men, mean age 71 ± 11yrs, 9 bicuspid). LF-LG AS patients were more likely to be hospitalised with pulmonary oedema (36% vs 16%, $p < 0.001$). Symptoms present in these patients include dyspnoea 87%, chest pain 23% and syncope 2%. New York Heart Association class III and IV symptoms were present in 34% and 6% of LF-LG AS patients respectively. On transthoracic echocardiogram, the mean LVEF of LF-LG AS patients was 35 ± 8%. Only 6 (11%) of the LF-LG AS patients underwent a dobutamine stress echocardiogram (DSE), all of which confirmed true severe AS.

Conclusion: In LF-LG AS referred for AVR, additional investigations should be considered to exclude moderate AS, pseudo-severe AS, or intrinsic myocardial impairment due to other causes. In particular, DSE is underutilised in this cohort of patients.

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Comparing Hospital Costs Of Trans-Catheter Aortic Valve Replacement and Isolated Surgical Aortic Valve Replacement in Patients with Aortic Stenosis Treated in New South Wales, Australia

K. Shah [1,*], M. Nguyen [1], M. Seco [2], D. Elder [3], L. Turner [3], J. Wu [3], M. Doyle [4], D. Watson [3], K. Woldendorp [4], A. Keech [1], M. Ng [3], R. Morton [1]

[1] National Health and Medical Research Council Clinical Trials Centre, University of Sydney, Sydney, Australia, Sydney, Australia
[2] Department of Cardiothoracic Surgery, Royal North Shore Hospital, Sydney, Australia
[3] Department of Cardiology, Royal Prince Alfred Hospital, Sydney, Australia
[4] Department of Cardiothoracic Surgery, Royal Prince Alfred Hospital, Sydney, Australia

Introduction: The data on comparison of costs and benefits for aortic valve replacement from an Australian healthcare perspective are scarce. The study quantifies hospital-associated resource use and costs of trans-catheter valve insertion (TAVI) and surgical aortic valve replacement (SAVR) procedures including length of stay, ICU hours; subsequent hospital admissions related to aortic stenosis, over 12 months.

Methods: A retrospective cohort analysis of patients who underwent TAVI or SAVR undertaken at Royal Prince Alfred Hospital (2012–2017). Patients were identified using the hospital patient database and electronic medical records. Resource use was valued using the Independent Hospital Pricing Authority's net efficient price and national weighted activity units (NWAUs). Results are presented as mean values with standard deviations, and costs are presented in 2017 Australian dollars.

Results: Of 482 patients, mean age 77 years (SD 13), 64% males:

	TAVI (SD) $n = 186$	SAVR (SD) $n = 296$
Average length of stay (days)	9.24 (10.24)	14.26 (13.42)
Average hours in ICU	23.16 (51.34)	78.64 (91.73)
Average cost of procedure	$68,949 ($24,493)	$62,870 ($36,252)
Average cost of hospital readmissions (up to 12 months post-procedure)	$10,022 ($20,123) [$n = 22$]	$16,030 ($20,658) [$n = 55$]
Total cost	$78,971	$78,900

The costs will be stratified by patients age (< and ≥80 years) and risk scores.

Conclusions: 12-month hospital costs for TAVI and SAVR are similar. TAVI costs are largely driven by cost of the prosthesis; SAVR costs are driven by hospital length of stay and ICU hours. A comparative analysis of outcomes for TAVI and SAVR is required to further inform health policy decision-making.

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Cost-Effectiveness of Transcatheter Aortic Valve Implantation Compared to Surgical Aortic Valve Replacement in the Intermediate Surgical Risk Population

J. Zhou [1,*], D. Liew [1,2], S. Duffy [1,2], A. Walton [1], N. Htun [1], D. Stub [1,2]

[1] *The Alfred Hospital, Melbourne, Australia*
[2] *The School of Public Health and Preventive Medicine, Monash University, Melbourne, Australia*

Background: The recent PARTNER S3i trial compared transcatheter aortic valve implantation (TAVI) using the third-generation SAPIEN 3 device to surgical aortic valve replacement (SAVR) in intermediate-risk patients with severe symptomatic aortic stenosis. Using data from PARTNER S3i, we performed a contemporary cost-effectiveness analysis of current-generation TAVI versus SAVR from the Australian healthcare system perspective.

Methods: A Markov model with monthly cycles and a ten-year horizon was constructed to estimate costs, life-years and quality adjusted life-years (QALYs) associated with TAVI and SAVR. Efficacy inputs were derived from the PARTNER S3i study. Costs were estimated from published sources. Deterministic and probabilistic sensitivity analyses were performed to assess model uncertainty.

Results: TAVI was found to have higher immediate procedural costs than SAVR, driven primarily by the cost of the transcatheter valve. This was offset by a shorter length of hospitalisation following TAVI, such that the combined cost of initial procedure and hospitalisation was lower in TAVI compared to SAVR. With 5% annual discounting, total costs over a ten-year horizon were $50,144 in TAVI and $60,085 in SAVR, and TAVI was found to produce 0.33 more life years and 0.31 more QALYs than SAVR. Thus, from a health economic perspective, TAVI was dominant compared to SAVR. Results were robust to sensitivity analyses, with TAVI being dominant in 70% of 10,000 Monte Carlo iterations and cost-effective in 92% of iterations at a willingness-to-pay threshold of $50,000/QALY gained.

Conclusions: TAVI is likely to be highly cost-effective compared to SAVR in management of severe symptomatic aortic stenosis.

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Cryoablation Versus Radiofrequency Ablation for Maze Procedures

D. Florisson [1], S. Conte [2], J. De Bono [1,*], M. Rahnavardi [1]

[1] *St Vincent's Hospital Melbourne, Fitzroy, Australia*
[2] *St Vincent's Hospital Sydney, Darlinghurst, Australia*

Background: The Cox-Maze IV procedure for the treatment of atrial fibrillation (AF) is faster, less technically complex, portends fewer complications, and results in lower morbidity compared to the traditional cut-and-sew Cox-Maze III procedure. Cox-Maze IV is highly effective, with recurrence rates of only 5–10%. The most studied energy sources are radiofrequency and cryoablation.

Methods: A best evidence topic was written according to a structured protocol addressing the question "for patients undergoing maze procedure, do cryoablation and radiofrequency ablation differ with respect to rate of recurrence of atrial fibrillation?" Altogether, 480 papers were found searching Medline, Embase, and Pubmed databases of which ten represented the best evidence to answer the question. Randomised trials or cohort studies among adults undergoing cardiac surgical procedures that included maze procedure were included.

Results: Rates of sinus rhythm or freedom from AF at long-term follow-up (usually 12 months) ranged from 70–95% and 73–89% in the radiofrequency and cryoablation groups respectively. Both methods were much more effective at maintaining sinus rhythm compared to placebo. The two groups were also evenly matched in terms of reported rates of complications. Mortality, when reported, ranged from 0–2% in both groups.

Conclusions: We conclude that radiofrequency and cryoablation are equiefficacious in terms of freedom from AF recurrence at long-term follow-up. Rates of complications such as bleeding and cardiac tamponade as well as mortality did not differ between groups. Choice of energy source for Cox-Maze IV procedure does not appear to markedly affect outcomes and should depend on centre and operator experience.

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Echocardiographic Outcomes Following Surgical Minimally Invasive Mitral Valve Repair in Patients With Severe Mitral Regurgitation and Pre-Existing Left Ventricular Dysfunction

S. Hungerford [1,2,3,*], N. Bart [1,2], M. Christofi [1], P. Jansz [1], C. Hayward [1,2,3], D. Muller [1,2,3]

[1] St Vincent's Hospital, Sydney, Australia
[2] University of New South Wales, Sydney, Australia
[3] Victor Chang Cardiac Research Institute, Sydney, Australia

Chronic severe mitral regurgitation (MR) results in left ventricular dysfunction (LVD), pulmonary hypertension, increased right ventricular (RV) afterload and RV dysfunction. The effect of minimally invasive mitral valve repair (MIMVR) in patients with pre-existing LVD (LV ejection fraction [EF] <50%) has not been well studied.

Objectives: To examine the short- and intermediate-term echocardiographic outcomes following MIMVR for patients with severe MR and pre-existing LVD.

Methods: This is a single-centre, retrospective, observational cohort study of patients with severe MR and LVD who underwent MIMVR between February 2008-August 2018. Baseline and post-operative transthoracic echocardiograms (day 1; 3 months) were analysed by two-blinded investigators for: LVEF; LV end-diastolic/end-systolic volumes (LVEDV/LVESV); MR; RV-fractional area change (FAC); RV-free wall longitudinal strain (FWLS); pulmonary artery systolic pressure (PASP); tricuspid regurgitation; tricuspid annular plane systolic excursion, and RVS.

Results: 46 patients (age 64 ± 14 years; 29 men) with grade 3–4 MR and pre-existing LVD underwent MIMVR. Less than 1+ MR was achieved in 97.8% of patients with a reduction in LVEDV/LVESV at day-1 (127.3/71.2mls to 98.8/68.0mls). There was a reduction in LVEF at day-1 (47.9% to 36.5%; $P = 0.028$), but this returned to baseline at 3-months. 66.7% of patients had RV-dysfunction pre-operatively (RVFAC $\leq 35\%$). PASP improved post MIMVR ($P = 0.002$), despite no improvement in RVFAC or RVFWLS.

Conclusions: MIMVR is effective treatment option for the correction of MR, resulting in a reduction of LVEDV and LVESV. Concomitant RV dysfunction is a frequent finding in patients with severe MR and LVD, and a post-operative reduction in PASP is likely the first indicator of RV recovery.

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First Australian Experience with Total Thoracoscopic Left Atrial Appendage Occlusion with Atriclip PRO2 device

P. Joshi [1,2,3,*], P. Sadlier [1,2,3,4], R. Weerasooriya [1,3], D. Playford [1,3]

[1] Mount Hospital, Perth, Australia
[2] Sir Charles Gairdner Hospital, Perth, Australia
[3] University of Notre Dame, Fremantle, Australia
[4] University of Western Australia, Crawley, Australia

Introduction: Oral anticoagulation (OAC) decreases ischaemic stroke in non-valvular atrial fibrillation (AF). Closure of the left atrial appendage (LAA) should be considered in patients unsuitable for OAC. We describe the first Australian series of totally thoracoscopic external LAA occlusion with the Atriclip PRO2[TM] device.

Methods: Patients with chronic AF at high risk of stroke and unable to take anticoagulation, or with embolic events despite anticoagulation, were considered for Atriclip device by a Heart Team at the Mount Hospital, Western Australia. All procedures were performed thoracoscopically, and not associated with any other cardiothoracic procedure. Under transesophageal echocardiography (TOE) guidance, LAA thrombus was excluded, and three 5-mm left chest ports were used for thoracoscopic insertion of the AtriClip device.

Results: All 15 patients (mean age 77 years, 11 males) deemed suitable for the device underwent the procedure successfully with mean procedure time of 26 minutes. Median CHA_2DS_2VaSC and HASBLED scores were 4.5 (range 2–7) and 4 (1–5), respectively. No complication, reoperation, infection or persistent wound pain was reported. The median postoperative stay was 2 days (range 1–14 days) with no ICU admissions, and good to excellent patient satisfaction scores. A total of 2203 patient-days of post-discharge follow-up were obtained with no strokes despite no patient taking anticoagulants or antiplatelet agents. Post-procedure TOE and follow-up CT scans confirmed successful LAA occlusion (figure).

Conclusions: Our initial experience with thoracoscopic LAA occlusion using the Atriclip device is excellent, with good safety, short procedure times and hospital stays, high satisfaction scores and no strokes during follow-up.

Figure: 3D TOE showing complete LAA occlusion (left panel) and 3D CT reconstruction showing Atriclip device (right panel)
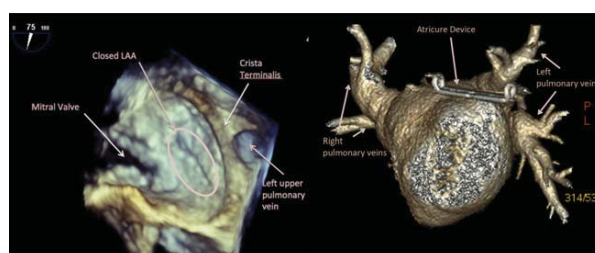
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Healthcare Costs Associated with Early Complications Following Cardiovascular Implantable Electronic Device Implantation

T. Dang [1,2], L. Ngo [1,2], A. Ali [1,2], S. Hossain [1,2], B. Kaambwa [3], A. Ganesan [3], A. McGavigan [3], I. Ranasinghe [1,2,4,*]

[1] Basil Hetzel Institute for Translational Research, Adelaide, Australia
[2] Discipline of Medicine, University of Adelaide, Adelaide, Australia
[3] College of Medicine, Flinders University, Adelaide, Australia
[4] Central Adelaide Local Health Network, Adelaide, Australia

Background: Healthcare costs associated with complications following cardiovascular implantable electronic device (CIED) procedures are poorly understood. We examined the direct healthcare costs associated with CIED complications, and how these costs varied by the type of complication and device implanted.

Method: We included patients aged ≥ 18 years with new CIEDs (pacemakers, ICDs and CRT-D/P) from 2010–15 from all states and territories except NT. We assessed major complications occurring in-hospital and within 90-days of discharge by linking records with subsequent hospitalisations and death registries. Costs were identified by matching the admission Diagnostic Related Group to the published schedules of public and private hospital costs from the National Hospital Cost Data Collection and converted to 2018 dollars. In-hospital costs were estimated by calculating the incremental costs associated with a complication using a generalised linear model, adjusted for other patient characteristics. To estimate post-discharge complications, we computed the cost of one or more readmissions for device-related complications.

Results: 40,155 CIEDs (29,391 PPMs, 6,921 ICDs, 3,843 CRT-D/P) were included. Of these, 8.3% experienced a device-related complication with 3.3% occurring in-hospital and 5.3% post-discharge. In-hospital complications were associated with an average of $9,186 increase in costs per patient with post-procedural shock ($24,235) associated with the highest incremental cost. Post-discharge complications cost an average of $22,296 per patient with the highest cost in patients who required a generator reoperation ($49,167/patient).

Conclusion: Early complications following CIED implantation are exceedingly costly. Reducing CIED complications not only reduces patient harm but offers a significant opportunity to reduce avoidable healthcare costs.

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Is Preoperative Platelet-to-Lymphocyte Ratio a Predictive Biomarker of Postoperative Atrial Fibrillation in Patients following Coronary Artery Bypass Graft Surgery?

R. Navani [1,*], K. Huang [1], D. Jin [1,2], A. Baradi [1,2,3], S. Paleri [2,3], J. Nguyen [1], Z. Ellis [1], A. Newcomb [1,2,4], A. Wilson [1,2,3]

[1] The University Of Melbourne, Melbourne, Australia
[2] St Vincent's Hospital, Melbourne, Australia
[3] Department of Cardiology, St Vincent's Hospital, Melbourne, Australia
[4] Department of Cardiothoracic Surgery, St Vincent's Hospital, Melbourne, Australia

Background: Platelet-to-lymphocyte ratio (PLR) has received interest as a novel, inexpensive and readily available inflammatory biomarker. While PLR has been correlated to adverse cardiovascular events in patients with acute coronary syndrome, there is a paucity of literature examining its relationship to postoperative atrial fibrillation (POAF) following coronary artery bypass graft (CABG) surgery. This study sought to investigate the positive association between PLR and POAF found in two previous studies.

Methods: A total of 3,637 patients who underwent cardiac surgery were identified from the ANZSCTS database (2010–2018) at St Vincent's Hospital, Melbourne. After excluding patients with a preoperative arrhythmia and selecting for patients who underwent isolated CABG, a total of 1,671 patients were analysed. Patients were assigned to two groups based on a PLR cut-off derived from receiver operating curve analysis. The incidence of POAF was then compared.

Results: Patients in the high PLR (≥ 86) group had a greater incidence of POAF than those in the low PLR (<86) group (34.8% vs 31.3%) although this was not statistically significant ($p = 0.257$). Using multiple logistic regression analysis, high PLR was not independently associated with POAF when compared to the low PLR group (OR 1.264, $p = 0.181$). No other independent predictors were found aside from age (OR 1.064, $p = 0.001$).

Conclusion: In our study, PLR was not independently associated with POAF in patients undergoing isolated CABG. This is the largest study to date, and in direct contrast to the only two previous studies examining this relationship.

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Preoperative Serum C-reactive Protein/Albumin Ratio Predicts Early Mortality and Adverse Outcomes following Cardiac Surgery

K. Huang [1,*], R. Navani [1], A. Baradi [1,2,3], D. Jin [1,2], S. Paleri [2,3], Z. Ellis [1], J. Nguyen [1], A. Newcomb [1,2,4], A. Wilson [1,2,3]

[1] The University Of Melbourne, Melbourne, Australia
[2] St Vincent's Hospital, Melbourne, Australia
[3] Department of Cardiology, St Vincent's Hospital, Melbourne, Australia
[4] Department of Cardiothoracic Surgery, St Vincent's Hospital, Melbourne, Australia

Purpose: Systemic inflammation and nutritional status are established predictors of poor early outcomes following cardiac surgery. There has been increasing interest in the prognostic value of CRP/albumin ratio (CAR) in inflammatory processes. However, its utility in predicting patient outcomes following cardiac surgery is not known. This study aims to investigate preoperative CAR on major adverse outcomes and mortality.

Methods: A total of 3,637 patients who underwent cardiac surgery were identified from ANZSCTS database (2010–2018) at St Vincent's Hospital, Melbourne. All 1,200 patients for whom preoperative CRP and albumin had been measured were included in the study. We assigned patients to two groups based on a CAR cut-off derived from receiver operating curve analysis. A composite primary outcome (mortality, major adverse events, readmission) and in-hospital mortality were compared against CAR levels and were adjusted for established risk factors using multiple logistic regression.

Results: Higher CAR (≥ 0.47) was significantly associated with the primary composite outcome (OR 1.82, $p < 0.001$), in-hospital mortality (OR 3.84, $p < 0.001$), and prolonged hospital stay (OR 3.68, $p < 0.001$). On multivariable analysis, CAR remained as an independent predictor after adjusting for body mass index, chronic kidney disease, chronic lung disease, congestive heart failure, operative status, and age.

Conclusion: Preoperative serum CRP/albumin ratio predicts in-hospital mortality and major adverse outcomes following cardiac surgery.

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Renal Outcomes after Cardiac Surgery in Relation to Angiotensin Converting Enzyme Inhibitor/Angiotensin II Receptor Blocker Use

J. De Bono [1,*], S. Conte [2], D. Florisson [1], P. Vale [3]

[1] St Vincent's Hospital Melbourne, Fitzroy, Australia
[2] St Vincent's Hospital Sydney, Darlinghurst, Australia
[3] Mater Hospital Sydney, Crows Nest, Australia

Background: Angiotensin converting enzyme inhibitors (ACEI) and angiotensin II receptor blockers ARB) are first-line therapies in hypertensive and heart failure. Their use in patients undergoing cardiac surgery is common. Concern regarding renal outcomes exists for patients administered these medications perioperatively, resulting in heterogeneous practice.

Methods: A best evidence topic was written addressing the question "in patients undergoing cardiac surgery, is long-term preoperative ACEI/ARB therapy associated with postoperative renal dysfunction?" Altogether, 11 studies representing 47,072 patients comprised of two randomised trials, two prospective cohorts, and seven retrospective cohorts with 811, 5,818, and 40,443 patients respectively were identified searching Medline, Embase, and Pubmed databases from 1980 to February 2019.

Results: Evidence is conflicting. The two randomised trials showed that preoperative ACEI/ARB were protective against the development of postoperative acute kidney injury (AKI). The two prospective cohorts showed opposite results and of the seven retrospective cohorts, four demonstrated increased risk, two no difference, and one a protective effect against AKI in relation to preoperative ACEI/ARB therapy.

Conclusions: Most data are derived from large cohort studies of moderate quality (average Newcastle Ottawa Scale score of five) and overall suggest an increased risk of postoperative AKI with preoperative ACEI/ARB. However, more recent, higher quality, randomised studies have shown the opposite: preoperative ACEI/ARB therapy reduces incidence of postoperative AKI; emphasizing the impact of selection and confounders. Large randomised trials are necessary to identify patients who may benefit from continued ACEI/ARB therapy in the context of cardiac surgery.

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This abstract has been withdrawn

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Restrictive Versus Liberal Transfusion Strategies for Cardiac Surgery

S. Conte[1], J. De Bono[2,*], D. Florisson[2], P. Vale[3]

[1] *St Vincent's Hospital Sydney, Darlinghurst, Australia*
[2] *St Vincent's Hospital Melbourne, Fitzroy, Australia*
[3] *Mater Hospital Sydney, Crows Nest, Australia*

Background: Anaemia is an important complication affecting cardiac surgery patients. Following cardiac surgery, transfusion of red blood cells is often required for haemodynamic support. Traditionally, haemoglobin cutoffs of 9–10 g/dL were used for to trigger transfusion. New randomised trial evidence has recently bolstered support for restrictive protocols with haemoglobin cutoffs of 7–8 g/dL.

Methods: A best evidence topic was written addressing the question "does post-operative mortality among adult patients undergoing cardiac surgery differ with restrictive versus liberal transfusion strategies?" Altogether, ten randomised trials representing 11,826 patients were identified searching Medline, Embase, and Pubmed databases from 1980 to February 2019 which represented the best evidence to answer the question.

Results: Some older trials have suggested a trend toward long-term mortality benefit with liberal transfusion protocols: Hazard Ratio (HR) 0.7 [95% confidence interval (CI) 0.49–1.02, $p = 0.06$] from a meta-analysis summarising six trials. However, more recent, larger, high-quality contemporary trials have demonstrated noninferiority with regard to mortality for a restrictive strategy, with the largest of which producing an odds ratio of 0.85 (95% CI 0.62–1.16) for 28-day mortality and 1.02 (95% CI 0.87–1.18, $p = 0.006$) for 6-month mortality.

Conclusions: Among cardiac surgery patients, restrictive and liberal transfusion strategies do not differ with respect to mortality. Adverse outcomes such as stroke, nonfatal myocardial infarction, and renal failure did not differ between the two groups. Restrictive strategies result in fewer transfusions and less health care expenditure.

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Review of Systemic to Pulmonary Shunts: A Seventeen Year Experience at a Tertiary Paediatric Hospital

A. Tarca*, G. Scaramella, D. Andrews, J. Saundankar

Perth Children's Hospital, Perth, Australia

Background: The systemic to pulmonary shunt was first described and performed in 1944 by doctors Blalock, Taussig and Thomas. Since then, the Blalock-Taussig shunt (BT shunt) and modified versions, have been utilised as both a bridging procedure to complete repair and for palliation of children with cyanotic congenital heart disease.

Method: We explore the outcomes of modified BT shunts placed during a seventeen-year period, 2000 to 2017, at a tertiary paediatric hospital. The surgical approach by the primary surgeon was via lateral thoracotomy, in contrast to the central approach often utilised. Data was collected from the electronic pathology, cardiology and cardiothoracic databases, medical in-patient documentation, observation charts and clinic letters. Multiple variables were collected including underlying cardiac anatomy, concurrent diagnoses, pre and post-procedure status, operation details, subsequent procedures and short and long-term morbidity and mortality.

Results: 148 modified BT shunts were placed in 126 patients during the study period. Underlying cardiac anatomy included double (97) and functionally single ventricle (29) circulations, excluding hypoplastic left heart lesions requiring the Norwood procedure. Overall all-cause mortality was 15.87% (20 patients), six early (30 day) and fourteen late. Mortality in single ventricle circulation was higher than double ventricle, 17.24% (5) and 15.46% (15) respectively.

Conclusion: The mortality rates are comparable to those previously reported for the double ventricle group. These results highlight that outcomes of BT shunts performed via lateral thoracotomy are comparable to those by midline sternotomy. Operating via the lateral approach is advantageous as it avoids the complications of multiple sternotomies.

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The Effect of Embolic Phenomenon on Surgery in Native versus Prosthetic Valve Endocarditis

A. Dorai-Raj[1,*], G. Dwivedi[1], J. Rankin[1], B. Jaltotage[1], N. Stamp[2]

[1] *Fiona Stanley Hospital Department of Cardiology, Murdoch, Australia*
[2] *Fiona Stanley Hospital Department of Cardiothoracic Surgery, Murdoch, Australia*

Background: Cardiac surgery is an important component of therapy in infective endocarditis (IE). However, the evidence in favour of early surgery especially in patients with prosthetic valve endocarditis (PVE) with recurrent emboli and/or large vegetations is less robust. This study aimed to characterise the frequency of embolisation in PVE versus native valve endocarditis (NVE) and delay in surgery as a result of emboli.

Methods: This is a retrospective single centre study at Fiona Stanley Hospital, WA and included 56-patients with confirmed IE receiving operative intervention between 2015–2019. Their medical/surgical records were examined.

Results: 11 (19%) patients from the 56-patient cohort receiving surgery had PVE. Patients with PVE had significantly lower rates of embolisation with 18% (2 cases) having radiological evidence of embolisation compared to 42% (19 cases) of NVE. Of the 11 cases with PVE, 3 (27%) had vegetations >0.9 cm of which 1 showed evidence of systemic emboli. NVE had 22 cases (49%) with vegetations >0.9 cm of which

13 embolised. The PVE group on average waited 8.4 ± 3.8 days for surgery from time of admission while the NVE group waited 9.1 ± 7.7 days. The analysis of embolic versus non-embolic group from admission to surgery showed those with embolic phenomenon had on average a longer wait; 10.5 ± 8.8 days compared to the non-embolic with a mean wait of 7.5 ± 4.7 days for surgery.

Conclusions: Patients with PVE had lower rates of embolisation than those with NVE which may have delayed surgery in the latter group.

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The Impact of Cryoballoon Versus Radiofrequency Ablation for Paroxysmal Atrial Fibrillation on Healthcare Utilisation and Costs: An Economic Analysis From the FIRE AND ICE Trial – An Australian private payer perspective

M. Huynh

Medtronic Australasia Pty Ltd, Macquarie Park, Australia

Background: Secondary analyses of the FIRE AND ICE trial showed patients treated with cryoballoon experienced significantly fewer repeat ablations and cardioversion (CV) hospitalisations compared to radiofrequency (RF) catheter ablation. These in turn led to significantly lower payer costs for the cryoballoon patients compared to the radiofrequency group.

Objective: To convert the secondary analysis outcomes costs from an Australian private payer perspective.

Methods: Translated the hospital DRGs from the study outcomes (German, UK and US) to Australian equivalent DRGs and costs using v6.0x AR-DRG grouper and Private Hospital Data Bureau 2016–17 v6.0x National charges, respectively. Sensitivity analysis was also carried out.

Results: The analysis showed the cryoballoon group used fewer post-procedure healthcare resources, including fewer repeat ablations and reinterventions compared to the RF group (205 healthcare utilisation (HCU) events vs. 268 HCU events), demonstrating favourable health economics consistent over multiple healthcare systems:

$AUD510 trial savings per patient under the Australian system ($p = 0.009$)
€640 trial savings per patient under the German system ($p = 0.012$)
£364 trial savings per patient under the UK system ($p = 0.013$)
$USD925 trial savings per patient under the US system ($p = 0.016$)

Conclusion: Fewer repeat ablations and CV hospitalisations led to significantly lower payer costs for the cryoballoon patients compared to the RF group. Cryoballoon improves patient outcomes with reduced healthcare utilisation and lower healthcare system costs from an Australian private payer perspective.

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Transcatheter Aortic Valve Implantation vs. Surgical Aortic Valve Replacement for the Treatment of Severe Aortic Stenosis in the Elderly Cohort

A. Sheikh [1,2,*], S. Chowdhary [2], M. Buch [2], R. Levy [2], I. Kadir [2], A. McNab [2]

[1] *University of Adelaide, Adelaide, Australia*
[2] *Wythenshawe Hospital, Manchester University Foundation Trust, Wythenshawe, South Manchester, UK*

Background: The number of patients who suffer from aortic stenosis (AS) is steadily increasing. While surgical aortic valve replacement (SAVR) remains the gold standard; transcatheter aortic valve implantation (TAVI) has been identified as an alternative in elderly, inoperable or of higher surgical risk.

Aim: To know what valve replacement modality should we offer our elderly patients with severe symptomatic AS and is there any difference in the post operative (op) total length of stay (LoS) and ITU days; as it has major resource implications.

Methods: Data of patients who underwent aortic valve replacement from 2013–2017 at Wythenshawe Hospital, South Manchester UK were analysed. 577 SAVR (isolated valve surgery) and 280 TAVI were performed. Pre op variables and post op outcomes were compared in elderly cohort i.e. patients with age 80 and above.

Results: Total 269 patients aged ≥80 had valve replacement (90 SAVR and 179 TAVI). Patients undergoing TAVI were sicker than SAVR group (Table 1). However post op LoS and ITU days were significantly higher in SVAR than TAVI (12.6 +/- 11.4 vs 8.7 +/- 8.7; $P = < 0.0001$ & 3.7 +/- 3.7 vs 01+/- 0.3; $P = <0.0001$ respectively). There was no significant difference in post op outcomes including in hospital and 30 day mortality (Table 2).

Conclusions: Elderly patients undergoing SAVR stay longer in hospital in comparison to TAVI. Overall outcome is not different in both groups. The "Heart Team" should be considered in the decision process to select most appropriate modality for individual patient.

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A Qualitative Study of Individuals' Experiences of Living with Peripheral Arterial Disease

S. Allida [1,*], M. DiGiacomo [1], R. Pritchard [1], K. Delbaere [2], A. Omari [3], S. Inglis [1]

[1] University Of Technology Sydney, Broadway, Australia
[2] Neuroscience Research Australia, Randwick, Australia
[3] Department of Vascular Medicine, St. Vincent's Hospital, Darlinghurst, Australia

Background: Peripheral Arterial Disease (PAD) occurs mainly among the older population and this is likely to increase as the population ages. Benefits to quality of life and outcomes can be gained through self-management strategies, yet there are limited opportunities available that offer specialised and tailored self-management programs to support patients in Australia. The aim of this study to ascertain a comprehensive perspective of the impact of PAD on people's lives and perceived needs for better access to disease-specific information, education, services, and support.

Methods: Participants were recruited from outpatient clinics at a tertiary hospital in a metropolitan area in Australia. Telephone and face-to-face semi-structured interviews were conducted with nine individuals living with PAD. Interview proceedings were transcribed and analysed using qualitative content analysis.

Results: A total of nine participants with an average age of 74.2 (SD 10.9), predominantly women (67%), and reported a variety of co-morbid chronic conditions participated in the study. A lack of understanding of PAD and inconsistent information resulted in confusion around which self-management strategies were appropriate and available. Although pain and problems with mobility were reported by the majority of participants, effects of these were amplified for participants who lived alone and did not have a carer to provide support.

Conclusions: Poor outcomes experienced by older people who may have low levels of health literacy and those without carers signal the urgent need for integrated care and multidisciplinary teams to support people with PAD.

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An Audit of Cardiac Monitoring Documentation in Patient Records by Cardiology Staff

R. Stubbs*, A. Lee

Wollongong Hospital, Wollongong, Australia

Introduction: The aim of this project was to audit documentation of cardiac monitoring for cardiology patients at Wollongong Hospital.

Methods: An audit was conducted of 30 patient notes using a tool developed to measure the standards of documentation against the Cardiac Monitoring of Adult Cardiac Patients in NSW Public Hospitals Guideline (GL2016_019). This measured nursing and medical documentation for indication, rhythms, reviews of arrhythmia and plan for the cardiac monitoring. The rhythms that nursing staff recorded in notes were then checked for accuracy.

Results: 145 days of cardiac monitoring for 30 patients with 330 nursing and 148 medical record entries were audited. Initial rhythms were documented 97% and 36% of the time for nursing and medical staff respectively. The indication for cardiac monitoring was recorded 70% and 80% for nursing and medical staff respectively. Neither nursing nor medical staff consistently mentioned arrhythmia reviews, with 11% and 10% of total nursing and medical notes mentioning arrhythmias, respectively. Plans for cardiac monitoring were documented in 26% of patients' notes by the medical team. A cardiac rhythm was recorded in 88% of nursing notes; 220 rhythms were checked for accuracy with 79% being correct.

Conclusions: The standard of documentation regarding arrhythmia reviews and plans was poor. This audit shows a need to improve the documentation of cardiac monitoring as an acute assessment tool within the cardiology department.

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Cardiac Monitoring Survey of Cardiology Nursing Staff

R. Stubbs*, A. Lee

Wollongong Hospital, Wollongong, Australia

Introduction: We decided to survey nursing staff about cardiac monitoring to examine their knowledge and education needs due to significant staff turnover.

Methods: A survey was made available to staff electronically using QARS. It collected demographics and used a Likert scale for 20 questions relating to confidence, knowledge and current practices.

Results: There were 30 responses (46% response rate). 57% had 1–3 years' experience in cardiac nursing and 40% had over 6 years of nursing experience. 92% of staff agreed cardiac monitoring is an important part of their role. 50% were confident using NSW health guidelines for cardiac monitoring and 69% in their documentation of cardiac monitoring. 86% had adequate knowledge of the Philips monitoring system and 72% agreed they had adequate knowledge of cardiac rhythms. 86% review patient's rhythms on every shift. 51% agreed that only patients who have indications for monitoring are monitored. 30% thought we are efficient at ceasing cardiac monitoring and 43% thought there is a clear plan for cardiac monitoring.

Conclusion: The majority of nursing staff surveyed have minimal cardiac experience. However, they were confident and had good knowledge of the monitoring system. Education focuses are now on the NSW Health guidelines and documentation.

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Cardiac Sonographer intravenous (IV) Cannulation Training – Workflow Innovation Pilot Study to Assess Safety and Drive Efficiency

M. James

Princess Alexandra Hospital Brisbane, Camp Hill, Australia

Background: Using echocardiography to thoroughly investigate clinical questions can involve the need for IV cannulation (eg. administering saline or echo contrast agents). This can result in delays while seeking a suitably qualified nurse or doctor to cannulate. At our centre, a tertiary referral echocardiography laboratory we investigated if sonographers undertaking cannulation training as advanced practice would reduce procedure times.

Methods: Staff completed training through the Vascular Access Surveillance Team (part of infection control). The core component of this program is to provide support to clinical areas. The hospital's procedure plan – Peripheral Intravenous Cannulation (PIVC) – insertion and management, provided guidelines for the department.

General pilot project scope: Initially three staff members completed training to perform IV cannulation for procedures within the unit. 'Guidelines for the Cardiac Sonographer in the Performance of Contrast Echocardiography: A Focused Update from the American Society of Echocardiography' reemphasizes the 2001 statement that the ASE supports IV training for sonographers.

Results: Sonographer performed IV cannulation resulted in a mean time (from last image to first image post IV) of 18 minutes vs 19 minutes, for Sonographers vs doctors respectively.

Conclusion: Following the initial twelve month trial period, IV cannulation performed by sonographers improved workflow with a marginal decrease in cannulation time with no adverse safety outcomes. Sonographer performed IV cannulation should be considered as an advance scope of practice, particular in facilities with reduced medical workforce capacity.

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Cardiovascular Risk Behaviour is an Emerging Health Issue in Developing Countries

L. Negesa, J. Magarey, P. Rasmussen, J. Hendriks *

University Of Adelaide, Adelaide, Australia

Introduction: The global progress in CVD prevention is scarce particularly in developing countries, which are facing a high burden of CVD whilst there is limited availability of resources and evidence to educate and modify lifestyle behaviours in the population.

Method: A hospital based cross-sectional survey was conducted in two referral hospitals in Ethiopia. Outpatient unit patients who had a confirmed diagnosis of CVD were eligible for participation in the study. Data were collected through face-to-face interviews with patients using validated tools.

Result: All patients had inadequate consumption of fruit and vegetables, 20% were current khat chewers, 19% were current alcohol drinkers and only 1% were current smokers. The prevalence of low physical activity in the total population was 51.6% for both sexes. Approximately one-third (30%) of patients had only one of these risk behaviours, more than half (52%) had two, 18% had three or more risk behaviours. The majority (70%) of the patients had multiple risk behaviours.

Conclusion: Patients with CVD maintain unhealthy lifestyles even though attending follow up care with a specific focus on risk management. The findings of this study demonstrate a high prevalence of physical inactivity, alcohol consumption and inadequate fruit and vegetable consumption in developing countries. Moreover, this study shows the existing follow-up care is ineffective and provides evidence for policy makers that health services reform is required. Implementation of lifestyle support programmes should be considered for the disease prevention policy agenda in developing countries.

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Development of an Avatar-Based Education Application for Improving Knowledge and Self-Care behaviours in Heart Failure: A Feasibility Study

P. Wonggom [1,*], H. Du [1], P. Nolan [1], C. Burdeniuk [2], S. Kelman [3], T. Barry [1], K. Nesbitt [1], R. Clark [1]

[1] *College Of Nursing And Health Sciences, Flinders University, Adelaide, Australia*
[2] *Cardiac Services, Flinders Medical Centre, Southern Adelaide Local Health Network, Adelaide, Australia*
[3] *Community Heart Failure Service, Southern Adelaide Local Health Network, Adelaide, Australia*

Background: Self-care is important in Heart Failure (HF) to prevent hospitalization and improve health outcomes. Interactive technology has been demonstrated to assist in improving HF knowledge and self-care.

Purpose: To develop and evaluate an interactive avatar-based application to improve HF knowledge and self-care.

Methods: Participatory action research and feasibility testing using pre-post test methods.

Results: Six HF patients, two HF family members and HF and information technology experts participated in the design and development an avatar-based application using two cycles on critical reflection. Based on the feedback in this co-design, avatar characteristics, images, concepts and quizzes of the application were updated for improving user experience.

Thirteen participants (66 ± 13 years, 76.9% male) were recruited to evaluate the application's feasibility for improvements in HF knowledge, self-care behaviors, and satisfaction.

After using the app there was a significant improvement in HF knowledge (median (IQR): 80.0 (70.0 - 93.3) to 86.7 (76.7 – 96.7), $p = 0.020$), self-care maintenance (82.5 (70.0 – 82.5) to 85.0 (77.5 −96.3), $p = 0.027$) and self-care confidence (75.0 (72.9 – 91.7) to 100.0 (95.9 – 100.0), $p = 0.002$). Self-care management did not significantly improve (62.5 (72.7 – 91.7) to 75.0 (29.2 – 93.8), $p = 0.113$). Overall satisfaction with the revised application was high at 90%. There were no particular characteristics that correlated with improved HF knowledge and self-care behaviors

Conclusion: The avatar-based technology indicated positive improvements in knowledge and self-care. Using a participatory approach in development the application is acceptable and valuable to meet appropriate user experience.

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Differences in Characteristics, Performance Targets and Outcomes for Men and Women with STEMI in a Large Tertiary Australian Hospital

L. Martin [1,2,*], V. Lewis [2], M. Murphy [2], D. Clark [1,3], D. Edvardsson [2], O. Farouque [1,3]

[1] Austin Health, Heidelberg, Australia
[2] La Trobe University, Melbourne, Australia
[3] University of Melbourne, Melbourne, Australia

Introduction: Gender comparison in the management of STEMI was explored in a large Australian dataset from 41 hospitals, concluding women experience disparity in care and outcomes [1]. We aimed to establish whether these disparities in outcomes occurred in our STEMI dataset at a tertiary hospital in Melbourne.

Methods: We analysed a prospective all-comer cohort of 922 STEMI patients receiving percutaneous coronary intervention at a single site. Univariate analyses compared characteristics of presentation, performance targets, specific timepoints of care and outcomes between men and women.

Results: Women treated for STEMI were older than men (70 ± 13 vs 62 ± 12 years, $p < 0.001$); more likely to present 8am-6pm Monday-Friday (48% vs 37%, $p < 0.01$), via regular ambulance (42% vs 25%, $p < 0.001$); with atypical symptoms (23% vs 11%, $p < 0.001$); TIMI risk score >5 on admission (43% vs 22%, $p < 0.001$); and fail the 90 minute performance target (36% vs 20%, $p < 0.001$). Differences between women and men for time taken to reach specific timepoints of care, did not reach statistical significance; Symptom Onset-Door (135 vs 117 min, $p = 0.06$); Door-ECG (7 vs 6 min, $p = 0.19$); Door-Cath Lab (37 vs 30 min, $p = 0.07$); Cath Lab-Device (32 vs 30 min, $p = 0.05$) respectively. Women were more likely to have a LV ejection fraction <40% (40% vs 30%, $p = 0.03$) and higher 365-day mortality (15% vs 7%, $p < 0.01$).

Discussion: Women presenting with STEMI had a higher comorbid condition. STEMI management at particular timepoints was similar for both men and women. Future multivariate analysis, controlling for age and comorbid conditions, will ascertain whether higher mortality for women persists.

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Discharge Against Medical Advice: A Tertiary Referral Centre Experience

T. Williams, M. Woolley, M. Al-Omary *

Hunter New England Health, Ashtonfield, Australia

Background: Discharge against medical advice (DAMA) is an infrequent event within hospital. It has been shown this group maybe more likely to have higher rates of readmission and post discharge mortality.

Aims: To describe the clinical characteristics, comorbidities, organisational factors, and health outcomes of consecutive patients who DAMA in a large tertiary hospital.

Methods: DAMA patients were identified by ICD codes during the period 2012–2017. Inpatient characteristics were sourced from the medical records. Length of hospital stay, 30-day readmission, and mortality rates were included and sourced from the Cardiac and Stroke outcomes.

Results: A total of 69 patients were classified as DAMA during the study. The median age was 56 (IQR 47–66). Males were more likely to DAMA (75%). DAMA patients predominantly presented with ACS (64%), CHF (17%), and arrhythmia (13%). The cardiac co-morbidities of this group included prior PCI (28%), ischaemic heart disease (43%), diabetes (52%), heart failure (23%), and renal failure (23%). Indigenous patients accounted for 17% of this group. Additional patient characteristics showed that DAMA patients had a high rate of unemployment (51%), and 38% had a current mental illness. Of interest in a large geographical area, the median distance from home to hospital was 20km (IQR 10–47). This patient group showed a high 30-day readmission rate (45%), but low 30 day mortality rate.

Conclusion: The incidence of DAMA is low. DAMA patients have identifiable comorbidities and complex social issues. DAMA does confer a high readmission rate. DAMA patients were more likely to be male and Indigenous.

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Disease Management Interventions in Lower-Limb Peripheral Arterial Disease: Impact on Functional Status

S. Allida[1,*], R. Pritchard[1], M. DiGiacomo[1], H. Du[2], S. Inglis[1]

[1] University Of Technology Sydney, Broadway, Australia
[2] Flinders University, Bedford Park, Australia

Background: Peripheral arterial disease (PAD) is a chronic atherosclerotic cardiovascular disease that is associated with significant morbidity, mortality and reduced quality of life. Disease management interventions may improve outcomes for people with PAD. The aim is to systematically review and quantify the effects of non-pharmacological and non-surgical chronic disease management interventions targeting people with lower-limb PAD.

Methods: An electronic search of bibliographic databases and registries using terms to identify PAD and disease management was conducted. Databases were searched from inception to November 2018.

Main results: Twelve trials with a total of 1287 participants were included in this review. Mean age of participants ranged from 65 to 73 years and 57% were male. Treatment effects were observed on the following primary outcomes with very low quality evidence: WIQ speed [MD 7.14 (2.65, 11.62); 4 trials; $n = 412$ participants]; WIQ stair climbing [MD 9.74 (4.55, 14.93); $n = 412$ participants]; WIQ walking distance [MD 12.65 (7.07, 18.24); 4 trials; $n = 412$ participants] and six-minute walking distance [MD 5.20 (2.56, 7.84); 3 trials; $n = 451$ participants].

Conclusions: Disease management interventions may improve functional status based on very low quality evidence. Our conclusions must be qualified by several methodological deficiencies in the studies and interpreted with caution despite the effect demonstrated.

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Does the Implementation of Same Day Discharge Following Percutaneous Coronary Intervention Really Improve Healthcare Resources Utilisation?

Y. Chen[1,2,*], A. Marshall[1,2], F. Lin[1]

[1] Griffith University, Southport, Australia
[2] Gold Coast University Hospital, Southport, Australia

Background: Same day discharge (SDD) following percutaneous coronary intervention (PCI) is a safe option that can facilitate discharge process and improve healthcare resources utilisation.

Objectives: The aim of this study was to evaluate whether implementation of SDD made impacts on length of hospital stay and healthcare costs in a tertiary health service in southeast Queensland Australia.

Methods: A pre-post quasi-experimental study design was adopted in this study. Data from outpatients who underwent PCI 6 months before ($n = 66$) and 6 months after ($n = 82$) the implementation of SDD were compared. Data from the hospital-based data repositories and electronic medical record were extracted. Descriptive and inferential statistical analyses were undertaken.

Results: During SDD implementation, 82 outpatients underwent PCI and 19 went home the same day: patients who had SDD required 20.5 hours shorter in length of hospital stay (median 7.4 hours vs 27.9 hours respectively) and spent $2,546 fewer in healthcare costs than those who did not (median $3,372 vs $5,918 respectively). When comparing data before and after the implementation, the median length of stay in the post-implementation group was 1.6 hours shorter and it was statistically significant; while the median healthcare costs in the post-implementation group was $526 more, although the result was not statistically significant.

Conclusion: The results suggest that a substantial number of patients who have SDD are required to make a meaningful impact on length of hospital stay and healthcare costs. Strategies that aim to increase the number of patients who can go home the same day are warranted.

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Gender and Racial Differences in Rural NSW for Possible Admission With Acute Coronary Syndrome

D. Mcivor[1], L. Savage[1], H. Orvad[2,*], F. Dee[1], M. Price[1], T. Williams[1], M. Al-Omary[1], A. Sverdlov[1]

[1] John Hunter Hospital, Locked Bag No 1, Hunter Region Mail Centre, Australia
[2] Tamworth Hospital, Dean Street, Tamworth, Australia

Introduction: Gender and race have previously been shown to influence admission rates for presentation to rural hospitals with possible Acute Coronary Syndrome (ACS). The exact cause of the variance and whether it is universal is unclear.

Objectives: To compare influence of gender and aboriginality on presentation and admission rates for possible ACS in two large rural referral hospitals for the period February 2018 to February 2019.

Methods: The Hunter New England Health Acute Coronary Syndrome Registry was utilised to compare admission rates in two large rural referral hospitals. Aboriginality was assessed by self-identification at triage and gender from patient demographics. Admission rates were obtained from the patient management system (iPIMS)

Results: Overall there was no difference in admission rate between aboriginal and non-aboriginal patients. Despite more females presenting at triage with possible ACS (55%) their admission rate was lower (25% versus 30% for males). Males had a higher 28-day mortality. There was no difference in the latter between aboriginal and non-aboriginal patients.

Conclusion: In our patient cohort there was no difference in ACS admission rates between the general population and those identifying as aboriginal. Males had a higher admission rate among aboriginal and non-aboriginal groups but the 28 day mortality was lower in the female cohort.

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Implementing a Primary PCI Urgent Transfer Process as First Line Management of STEMI at a Non-PCI Hospital in a Large Regional Area

M. Aquilina [1], R. Stubbs [2,*]

[1] *Illawarra Shoalhaven Local Health District, Wollongong, Australia*
[2] *Coronary Care CNC Wollongong Hospital, Wollongong, NSW, Australia*

Introduction: Primary PCI (pPCI) has been demonstrated to be superior to fibrinolysis therapy in reducing mortality, recurrent MI and stroke but benefits are lost if the delay to PCI is >121 mins (1). ESC recommends pPCI as the preferred reperfusion strategy provided PCI can be performed within 120mins from STEMI diagnosis. (2). CSANZ guidelines recommend PCI if a "Door in-Door Out time" (DI-DO) of ≤30mins can be achieved. Wollongong Hospital (WH) is the PCI-capable centre for the ISLHD. Bulli District Hospital (BDH) and Shellharbour Hospital (SHH) are a short drive to WH (18 and 34 minutes respectively).

Aim: To develop a process to Transfer for pPCI if a DO in-DO time of ≤30mins can be achieved Treat with fibrinolysis if this time cannot be achieved.

Methods: NSWA and the departments of Cardiology and ED at BH, SHH and WH developed a system of patient review, cardiac consultation and expedited ambulance booking and transfer. Data was collected looking specifically at key times for example DI-DO, ECG to ambulance booking, ambulance arrival and departure, arrival to PCI Hospital and time to device.

Results:

2016-2018 SHH pPCI ECG to Device
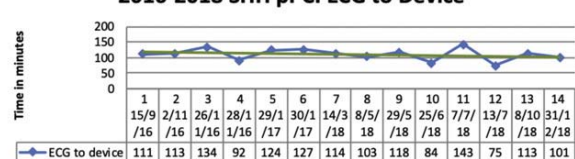
	SHH pPCI transfers		SHH Fibrinolysis
Total number STEMI treated (Nov 2016-Dec 2018)	15 (1 patient angiogram normal coronary arteries)		12 (1 patient angiogram normal coronary arteries)
Angiogram- normal coronary artery	1		1
Mean length of stay	3 days		4 days
	Nov-Dec 2016	Jan-Dec 2017	Jan-Dec 2018
Total pPCI transfers	4	3	7
Mean ECG to NSWA booking	19.5 mins	25 mins	14 mins
Mean ECG to device	112.5 mins	125.5 mins	106 mins

Conclusion: Urgent transfer for pPCI is achievable for non-PCI hospitals within a short driving distance to a PCI centre. Biggest predictor of achieving a STEMI diagnosis to device time of <120mins is the time from STEMI diagnosis to NSWA booking. This system also resulted in a decreased LOS of 1 day.

National Heart Foundation of Australia & Cardiac Society of Australia New Zealand: Australian Clinical Guidelines for the Management of Acute Coronary Syndromes 2016.

2017 ESC Guidelines for the Management of Acute Myocardial Infarction in Patients Presenting with ST-Segment Elevation

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Philips Cardiac Monitoring System Alarms Within a Cardiology Inpatient Unit

R. Stubbs*, A. Lee

Wollongong Hospital, Wollongong, Australia

Introduction: The aim of this project was to review the frequency of alarms within a one-month period by the Philips monitoring system and analyse the rhythm resulting in these alarms. We also assessed if there was a need to produce a new set of alarm parameters to reduce alarm fatigue amongst staff in an inpatient unit.

Methods: An audit was conducted for total alarms produced in April 2018. All alarms not relating to cardiac arrhythmia were excluded. Alarms were grouped into tachycardia and bradycardia and other major alarm groups. They were ordered by the alarm limit being breached. For analysis, the order was changed into heart rates.

Results: There were 364,107 alarms recorded throughout April 2018, Of these, 69,205 were arrhythmia-related alarms. The highest number of alarms were tachycardia (34,750, 50%), bradycardia (19,102, 28%), all PVC alarms (5,592, 8%) and NSVT (1,939, 3%). Heart rates between 120–130bpms produced 13,535 (39%) alarms. Heart rates between 45–49bpms produced 46% of all bradycardia alarms.

Conclusion: To reduce alarm fatigue and associated outcomes, we changed our alarm parameters to 130 bpm to reduce tachycardia alarms by 39%. The lower alarm limit was

changed from 50 to 45bpm to reduced bradycardia alarms by 46%. Some customised alarms including PVCs alarms, irregular heart rate and atrial fibrillation were turned off. Graph trends and ECG statistics are now accessible for this data.

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Paediatric and Congenital Cardiology (492–510)

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A "Good" Fontan Circulation at Transition to Adult Care: Late Clinical Outcomes and Risk for Systolic Ventricular Dysfunction

M. Dennis [1,*], D. Zannino [2], K. du Plessis [2], A. Bullock [3], P. Disney [4], D. Radford [8], T. Hornung [5], L. Griggs [6], Y. d'Udekem [2,7], D. Celermajer [1], R. Cordina [1]

[1] Royal Prince Alfred Hospital, Camperdown, Australia
[2] Murdoch Children's Research Institute, Melbourne, Australia
[3] Children's Cardiac Centre, Princess Margaret Hospital for Children, Perth, Australia
[4] Department of Cardiovascular Services, Royal Adelaide Hospital, Adelaide, Australia
[5] Green Lane Paediatric and Congenital Cardiac Service, Starship Children's Hospital, Auckland, New Zealand
[6] Department of Cardiology, The Royal Melbourne Hospital, Melbourne, Australia
[7] Department of Cardiac Surgery and Cardiology, Royal Children's Hospital, Melbourne, Australia
[8] Adult Congenital Heart Unit, The Prince Charles Hospital, Brisbane, Australia

Background: A high risk of morbidity and mortality is known in adults with a Fontan circulation. The difference in outcomes between those with and without significant morbidity at transition to adult care has not been characterised.

Methods: We analysed patients in the ANZ Fontan Registry who were 16 years of age. "Well" Fontan patients were defined as those without history of sustained arrhythmia, Fontan failure (death, transplantation, Fontan takedown or conversion, protein-losing enteropathy, plastic bronchitis or NYHA Class III/IV), thromboembolic event, moderate-severe atrioventricular valve regurgitation and/or moderate-severe ventricular dysfunction. The remainder were considered "Not Well".

Results: 796 patients were included; median age 25 years (16–67.6), 546 (69%) were "Well", 250 "Not Well"; 206 had an atriopulmonary connection, 253 lateral tunnel and 337 extra-cardiac conduit. Survival at 30 years of age was superior in the "Well" vs. the "Not Well"; 94% (95% CI 91%–96%) vs 82% (95% CI 75%–89%), $p = 0.01$. The "Well" were less likely to experience mortality (HR 0.54, 95% CI: 0.33–0.87), $p = 0.01$ and Fontan failure (HR 0.42, 95% CI: 0.30–0.58), $p < 0.001$. On multivariate analysis previous PA banding (HR 2.73, 95% CI: 1.19–6.24), male gender (HR 3.39, 95% CI: 1.52–7.54) and prior cardiac procedures (HR 1.62, 95% CI: 1.21–2.17), $p < 0.001$ were predictive of ventricular dysfunction in the "Well" Group.

Conclusions: Outcomes for adolescents "Well" at transition to adult care are markedly superior to those who are not. An important consideration when formulating individualized long-term risk estimates and counselling patients.

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A Designated Single Ventricle Group Improves Outcomes for Infants with Single Ventricle Physiology

N. Anderson*, M. Saint Marshall, J. Stirling, J. Wright, J. MacCormick, J. Artrip, M. Hamer, S. Thompson, A. Kennedy, K. Finucane, T. Gentles

Starship Child Health, Auckland District Health Board, Auckland, New Zealand

Aims: To determine the impact of the implementation of a single ventricle group (SVG) in management of infants between stage 1 and stage 2.

Methods: A SVG commenced January 2017 at our hospital and consisted of cardiologists and senior nursing staff. Data from infants enrolled on the Home Monitoring Programme (HMP) was reviewed each week to inform clinical decisions. Criteria for inclusion were infants with single ventricle physiology who had a Norwood or aorto-pulmonary shunt in 2017–2018 and had completed stage 2. An infant admitted to hospital for a breach of the HMP was defined as a "save". A breach in criteria included hypoxemia, poor growth (<150 g/week) or weight loss (>50 g in one day). Breaches were escalated to the Nurse Specialists who facilitated their admission to the local hospital or cardiac centre for further assessment.

Results: A total of 25 infants have completed stage 2 with no mortality. Inter-stage discharge criteria were not met in 5/25 (20%). Of the remaining, 3/20 (15%) followed their expected trajectory. The remaining 17/20 (85%) breached criteria requiring hospital admission. Hypoxaemia was the commonest breach 13/17 (76%) with the remaining 4/17 (24%) admitted for poor growth/weight loss. Early CT scan was required for 13/17 (76%), 6 had re-intervention and 5 had early Bi-Directional Glenn.

Conclusion: Close surveillance and uniformity of practice by a specified group of clinicians can result in excellent outcomes for this vulnerable population.

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Assessment of Disease Progression in Patients with Repaired Tetralogy of Fallot Using Cardiac Magnetic Resonance Imaging

I. Mohamed [1,*], S. Coffey [1], R. Keenan [2], B. Lowe [3]

[1] Department of Medicine - Dunedin School of Medicine, University of Otago, Dunedin, New Zealand
[2] Department of Radiology, Heart Otago, Christchurch School of Medicine, University of Otago, Christchurch, New Zealand
[3] Department of Medical and Health Sciences, University of Auckland, Auckland, New Zealand

Background: Tetralogy of Fallot (ToF) is the commonest cyanotic congenital heart disease with a long term survival of over 85%, making adult survivors an ever growing population. Late pulmonary outflow tract and pulmonary valve post-operative complications are frequent, leading to risk of right ventricular (RV) failure and arrhythmias related sudden death. Timing of pulmonary valve intervention remains challenging, with early intervention being balanced against the risk with the number of interventions over a patient's life time. Imaging frequency for correct timing of intervention is unclear, largely based around estimation of rate of RV dilatation.

Aim: To perform a systematic review of the use of cardiac magnetic resonance imaging (CMR) to predict disease progression (RV dilatation, dysfunction, or adverse clinical event) in patients with repaired tetralogy of Fallot (rToF), and use the information to determine the optimal interval for follow-up CMR.

Methods: PubMed searched from inception until 30th April 2018 for relevant articles.

Results: 25 studies identified. Right and left ventricular volumes and function have proven significance in predicting timing for intervention. Severity of pulmonary valve regurgitation has also been shown to predict progression of RV dilatation, with pulmonary valve regurgitant volume appearing more predictive than regurgitant fraction. Optimal frequency of clinical and imaging review in adult patients with rToF remains uncertain.

Conclusion: The optimal timing of repeat cardiac imaging in rToF remains controversial, with a three year schedule for repeat CMR appearing reasonable in asymptomatic patients. Large prospective studies will provide important information to guide clinical decision in this area.
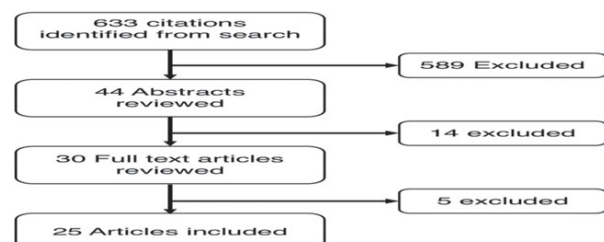
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Bicuspid Aortic Valve Disease – Valve Morphotype Influences Age at and Indications for Operative Treatment

M. Lim [1,2,*], P. Bannon [1,2], D. Celermajer [1,2]

[1] Royal Prince Alfred Hospital, Camperdown, Australia
[2] The University of Sydney, Camperdown, Australia

Introduction: Patients with BAV are heterogeneous and risk prediction for the complications of valvulopathy and/or aortopathy remains challenging.

Methods: Adult patients who had undergone aortic or aortic valve surgery for BAV were identified from our Adult Congenital Heart and Cardiothoracic Surgery databases. BAV morphology was classified according to the number of raphes present according to the Sievers classification [1].

Results: 571 patients were included (73.4% males, median age at surgery 62 years). The commonest indication for surgery was aortic valve dysfunction (69.5%) followed by aortic disease (15.2%). The commonest haemodynamic abnormality was aortic stenosis (74.4%), then aortic regurgitation (13.1%). 36.6% required aortic surgery in addition to valve replacement. 24.7% of patients had concomitant CABG. 30-day mortality was 1.4%, in patients with and without aortic replacement surgery.

Data on BAV morphotype was available in 346 patients (60.6%); one raphe (type 1) in 82.1%, no raphes (type 0) in 7.2% and two raphes (type 2) in 2.3%. Patients with type 2 valves were significantly younger at time of surgery than patients with type 1 valves (36 vs 63 years, $p = 0.008$). Patients with type 0 valves were much more likely to require aortic surgery than patients with type 1 valves (68% vs 37.3%, $p = 0.005$) and were more likely to require both proximal and distal aortic replacement ($p = 0.014$).

Conclusion: A significant number of patients undergoing surgery for BAV had associated aortopathy requiring aortic surgery. BAV morphology influenced age at valve surgery, and the need for aortic surgery.

Reference

[1] Sievers HH, Schmidtke C. A Classification System for the Bicuspid Aortic Valve from 304 Surgical Specimens. The Journal of Thoracic and Cardiovascular Surgery 2007;133:1226–33.

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This abstract has been withdrawn

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Depression and Anxiety Among People with a Fontan Circulation: Findings from the Australian and New Zealand Fontan Registry

K. Marshall [1,2,*], Y. d'Udekem [3,4], G. Sholler [1,5], D. Costa [6,5], D. Celermajer [5,7], D. Winlaw [1,5], N. Kasparian [2,8,9]

[1] *Heart Centre for Children, The Sydney Children's Hospitals Network, Sydney, Australia*
[2] *Discipline of Paediatrics, School of Women's and Children's Health, UNSW Medicine, The University of New South Wales, Sydney, Australia*
[3] *Heart Research Group, Murdoch Children's Research Institute, Melbourne, Australia*
[4] *Department of Cardiac Surgery, The Royal Children's Hospital, Melbourne, Australia*
[5] *Sydney Medical School, The University of Sydney, Sydney, Australia*
[6] *Pain Management Research Institute, Royal North Shore Hospital, Sydney, Australia*
[7] *Department of Cardiology, Royal Prince Alfred Hospital, Sydney, Australia*
[8] *Department of Cardiology, Boston Children's Hospital, Boston, United States*
[9] *Harvard Medical School, Boston, United States*

Background: Little is understood about the ways in which living with a Fontan circulation impacts a person's mental health and psychological wellbeing. Using a web-based platform, our aim was to examine the prevalence and predictors of depression and anxiety in people of all ages with a Fontan circulation enrolled in the Australian and New Zealand (ANZ) Fontan Registry.

Methods: Patients aged ≥6 years and at least 12 months post-Fontan surgery were invited to participate. Self-report data were captured cross-sectionally and analysed in combination with clinical variables extracted from the ANZ Registry.

Results: One-hundred thirty-nine children, adolescents and adults with a Fontan circulation were included in this analysis. Participants ranged in age from 6–50 years ($M = 20.3$, $SD = 10.8$) and 51% were male. Twenty-seven percent of children and adolescents aged 8–17 years, and 34% of adults, reported symptoms of anxiety warranting clinical intervention. Depressive symptoms requiring clinical intervention were reported by 26% of child and adolescent participants and 26% of adults. Only 14% of adults reported accessing mental health care through their hospital, and 21% reported seeking psychological assistance outside of their treating hospital or cardiac centre. While 73% of the sample perceived talking about their mental health needs as helpful, only 52% of children and adolescents had shared concerns about their health with another person.

Conclusion: A substantial proportion of children, adolescents and adults with complex congenital heart disease report high levels of anxiety or depressive symptoms; however, timely access to mental health services is wanting.

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Does Disease Severity Contribute to Disparity in Outcome Amongst Ethnic Groups in Patients with Hypoplastic Left Heart syndrome in New Zealand?

N. Soszyn [1,*], E. Cloete [2], L. Sadler [3], M. Stein-de Laat [3], S. Crengle [4], F. Bloomfield [2], T. Gentles [1]

[1] *Green Lane Paediatric and Congenital Cardiac Service, Starship Children's Hospital, Auckland, New Zealand*
[2] *Liggins Institute, University of Auckland, Auckland, New Zealand*
[3] *Women's Health, Auckland City Hospital, New Zealand*
[4] *Preventive and Social Medicine, University of Otago, Dunedin, New Zealand*

Māori/Pacific Island patients with hypoplastic left heart syndrome (HLHS) have a later diagnosis, lower termination rates and higher mortality compared to other ethnic groups in New Zealand (NZ). Our aim was to determine if HLHS disease severity contributes to these outcome differences.

Patients with HLHS diagnosed on a fetal or post-natal echocardiogram in NZ 2006 - 2015 were identified via a national database and divided into sub-groups (NZ European, Māori/Pacific Islander, and Asian). A fetal echocardiography risk score was calculated based on predictors of severity. Mitral stenosis/aortic atresia, hypoplastic aortic arch, intact/restrictive atrial septum, moderate-severe tricuspid regurgitation, and moderate-severe right ventricular dysfunction were each allocated one point. There were 125 patients with HLHS. Twenty-seven (22%) were excluded due to insufficient fetal data. All 27 were terminated or still-born. Results for included cases:

	NZ European	Māori/PI	Asian	p
Total patients (98)	60 (61%)	29 (30%)	9 (9%)	
Birth state				0.002
Termination of pregnancy	32 (53%)	3 (10%)	5 (56%)	
Stillbirth	2 (3%)	2 (7%)	2 (22%)	
Livebirth	26 (43%)	24 (83%)	2 (22%)	
Risk score ≥2	19 (32%)	20 (69%)	1 (11%)	0.02
Survival at 1 year (% live birth)	16 (62%)	5 (21%)	0 (0%)	0.009
Survival at 1 year if risk score ≥2	5 (26%)	2 (10%)	0 (0%)	0.49

Disparity exists in health outcomes amongst ethnic groups in patients with HLHS in NZ. More severe disease in Māori/Pacific Island patients may in part account for differences in outcome.

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Familial Sinus Bradycardia Secondary to Left Atrial Isomerism

A. Mustafa

Qch, Brisbane, Australia

We provide the first known case series of familial left atrial isomerism (LAI) affecting four individuals across three generations presenting with bradycardia.

Two sisters (now 2 and 4yrs of age) were diagnosed antenatally with bradycardia with the second child also diagnosed with an interrupted IVC with azygous continuation to the SVC, confirmed postnatally in both children, with otherwise structurally normal hearts. Both were confirmed postnatally to have sinus bradycardia with junctional escape rhythm. The older child had normal bronchi, abdominal situs and spleen, whilst the younger had bilateral hyparterial bronchi on CXR and polysplenia. Both remain clinically well in sinus rhythm with average heart rates of 57bpm and 43bpm respectively, with progressive ventricular dilation.

Their mother has a history of sick sinus syndrome and following the LAI diagnoses in the children was shown to have the same venous anatomy and polysplenia on MRI. Holter monitoring showed sinus bradycardia at an average rate of 40bpm with intermittent junctional rhythm. The maternal grandmother was bradycardic for a long period before going into persistent atrial fibrillation at age 41yrs. Maternal genetic testing did not demonstrate any known mutations associated with isomerism.

While familial right atrial isomerism has been reported this is the first known report of familial left atrial isomerism, presenting with marked sinus bradycardia and interrupted IVC with otherwise structurally normal hearts. The progression of disease over time suggests a need for ongoing follow-up for those with bradycardia with an isolated interrupted IVC.

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Heart Rate Reserve in Fontan Patients: Chronotropic Incompetence or Haemodynamic Limitation?

G. Claessen [1,2,*], A. La Gerche [1],
A. Van De Bruaene [2], M. Claeys [2],
R. Willems [2], S. Dymarkowski [2], J. Bogaert [2],
P. Claus [2], W. Budts [2], H. Heidbuchel [2],
M. Gewillig [2]

[1] *Baker Heart And Diabetes Institute, Melbourne, Australia*
[2] *Department of Cardiovascular Sciences, KU Leuven, Leuven, Belgium*

Background: Patients with a Fontan circulation achieve lower peak heart rates (HR) during exercise. Whether this impaired chronotropic response reflects pathology of the sinoatrial node or altered cardiac haemodynamics is uncertain. We evaluated the adequacy of HR acceleration throughout exercise relative to metabolic demand and cardiac output in Fontan patients relative to healthy controls.

Methods: 20 healthy controls and 10 Fontan patients underwent cardiac magnetic resonance imaging with simultaneous invasive pressure recording during supine bicycle exercise to near maximal exertion. Adequacy of cardiac index (CI), stroke volume (SVi) and HR reserve was assessed by determining the exercise-induced increase (Δ) in CI, SVi and HR relative to the increase in oxygen consumption (VO2).

Results: HR reserve was lower in Fontan patients compared to controls (71 ± 21 vs. 92 ± 15 bpm; $P = 0.001$). In contrast, increases in HR relative to workload and VO2 were higher than in controls. The change in CI relative to VO2 was similar between groups, but Fontan patients had increased $\Delta HR/\Delta VO2$ and reduced $\Delta SVi/\Delta VO2$. Fontan patients had a drop in SVi during low-intensity exercise, which resulted in a plateau of CI at a lower peak HR than controls.

Conclusions: In Fontan patients, the chronotropic response is appropriate relative to exercise intensity implying normal sino-atrial function. However, premature reductions in ventricular filling and stroke volume cause an early plateau in cardiac output beyond which further increases in HR would be physiologically implausible. Thus, abnormal cardiac filling rather than sino-atrial node dysfunction explains the diminished HR reserve in Fontan patients.

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Identification and Selection of Cardiomyocytes from Human p α-MHC/GFP Transgenic Embryonic Stem Cell Lines

Z. Wang

Nanjing Medical University, Nanjing, China

Objective: Although embryonic stem (ES) cells (ESCs) may be a promising donor source for the repairing of infarcted or ischaemic heart tissues, their successful application in regenerative medicine has been hampered by difficulties in identifying and selecting cardiomyocytes from the differentiating cells.

Methods: We established transgenic human ES cell lines by transcriptional control of the α-cardiac myosin heavy chain (α-MHC) promoter driving green fluorescent protein (GFP) expression. Traditional embryoid body formation method was used for differentiation. GFP expression was monitored by fluorescent microscope during the period of differentiation from transgenic clone, and the expression of cardiac specific makers was performed by qRT-PCR and immunocytochemistry staining. Flow cytometric cell sorting was used to select the GFP-expressing cells.

Results: GFP expression was detected after the onset of spontaneous contractions, and the troponin T (TNT) was positive in the area of GFP expression. The cardiac restricted transcription factors (Nkx2.5/GATA4) and cardiac specific genes (MLC2a/MLC2v) were found in the GFP-sorted cells. Functionally, the contractile frequency of the ES-derived CMs responded appropriately to the vasoactive drugs isoprenaline and carbachol.

Conclusion: The transgenic human ES cell lines were successfully established, which was of great benefit to identify and selection of differentiated cardiomyocytes.

Keywords: human embryonic stem cells ; cardiomyocytes; transgenic; differentiation

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Is Cardiorespiratory Fitness in Childhood Predictive of Subclinical Cardiovascular Disease in Adulthood: Findings from the Childhood Determinants of Adult Health Study

Q. Huynh[1,*], A. Venn[2], C. Magnussen[2], T. Marwick[1]

[1] *Baker Heart And Diabetes Institute, Melbourne, Australia*
[2] *Menzies Institute for Medical Research, Hobart, Australia*

Background: It is unclear if cardiorespiratory fitness (CRF) in childhood can predict cardiovascular disease in adulthood and whether it can do so independently of adult risk factors.

Methods: This study followed 562 participants from childhood (aged 7–15 years in 1985) to adulthood (aged 36–49 years in 2017–19). Time to finish a 1.6 km run was standardised by age and sex to estimate CRF in childhood. CRF in adulthood was estimated using physical working capacity at a heart rate of 170bpm. Echocardiogram was used to identify abnormal myocardial function and structure in adulthood, including reduced global longitudinal strain (GLS>-18% in 102/562 participants), left ventricular hypertrophy (LVH in 55/562), dilated left atrial (LA volume index>34 in 268/562) and increased LV filling pressure (E/e'>8 in 32/562).

Results: CRF tracks weakly through the life-course ($r = 0.14$, $p < 0.001$). Childhood CRF was negatively associated with abnormal GLS (OR = 0.76 [0.62, 0.92]), and was positively associated with dilated LA (OR = 1.33 [1.12, 1.59]) and LV hypertrophy (OR = 1.39 [1.01, 1.92]) in adulthood. There was no association with increased LV filling pressure. While the associations with abnormal GLS and dilated LA were independent of adult CRF, the association of LV hypertrophy was attenuated and rendered insignificant after adjusting for adult CRF. A simple predictive model including age, sex and childhood CRF could predict abnormal GLS in adulthood with good discrimination (C-statistic = 0.71 [0.66, 0.77]) – which was not significantly different from a predictive model using adult risk factors ($p = 0.53$).

Conclusions: CRF in childhood is an important and independent predictor of subclinical cardiovascular disease in adulthood.

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Left Ventricular Volume is an Important Determinant of Exercise Capacity in Patients with Ebstein's Anomaly

G. Gnanappa*, L. Dryburgh, R. Puranik, J. Ayer

Heart Centre for Children, The Children's Hospital At Westmead, Westmead, Australia

Background: Mechanisms for impaired exercise capacity in Ebstein's anomaly (EA) remain unclear. We performed cardio-pulmonary exercise testing, rest and exercise cardiac magnetic resonance (CMR) to explore associations between disease severity and exercise capacity.

Methods: In 13 un-operated EA patients (median age 13.5 years; M:F = 42:58%) percent predicted VO2 max (%VO2max) was determined. From rest CMR, indexed end diastolic volumes were calculated: right atrium (RA), atrialised RV (aRV), functional RV (fRVEDV), left atrium (LA), left ventricle (LVEDV). Three CMR based severity indices [A:(RA+aRV)/(fRVEDV+LA+LV), B:(RA+aRV+fRVEDV)/(LA+LV), C:(fRVEDV)/(LVEDV)] and tricuspid regurgitation fraction (TRF = fRV stroke volume-PA flow) were calculated. Pulmonary artery (PA) and aortic flow (AO) were measured at rest and peak exercise and cardiac index (CI) calculated.

Results: Univariate associations were found between %VO2max and all measures of disease severity (A:$r = -0.66$, $p = 0.02$; B:$r = -0.67$, $p = 0.02$; C:$r = -0.71$, $p = 0.01$), TRF ($r = -0.62$; $p = 0.03$) and LVEDV ($r = 0.76$, $p = 0.004$) but not with fRVEDV ($r = -0.31$, $p = 0.33$) or age. LVEDV was asso-

ciated with CI at rest ($r = 0.84$, $p = 0.001$) and exercise ($r = 0.83$, $p = 0.001$). fRVEDV and TRF were not associated with rest or peak exercise CI. aRV was associated with CI at peak exercise ($r = -0.57$, $p = 0.05$); RA was associated with CI at rest ($r = -0.58$; $p = 0.05$) and peak exercise ($r = -0.53$; $p = 0.08$). Only severity index C was associated with CI at rest ($r = -0.61$, $p = 0.04$) and peak exercise ($r = -0.57$, $p = 0.05$). LVEDV was the only variable independently associated with %VO2max, rest and peak exercise CI on multivariate analysis.

Conclusions: Our data highlight the importance of maintenance of LV volume on exercise capacity in EA and suggest interactions between the RA, aRV and LV rather than between fRV and LV as seen in other congenital cardiac abnormalities.

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Mental Health of Parents of Children, Adolescents and Adults with a Fontan Circulation: Findings from the Australian and New Zealand Fontan Registry

K. Marshall [1,2,*], Y. d'Udekem [3,4], G. Sholler [1,5], D. Costa [5,6], D. Celermajer [5,7], D. Winlaw [1,5], N. Kasparian [2,8,9]

[1] Heart Centre for Children, The Sydney Children's Hospitals Network, Sydney, Australia
[2] Discipline of Paediatrics, School of Women's and Children's Health, UNSW Medicine, The University of New South Wales, Sydney, Australia
[3] Heart Research Group, Murdoch Children's Research Institute, Melbourne, Australia
[4] Department of Cardiac Surgery, The Royal Children's Hospital, Melbourne, Australia
[5] Sydney Medical School, The University of Sydney, Sydney, Australia
[6] Pain Management Research Institute, Royal North Shore Hospital, Sydney, Australia
[7] Department of Cardiology, Royal Prince Alfred Hospital, Sydney, Australia
[8] Department of Cardiology, Boston Children's Hospital, Boston, United States
[9] Harvard Medical School, Boston, United States

Objective: To examine the prevalence and predictors of anxiety and depression among parents of individuals with a Fontan circulation enrolled in the Australian and New Zealand (ANZ) Fontan Registry.

Methods: Parents of patients enrolled in the ANZ Fontan Registry, aged ≥ 6 years and at least 12 months post-Fontan completion were invited to participate. Participants completed validated measures capturing a range of demographic, environmental and clinical factors.

Results: Ninety-five mothers and 52 fathers were included in this analysis, representing 18% of eligible families. Parents ranged in age from 31–76 years ($M = 47.9$, $SD = 10.1$), 91% were married or in a committed relationship, and 63% were in full- or part-time employment. A substantial subset of fathers (31%) and mothers (18%) reported depressive symptoms indicative of a need for clinical intervention. Anxiety symptoms requiring clinical investigation were reported by 24% of fathers and 19% of mothers. Five percent of parents reported symptoms indicative of posttraumatic stress. While 31% of parents reported receiving emotional support from a health professional, 22% reported difficulties accessing psychological care, due to financial concerns (42%), feeling they should cope on their own (35%), and not knowing who to ask for support (30%).

Conclusion: Parents of people with a Fontan circulation report levels of depression 2.5 times higher than those found in the general community, and levels of anxiety twice as high as other adults. Psychological screening and family-centric mental health care is highly recommended for parents of people with a Fontan circulation.

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Percutaneous Pulmonary Valve Implantation (PPVI) in Australia and New Zealand (ANZ)

C. Lawley [1,2,*], D. Tanous [3], B. Anderson [5], D. Celermajer [8,9], W. Wilson [6], S. Shipton [7], C. O'Donnell [4], P. Roberts [1]

[1] Heart Centre For Children, The Children's Hospital at Westmead, Westmead, Australia
[2] Discipline of Child & Adolescent Health, The Children's Hospital at Westmead Clinical School, Sydney Medical School, Westmead, Australia
[3] Department of Cardiology, Westmead Hospital, Westmead, Australia
[4] Green Lane Paediatric and Congenital Cardiac Service, Starship Children's Hospital, Auckland, New Zealand
[5] Queensland Paediatric Cardiac Service, Queensland Children's Hospital, South Brisbane, Australia
[6] Department of Cardiology, Royal Melbourne Hospital, Parkville, Australia
[7] Children's Cardiac Centre, Perth Children's Hospital, Nedlands, Australia
[8] Department of Cardiology, Royal Prince Alfred Hospital, Camperdown, Australia
[9] Sydney Medical School, The University of Sydney, Camperdown, Australia

Background: The ANZ population undergoing PPVI, including short to medium term outcomes, has not been fully characterised. In particular, there are concerns about infective endocarditis (IE) risk.

Methods: A multi-site retrospective cohort study across seven centres in ANZ. PPVI cases were identified using institutional databases and relevant details collected. Key outcomes evaluated at follow-up included mortality, morbidity (repeat procedure, infective endocarditis) and echocardiographic data.

Results: From June 2009-March 2018, 134 individuals underwent PPVI utilising 123 Medtronic Melody[TM] valves and 11 Edwards SAPIEN valves (median age 18 years, range 9–60 years; median weight 59 kg, range 24–137 kg). Common

underlying diagnoses were tetralogy of Fallot ($n = 44$, 33%) and pulmonary atresia +/- ventricular septal defect ($n = 26$, 19%). The most common previously employed conduit was a homograft ($n = 91$, 67%). Indications for PPVI included conduit stenosis ($n = 75$, 56%), regurgitation ($n = 12$, 9%) or mixed disease ($n = 47$, 35%). Immediate haemodynamic outcome was good; the peak stenotic gradient decreased from mean 40 mmHg to mean 11 mmHg ($p = 0.047$). Risk of severe procedural complication was low. There was one early post procedural death; due to device embolisation within the RVOT. In follow-up (median 21 months, range 0–98 months), there were two further deaths, unrelated to PPVI. Thirteen individuals developed IE (annualised incidence rate 4.6% per patient-year), 9 of these individuals required valve re-replacement. Two further individuals underwent valve replacement without IE.

Conclusions: PPVI as performed in selected ANZ centres provides a relatively safe and feasible method of rehabilitating the RVOT.

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Poorer Self-Reported Physical Health and Higher Anxiety in Young Adults with Previous Coarctation Repair

M. Lee [1,2,3,*], T. Luitingh [1,2], M. Cheung [1,2,3], I. Konstantinov [1,2,3], C. Brizard [1,2,3], G. Lambert [4], Y. d'Udekem [1,2,3]

[1] Murdoch Children's Research Institute, Parkville, Australia
[2] The Royal Children's Hospital, Parkville, Australia
[3] University of Melbourne, Parkville, Australia
[4] Swinburne University of Technology, Hawthorn, Australia

Background: Little is known about the impact of a coarctation repair on the functional outcomes of young adults. This study aimed to determine (1) the functional and mental health status of young adults with previous coarctation repair, and (2) the impact of late hypertension on their quality of life.

Methods: A cross-sectional study using validated self-reported questionnaires (Short Form 36 version 2 [SF-36v2], Beck Depression Inventory [BDI], and State-Trait Anxiety Inventory [STAI]) was performed in 54 patients aged 15–47 years with previous paediatric coarctation repair. Questionnaire scores were compared to healthy age- and gender-matched controls. Patients' previously published 24-hour blood pressure monitoring results were included.

Results: Late hypertension was present in 64% (34/54) at a mean of 29 ± 8 years after coarctation repair. SF-36v2 mean physical component summary score was significantly lower in coarctation patients compared with controls (53.1 ± 6.8 vs. 56.0 ± 4.7, $p = 0.02$), but there was no significant difference in mean mental component summary score ($p = 0.2$). SF-36v2 mean role emotional score tended to be associated with 10 mmHg increases in mean 24-hour systolic blood pressure (regression coefficient 4.3, $p = 0.06$). STAI mean trait anxiety score tended to be higher in coarctation patients compared

with controls (36.6 ± 9.0 vs. 33.5 ± 7.8, $p = 0.06$). There was no significant difference in BDI scores between patients and controls.

Conclusion: Young adults with previous coarctation repair report poorer physical health and higher anxiety compared to healthy controls. Strategies to improve self-reported physical health and anxiety should be explored. Long-term assessment of quality of life outcomes in coarctation patients is warranted.

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Psychological Experiences of Siblings of People with a Fontan Circulation: Insights from the Australian and New Zealand Fontan Registry

K. Marshall [1,2,*], Y. d'Udekem [3,4], G. Sholler [1,5], D. Costa [6,5], D. Celermajer [5,7], D. Winlaw [1,5], N. Kasparian [2,8,9]

[1] Heart Centre for Children, The Sydney Children's Hospitals Network, Sydney, Australia
[2] Discipline of Paediatrics, School of Women's and Children's Health, UNSW Medicine, The University of New South Wales, Sydney, Australia
[3] Heart Research Group, Murdoch Children's Research Institute, Melbourne, Australia
[4] Department of Cardiac Surgery, The Royal Children's Hospital, Melbourne, Australia
[5] Sydney Medical School, The University of Sydney, Sydney, Australia
[6] Pain Management Research Institute, Royal North Shore Hospital, Sydney, Australia
[7] Department of Cardiology, Royal Prince Alfred Hospital, Sydney, Australia
[8] Department of Cardiology, Boston Children's Hospital, Boston, United States
[9] Harvard Medical School, Boston, United States

Objective: To examine the prevalence and predictors of psychological wellbeing among siblings of children, adolescents and adults with a Fontan circulation enrolled in the Australian and New Zealand Fontan Registry.

Methods: Siblings aged ≥ 6 years of patients enrolled in the ANZ Fontan Registry, who were at least 12 months post-Fontan completion were invited to complete a suite of validated psychometric instruments capturing a range of demographic, environmental and clinical factors.

Results: Eighty-two siblings from 63 families of patients enrolled in the ANZ Fontan Registry were included in this analysis. Siblings ranged in age from 6–45 years ($M = 15$, $SD = 8.1$), 52% were brothers, most (74%) were currently enrolled in primary of secondary schooling, 14% were in full- or part-time employment, and 10% had a university degree. Depressive symptoms requiring clinical intervention were reported by 38% of adult siblings, and 20% of child and adolescent siblings. Over one-quarter (29%) of adult siblings, and 16% of child and adolescent siblings, reported symptoms of anxiety warranting clinical assessment. Most participants (82%) reported feeling worried about their sibling's heart con-

dition (18% worried 'almost always'). While most siblings (71%) felt it would be helpful to share their concerns with someone, only 42% had done so.

Conclusion: Siblings of people with a Fontan circulation are an oft forgotten group; however, our findings suggest that siblings are at risk of psychological distress, including anxiety and depression. Family-centred mental health care designed to alleviate sibling distress is essential to support the psychological needs of this group.

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Pulse Oximetry Screening in Western Australia for Detection of Critical Congenital Heart Disease

Z. Vetten [1,*], E. Harris [2], J. Ramsay [1]

[1] Perth Children's Hospital, Nedlands, Australia
[2] Women's and Newborn Health Service, Subiaco, Australia

Background & aim: Critical congenital heart disease (CCHD) is a leading cause of infant death. Early identification of CCHD may improve outcomes and pulse oximetry screening (POxS) of neonates has been introduced to enhance detection. In July 2012, the neonatal service at the tertiary maternity hospital in Western Australia (WA) published a POxS guideline for CCHD screening of neonates. This audit aimed to assess the POxS practices in all WA maternity units and determine its effect on CCHD diagnosis.

Research method: A survey of all maternity units within WA was conducted in April 2018. The midwifery managers were asked whether POxS is routinely performed in their unit and how it is undertaken. Infants diagnosed with CCHD in WA from July 2012-December 2017 were then reviewed to determine the proportion identified on POxS. Patient information was obtained from the WA tertiary children's hospital cardiology patient and echocardiography databases.

Results: Of the 33 maternity units in WA, 32 routinely conduct POxS. The majority (18/32) of units perform a single post-ductal saturation measurement on all neonates prior to discharge with medical review sought for abnormal POxS results. During the study period, 164 neonates were diagnosed with CCHD. Of these, five (3%) asymptomatic neonates were identified by POxS. Fifteen (9.1%) neonates were discharged home prior to diagnosis with CCHD, with 10 (6.1%) of these presenting in shock.

Conclusion: POxS is routinely performed throughout WA to enhance CCHD detection. Since July 2012, CCHD has been detected in five asymptomatic neonates by POxS prior to hospital discharge. Greater detection may be achieved with implementation of a state-wide POxS guideline.

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Reduction in Interstage Mortality with Implementation of a Standardised Monitoring Group – a Single Centre Experience

N. Lwin *, K. Finucane, J. Stirling, MacJ. Cormick, J. Wright, J. Artrip, N. Anderson, D. Buckley, T. Gentles

Paediatric Congenital Cardiac Service, Starship Children's Hospital, Auckland, New Zealand

The Single Ventricle Group (SVG) was developed to provide a standardised approach to monitoring infants with single ventricle and shunt dependent physiology who had undergone Stage 1 palliation with either a Norwood or an aortopulmonary shunt prior to their Stage 2 procedure. The SVG was introduced in January 2017 with the aim of reducing Stage 1 and interstage mortality at our centre.

We conducted a retrospective review over a 6 year period of patients who had undergone single ventricle palliation from January 2013 to March 2019. Our primary endpoint was mortality. There were a total of 95 patients; 63 patients were pre-SVG group (35% Norwood) and 32 patients were managed as part of the SVG (63% Norwood). In the pre-SVG group, there were 14 interstage deaths (22%) compared to 0 deaths in the SVG group ($p = 0.004$) acknowledging that 6 patients in the SVG are currently interstage and awaiting Stage 2 palliation. Of the 14 pre-SVG deaths, 7 (64%) were Norwood and 10 (71%) occurred in hospital.

In this institution, the implementation of a multidisciplinary group with a standardised approach to managing and monitoring high risk infants through Stage 1 to Stage 2 palliation coincided with a significant reduction in mortality. The cause of this is likely multifactorial, however we hypothesise that this is largely a result of standardising the management for these children to a specialised single group.

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Indigenous (511–521)

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A Retrospective Analysis Investigating the Incidence of Major cardiac Adverse Events (MACE) in Indigenous Patients who Received Percutaneous Coronary Intervention (PCI) and Coronary Artery Bypass Graft (CABG) Surgery

D. Nour [1,*], S. Kang [2], V. Vangaveti [1], P. Saxena [2]

[1] James Cook University, Townsville, Australia
[2] The Townsville Hospital, Townsville, Australia

Aims: Cardiac intervention for the treatment of coronary disease has improved mortality and morbidity. Despite the incidence of coronary disease in the Australian-Indigenous population, outcomes of cardiac intervention is seldom reported. We aimed to determine the incidence of MACE in

the indigenous population over 10 years post cardiac intervention.

Methods & Results: We collected data from all PCI and CABG cases performed on Indigenous patients between January-2006 and December-2007 at The Townsville Hospital. Procedural and clinical data was collected and MACE outcomes were assessed at 30 days, 1, 5 and 10 years. MACE outcomes were defined as; sudden cardiac death, acute-MI, re-stenosis requiring revascularisation and stroke. The mean age of patients was 52.7, with 59% being males. 59 (46%) presented due to unstable angina, whilst 28 (22%) presented with NSTEMI and 42 (33%) with STEMI. 89.1% of the patients had a history of hypertension; 85.3% hypercholesterolaemia; 53.5% diabetes mellitus; 19.4% renal disease; 1.6% a previous stroke; 72.9% a smoking history and 40.3% had relevant family history. A total of 66 patients underwent PCI and 63 underwent CABG. Of patients whom underwent PCI, 1 (1.5%) had a MACE event at 30 days, 4(6.1%) at 1 year, 19 (28.7%) at 5 years and 32 (48.5) at 10 years. Of patients whom underwent CABG, 1 (1.6%) had a MACE event at 30 days, 5 (7.9%) at 1 year, 8 (12.7%) at 5 years and 32 (34.9%) at 10 years.

Conclusion: The indigenous population has a unique subset of comorbid conditions which predisposes them to cardiovascular disease and a subsequently high incidence of MACE events 10 years post intervention.

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Access to Care for Acute Coronary Syndrome in the Top End

J. Marangou [1,2,3,*], N. McMurdock [2],
E. Wing-Lun [2,3], M. Ilton [2,3]

[1] *Fiona Stanley Hospital, Perth, Australia*
[2] *Royal Darwin Hospital, Darwin, Australia*
[3] *NT Cardiac, Darwin, Australia*

Background: The morbidity and mortality due to acute coronary syndrome (ACS) in Australia is substantial. People living in rural and remote Australia and Indigenous Australians have poorer access to guideline recommended ACS treatment.

Aim: To assess treatment practices of ACS patients in the Top End of the Northern Territory.

Method: A retrospective review of all ACS first episodes over a six-month period at a single tertiary hospital was performed. Patient demographics, presentation and treatment data were collected.

Results: There were 92 patients of whom 39 (42.3%) were indigenous. Indigenous patients were significantly younger (48 vs 62 years p-value < 0.01). ST elevation myocardial infarction occurred in 17 (43.5%) indigenous and 18 (34%) non-indigenous patients (NS). Prescription of dual antiplatelet, statin and beta-blocker therapy were similar between both groups (95% vs 92%, 100% vs 90.5%, 69% vs 69%). Angiography was performed for the majority (37 (95%) vs 52 (98%)). 28 indigenous and 43 non-indigenous patients undergoing angiography had at least one significant coronary artery stenosis identified. Of these, 20 (71%) indigenous and 32 (74%) non-indigenous patients underwent

percutaneous intervention. 3 (10.7%) indigenous and 4 (9.3%) non-indigenous patients were referred for coronary artery bypass graft surgery.

Conclusion: Rates of medical therapy, angiography and coronary intervention were similar for indigenous and non-indigenous patients living in the Top End. Unfortunately, indigenous patients are significantly younger when first presenting with ACS. Investment in primary prevention of coronary artery disease as well as access to ACS treatment is imperative for this group of patients.

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Application of the WHF Criteria for Echo Diagnosis of RHD: A Sonographer's Perspective from the SACHRD Study

J. Williamson [1,*], A. Zanker [1],
R. Roberts-Thomson [1], M. Cursaro [1],
S. Noonan [1], G. Wheaton [2], A. Brown [1]

[1] *Wardliparingga, SAHMRI, Adelaide, Australia*
[2] *Women's and Children's Hospital, Adelaide, Australia*

Introduction: Screening for rheumatic heart disease (RHD) using echo has improved detection rates amongst indigenous children. The SACRHD study conducted in 2016 recruited seven cardiac sonographers to perform echo screening in schools across metropolitan, regional and remote locations in South Australia.

Method: The cases referred to a Cardiologist for review by the sonographers were recorded. Cases of known RHD or congenital heart disease (CHD) were excluded. 180 (10%) or non-referred cases were also reported. At the conclusion of the study, sonographers were surveyed about the ease of application of the WHF echo criteria and to highlight any challenges encountered.

Results: 6/7 (85.7%) of sonographers reported they were "confident" or "very confident" identifying normal and definite RHD cases, while only 4/7 (57.1%) were confident identifying borderline cases. No sonographers felt "very confident" identifying excessive mitral valve leaflet tip motion, chordal thickening, or thickening of the aortic valve. The Cardiologist was in agreeance with sonographer identification in 13/47 (27.7%) of RHD cases and 15/21 (71.4%) of CHD cases.

Conclusion: Sonographers participating in the SACRHD study correctly identified borderline or definite RHD in 27.7% of cases they referred. No non-referred scan was found to have any abnormality demonstrating a very high negative predictive value for sonographer screening. Borderline cases were perceived to be most challenging to classify with sonographers feeling least confident identifying with excessive mitral valve leaflet tip motion, chordal thickening, and thickening of the aortic valve.

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Atrial Fibrillation and Indigenous Australians: A Way Forward for Timely and Effective Screening and Treatment

K. Gwynne[1], J. Gwynn[1,*], H. Finlayson[4],
S. Hamilton[2], M. Lawrence[3], R. MacNiven[1],
L. Neubeck[5], B. Rambaldini[1],
R. Rodrigues[1], K. Taylor[3], S. Thompson[2],
B. Freedman[1]

[1] University of Sydney, Camperdown, Australia
[2] University of Western Australia, Perth, Australia
[3] Flinders University, Adelaide, Australia
[4] Western NSW LHD, Brewarrina, Australia
[5] Edinburgh Napier University, Sighthill, Scotland

Background: The leading cause of death for Indigenous Australians is cardiovascular disease, including stroke. Atrial Fibrillation (AF) increases stroke risk 5–7 fold. Early detection and treatment of AF in Caucasians has proven feasible.

Aim: To estimate AF prevalence in community settings and examine feasibility of using a handheld single-lead ECG device (iECG) for Indigenous Australians.

Methods: This study was developed using co-design principles to recruit and train health workers in 16 communities to use an iECG, obtain informed consent and screen ~50 indigenous patients. Participants with 'possible AF' or 'unclassified' result were referred for assessment and treatment. Subsequently, semi-structured interviews were conducted with the health staff involved in the study. Quantitative data were analysed using descriptive statistics and qualitative data were analysed thematically.

Results: 619 indigenous people aged ≥45 years were screened for AF, largely by indigenous health workers. Estimated AF prevalence was 4.7%. Most (19/29) people with AF were >74 years, though this age group comprised only 8.7% of the sample due to high premature cardiovascular mortality amongst indigenous people. Of 4 with AF detected by screening, 3 were aged 55–64. Analysis of 18 interviews found high confidence in providing iECG screening, managing the referral pathway and belief that the process was beneficial for patients.

Conclusions: Our estimated prevalence of AF aligns with post-hospitalisation data for Indigenous Australians. New AF occurred at a relatively young age. Screening for AF in primary healthcare would improve opportunities to identify, treat, and reduce adverse consequences and improve cardiovascular health of indigenous people.

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This abstract has been withdrawn

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Five-Year Outcome Data from the Budyari Cardiology Outreach Program

D. Nayyar[1,2,*], G. Kumarasinghe[1],
S. Irwin[1], L. Sharma[1],
U. Premawardhana[1,2], R. Rajaratnam[1],
K. Kadappu[1,2]

[1] Liverpool Hospital, Liverpool, Australia
[2] Campbelltown Hospital, Campbelltown, Australia

Introduction: The Budyari Cardiology Outreach Program in Miller, Sydney was commenced in August 2014 to provide specialist Cardiology services for Aboriginal patients due to non-attendance rates of 40–50% in hospital outpatient clinics. The clinic comprises a Cardiologist, Cardiology AT, two registered nurses and an Aboriginal Health Education Officer.

Methods: A retrospective cohort study of patient demographics, attendance rates and investigations was performed.

Results: From August 2014 to December 2018, 99 patients attended. There were 323 appointments over 44 clinics, with 80.5% attendance rate. 40/99 patients were male with mean age 57.0 (range 16.8–85.5). Mean follow up was 11.5 months (range 0–3.9 years) and mean number of appointments per patient was 3 (range 1–9). Initial mean blood pressure was $129 \pm 18/76 \pm 10$mmHg and BMI 33.7 ± 10.0kg/m^2, which reduced by $6 \pm 16/3 \pm 12$mmHg and 0.3 ± 2.0kg/m^2. 21/99 patients were lost to follow-up and 5/99 died. Referrals were from GPs in 92/99 patients. Most common indications included investigation of chest pain (33%), dyspnoea (17%), palpitations (11%) and risk factor modification (10%). There were a high number of abnormal results including 39/99 abnormal ECGs, 1/23 ESTs, 29/70 echocardiograms, 4/20 Sestamibis, 1/4 CTCAs, 1/8 stress echocardiograms, 4/13 Holter monitors and 9/11 coronary angiograms. Three patients were referred for a pacemaker. Medication changes were made in 61/99 patients and 36/99 were referred to other specialist or allied health services. Only 1/46 current smokers ceased smoking.

Conclusions: The program provides convenient and culturally appropriate specialist Cardiology care, resulting in high attendance rates. Future goals include successful intervention for smoking cessation and weight loss.

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Prevalence of Atrial Fibrillation in Remote Indigenous and non-Indigenous Populations: A Ten-Year Study in Central Australia

N. Clarke [1,*], N. Kangaharan [2],
C. Gallagher [1], B. Pitman [1], R. Mahajan [1],
D. Lau [1], P. Sanders [1], C. Wong [1]

[1] *Centre For Heart Rhythm Disorders,
University Of Adelaide And Royal Adelaide
Hospital, Adelaide, Australia*
[2] *Department of Cardiology, Alice Springs and
Royal Darwin Hospitals, Darwin, Australia*

Background: Although limited data from mainly urban settings exists on the prevalence of atrial fibrillation (AF) among Indigenous Australians, it is not clear if there is a similar prevalence in rural and remote populations.

Methods: Consecutive patients with a diagnosis of AF admitted to Alice Springs Hospital (ASH), the only secondary hospital and provider of specialist cardiac care in the region, were identified over a 10-year period from 2006–2016. Age and gender-standardised prevalence rates, in addition to rate-ratios, for Indigenous and non-Indigenous patients were estimated for AF using Census population data.

Results: Of 57,056 total patients over the study period, 1,210 (46% Indigenous) had a diagnosis of AF. Indigenous patients with AF were younger (mean age 56.6 ± 1.23 years versus 66.1 ± 1.08 years). The Indigenous and non-Indigenous age-standardised AF prevalence rates for males <45 years was 105.5 and 50.3 per 10,000 respectively (ratio = 2.10 [95%CI 1.45–3.04]) and for females < 45 years was 97.9 and 12.4 per 10,000 (ratio = 7.92 [95%CI 4.10–15.32]). In contrast, the Indigenous and non-Indigenous AF prevalence for males >65 years was 1,577 and 2,326 per 10,000 respectively (ratio = 0.68 [0.51–0.90]) and for females >65 was 1,713 and 1,897 per 10,000 respectively (ratio = 0.90 [95% CI 0.71–1.15]).

Conclusions: The prevalence of AF in remote Central Australia is significantly higher in younger Indigenous individuals, and particularly females, supporting trends seen in the urban setting. These data raise the possibility that AF may be in part contributing to the gap in morbidity and mortality experienced by Indigenous Australians in rural and remote settings.

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Surgical & Interventional Management of Rheumatic Valvular Heart Disease at The Prince Charles Hospital from January 2005–December 2017

S. Hlaing [1,2,*], S. Goh [1,2], S. Smith [1],
G. Scalia [1,2], P. Pohlner [1,2]

[1] *The Prince Charles Hospital, Chermside,
Australia*
[2] *The Univesity of Queensland, Brisbane,
Australia*

Background: The incidence of rheumatic heart disease (RHD) in the indigenous Australian population is the highest in the world. 240 indigenous patients underwent any valve related surgical and interventional procedures at Metro North HHS from January 2005-December 2017. Of these 75 were performed for rheumatic valves at TPCH.

Methods: Chart review and electronic database procedural data was analysed, with clinical follow up records, including echocardiography, being collated to identify survival and cardiac status following these interventions.

Results: Rheumatic interventions were required over an age range of 10–72 years dominantly female 82%. Percutaneous mitral balloon valvuloplasty was performed in 15 patients, transcatheter aortic valve implantation in 1 patient. Surgical valve repair of 11 isolated mitral valves was achieved. Single valve replacement was done in 10 with multiple valve repair/replacements required in the remaining 38 patients. Mechanical and tissue valves were used almost equally during replacement. Valve failure due to mitral valve thrombus formation, aortic prosthetic patient mismatch, and endocarditis required 8 reoperations. One reoperation following mitral valve repair has been required to date. Pre and post procedure LVEF mean of 56% (range 33–80%) and 57% (range 28–75%) respectively. 30-days hospital survival was 100%, 5 year was 88% and 12 year was 84%. Valve function on follow up with clinical and echo data remains satisfactory.

Conclusions: Mitral valve function is durable following valvuloplasty or surgical repair in RHD. Risk to survival during all forms of intervention is low. The type of systemic heart valve utilised for replacement requires close consideration of patient geography, medical access and patient compliance.

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This abstract has been withdrawn

The Temporospatial Epidemiology of Rheumatic Heart Disease in Far North Queensland (1997–2017)

K. Kang [1,2,*], J. Hanson [1,2], K. Chau [1,2]

[1] *Cairns Hospital, Cairns, Australia*
[2] *The Kirby Institute, UNSW, Sydney, Australia*

Background: Rheumatic heart disease (RHD) is still being diagnosed in Australia. It is essential to define the temporospatial epidemiology of the disease to inform strategies for its prevention.

Methods: Individuals diagnosed with RHD in Far North Queensland (FNQ) between 1997 and 2017, were identified using the RHD register and public health system data.

Results: There were 686 individuals diagnosed with RHD during the study period. Their median age at diagnosis was 29 (Interquartile range (IQR) 17–44) years; 458 (66.8%) were female; 616 (89.8%) identified as Indigenous Australians.

The incidence of RHD increased in FNQ from 4.7/100000/year in 1997 to 49.4/100000/year in 2017 ($p < 0.001$). RHD incidence increased in both metropolitan and rural and remote locations, but it was significant higher in rural and remote locations (median (IQR) 44.6/100000/year (20.3–90.7) versus 5.9/100000/year (1.3–10.4), $p < 0.001$).

There were 388 individuals with RHD receiving secondary prophylaxis (367 (94.6%) parenteral penicillin and 21 (5.4%) oral therapy). The median (IQR) adherence to parenteral secondary prophylaxis was only 41% (23–58%). The number of separate patients requiring valve surgery increased from 52 (41.9%) patients between 1997–2007 to 72 (58.1%) between 2008–2017 ($p = 0.03$).

Conclusion: The incidence of RHD and incidence of RHD-related surgery continues to rise in FNQ. Although this is likely to be partly explained by increased disease recognition and enhanced service delivery, the incidence of the disease remains unacceptably high and is disproportionately borne by the Indigenous population. Optimisation of primary and secondary prophylaxis is urgently required to reduce the burden of this preventable disease.

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Valvular Interventions in Rheumatic Heart Disease in Rural and Remote Indigenous Communities: An Update of Indigenous Cardiac Outreach Program Cohort

H. Forotan [3,4,*], M. Abdul Halim [1,2,3,4,*], A. Goodman [2], H. Beilby [2]

[1] *The Prince Charles Hospital, Chermside, Australia*
[2] *The Indigenous Cardiac Outreach Program, Chermside, Australia*
[3] *Queensland Health, Australia*
[4] *University of Queensland, Australia*

Background: Rheumatic Heart Disease (RHD) is highly prevalent in remote and rural Indigenous communities with a significant rate of valvular intervention. Contemporary data regarding valvular interventions is lacking.

Design: A retrospective review of medical records and echocardiography from multiple sources from 2007 to 2018.

Results: Out of 3005 patients, 152 patients were identified to have rheumatic heart disease. Mean age 38 (range 12 to 85) years. Median follow up period was 64.5 (range 6–153) months. All of them are of Indigenous background. Left sided valvular disease were the most common pathology (69%, $n = 107$) with isolated mitral regurgitation being the most common (32%, $n = 50$). Multi-valvular disease occurred in 41% ($n = 63$) with 16% ($n = 24$) had at least three valvular disease. Nearly one third (29%, $n = 45$) had valvular intervention. In the intervention cohort, mean age was 42 (range 16–76) with a female predominance (78%, $n = 35$). There were 90 valvular interventions with the most common valvular intervention was mechanical mitral valve replacement (34%, $n = 31$), in which all of them were prescribed vitamin K antagonist. Re-intervention occurred in 5 patients (3%). Most common complications in the intervention group were heart failure, 33% ($n = 15$), and atrial fibrillation, 8 ($n = 18$).

Conclusion: RHD remains a significant burden of disease in rural and remote Indigenous especially in the young and female population. There is a high rate of valvular interventions, which poses challenging implications regarding ongoing follow-ups and management of related morbidities.

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Rehabilitation and Prevention (522–567)

A Comparison of Victorian Regions at Different Risk Levels of Acute Myocardial Infarction - How are They Different?

J. Bray [1,2,3,*], R. Beauchamp [4], R. Clark [5], Z. Nehme [1,6], A. Nguyen [1], S. Cartledge [1,7], P. Cameron [1,2], D. Stub [1,2,6], J. Finn [1,3]

[1] *Monash University, Melbourne, Australia*
[2] *Alfred Hospital, Melbourne, Australia*
[3] *Curtin University, Perth, Australia*
[4] *Heart Foundation, Melbourne, Australia*
[5] *Flinders University, Melbourne, Australia*
[6] *Ambulance Victoria, Melbourne, Australia*
[7] *Deakin University, Melbourne, Australia*

Background: The National Heart Foundation's (NHF) Heart Maps allow for the identification of Local Government Areas (LGAs) at highest-risk of acute myocardial infarction (AMI). In this study we compared the underlying population's characteristics, knowledge, mortality and ambulance use of LGAs at highest and lowest risk of AMI.

Methods: We obtained the names of the LGAs with the highest ($n = 16$) and lowest ($n = 16$) age-standardised rates of AMI from the NHF Heart Maps Website. We compared data for each of these LGAs obtained from the: Australian Bureau of Statistics Census (2016); NHF Heart Maps; NHF Heart Watch Surveys; Victorian Department of Health and Human Services (DHHS) Victorian Population Health Sur-

vey (2016); and the DHHS Victorian Emergency Minimum Dataset (VEMD).

Results: High-risk regions were significantly ($p < 0.05$) more likely to have: lower population densities, different demographics (e.g. more Australian-born), lower socio-economic status and higher self-reported risk factors (e.g. hypertension). There was no difference in knowledge of AMI signs and symptoms between high- and low-risk regions; however, high-risk regions were less likely to identify poor diet (50% vs 56%) as a risk-factor, and quitting smoking to lower risk (19% vs. 23%). High-risk regions had higher rates of age-standardised coronary heart disease mortality (80 vs. 65 per 100,000, $p < 0.001$), and lower rates of ambulance use for AMI (adjusted OR = 0.87, 95%CI: 0.81–0.94).

Conclusion: Education targeting regions at highest-risk of AMI may provide a logical and practical opportunity to reduce cardiovascular mortality and morbidity. Tailoring this education to knowledge deficits and underlying characteristics may assist in reaching these populations.

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An Audit Of Glucose Lowering Therapies in Patients With Type 2 Diabetes and Hospitalisation for Heart Failure

D. Gayed [1,*], M. Azraai [1,2], B. Liu [1],
C. McMaster [1], R. O'Donavan [1,3], S. Patel [2],
D. Liew [1], L. Burrell [1,2]

[1] *Austin Health, Heidelberg, Australia*
[2] *University of Melbourne, Melbourne, Australia*
[3] *Royal Melbourne Hospital, Melbourne, Australia*

Background: The CSANZ Heart Failure (HF) guidelines state that sodium-glucose co-transporter-2 inhibitors (SGLT2i) are preferred second line agents in patients with type 2 diabetes mellitus (T2DM) and cardiovascular (CV) disease to reduce CV events and HF hospitalisation.

Aim: To review glucose lowering therapies in patients with T2DM who had been hospitalised with HF at Austin Health, and the percentage of patients who may be eligible for SGLT2i therapy.

Methods: A retrospective analysis of glucose lowering therapies in patients with a discharge diagnosis of HF and T2DM from 1/1/2016 to 31/12/2018. Eligibility for SGLT2i therapy was based on insufficient glycaemic control (HbA1c $\geq$7%), eGFR $\geq$30 mL/min/1.73 m^2 and age $\geq$84 years.

Results: We identified 1182 patients with T2DM who had a discharge diagnosis of HF, and a reported HbA1c within six months before discharge. After exclusion of patients based on age, eGFR and/or HbA1c, 318 (27%) patients were potentially eligible for SGLT2i therapy. Of these, 36 were on SGLT2i therapy leaving 282/318 (89%) which where not. They had a mean ($\pm$SD) age of 70 ± 10 years and HbA1c of 8.6 ± 1.8%. Medication for HF included diuretics (94%), ACEi/ARB (58%), beta-blockers (72%). Patients were on a median of 2 glucose lowering agents including metformin (61%), sulfonylureas (35%), gliptins (23%), GLP-1 analogues (4%), insulin (71%).

Conclusion: As many as 89% of eligible patients with T2DM and HF seen in real world clinical practice are not on SGLT2i therapy. We suggest that increasing familiarity and utilisation of SGLT2i may improve cardiovascular outcomes in this high-risk population.

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Availability of Automated External Defibrillators in Hamilton City

P. O'Callaghan [1], J. Swampillai [1,2],
M. Stiles [1,2,*]

[1] *Waikato District Health Board, Hamilton, New Zealand*
[2] *University of Auckland, Auckland, New Zealand*

Background: Last year there were 2,000 Out of Hospital Cardiac Arrests (OHCA) in NZ, 74% received CPR but only 5.1% accessed an Automated External Defibrillator (AED). The average survival rate of OHCA is 13%. The aim of this study was to visit all 50 AED locations shown on www.hamiltoncentral.co.nz to assess their true availability and visibility to the public in the event of an OHCA.

Method: All premises were visited and the first staff member encountered was asked if they were aware an AED was on site, its location, hours of availability, if restricted access applied and whether it had been used.

Results: Of the 50 locations, 3 sites no longer exist and 2 AEDs were listed twice. Therefore, only 45 AEDs exist. Two sites had grossly inaccurate locations. Three AEDs (6.6%) were continuously available. Nine AEDs were accessible after 6pm at least one day of the week. Thirteen AEDs were available on weekends; however, 5 required swipe card access. None of the AEDs were located outdoors.

Conclusion: Far fewer than 50 listed AEDs are freely available to the public, especially after 6pm. Most are privately funded and intended for staff use within their location. There are no outdoor AEDs for public use. Many AEDs are located within office blocks which required elevator use or swipe card access. Lack of signposting of AEDs would lead to delayed defibrillation. This important health issue needs addressing.

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Cardiac Rehabilitation in Victoria: Developing an Evidence-Based, Standardised Program Using a Modified-Delphi Process

S. Cartledge [1,2,3,4]

[1] *Institute for Physical Activity and Nutrition, Deakin University, Burwood, Australia*
[2] *Melbourne School of Population and Global Health, University of Melbourne, Melbourne, Australia*
[3] *National Heart Foundation of Australia (Queensland Division), Brisbane, Australia*
[4] *National Heart Foundation of Australia (Victorian Division), Melbourne, Australia*

Background: Currently in Australia, cardiac rehabilitation (CR) programs are not standardised, which has resulted in considerable variation in the delivery of content. This project aimed to develop a core standardised program outline for Phase II CR programs in Victoria.

Methods: Using the RAND/UCLA Appropriateness Method, a two-phase process was undertaken to develop and validate core content of a standardised CR program. Phase one consisted of a literature review of national and international CR guidelines/core components to determine core features and content recommended internationally to be delivered in CR programmes. The level of evidence underpinning each recommendation was then assessed. Phase two involved an invited national multidisciplinary expert advisory group (EAG) who rated the 'necessity' of the identified core content (scale 1–9) via a modified-Delphi process.

Results: The literature review identified ten content areas within four categories of education; CR foundations, developing heart health knowledge, psychosocial health and life beyond CR. From here, 45 best practice statements were identified. At the conclusion of the modified-Delphi process with the EAG ($n = 12$), 24 statements were rated as essential (median score ≥ 8), 23 as desirable (median score ≤ 8) and one statement was omitted (median score 5.5).

Conclusions/Implications: We have developed a well-defined, evidence-based, expert consensus driven, standardised program outline for Victorian CR which highlights the essential areas all programs need to provide at a minimum. This program outline will provide an essential resource for CR program coordinators and staff, irrespective of the mode of program delivery.

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Cardiac Rehabilitation Participation Rates in Patients with Acute Coronary Syndrome

B. Robinson [1,*], J. Layland [2,3], R. Sriamareswaran [2]

[1] *Department of Nursing, Peninsula Health, Frankston, Australia*
[2] *Department of Medicine, Peninsula Health, Frankston, Australia*
[3] *Monash University, Melbourne, Australia*

Acute coronary syndromes (ACS) are a major public health issue. In this patient population, cardiac rehabilitation, a six to ten-week program supported by a multidisciplinary team, has been shown to reduce morbidity and mortality. Despite these benefits, the use of cardiac rehabilitation remains poor with only 30% of patients attending. We aimed to quantify the rate of referral to cardiac rehabilitation in patients who have had an ACS event at one Victorian tertiary hospital and assess barriers to attendance.

A retrospective study was conducted on patients admitted under the Cardiology unit, who were diagnosed using ICD-10 coding with ACS from August 2017 to July 2018. We investigated all factors that may act as a barrier to course participation. This was done using hospital records and patient follow up by phone.

Of the 420 patients who met the inclusion criteria only 33 (18%) patients completed cardiac rehabilitation. Reasons for non-attendance at our institutions cardiac rehab included poor timing, lack of interest, no referral or geographic issues. Of the patients referred to cardiac rehabilitation only six (18%) patients completed cardiac rehabilitation, with the average attendance being 3.1 sessions out of 8. 22 patients declined to participate after initial assessment. Reasons for non-completion included lack of interest and geographical reasons.

Despite clear prognostic benefit, cardiac rehabilitation participation remains poor. Further studies into the barriers for participation in cardiac rehabilitation may aid in developing interventions to improve attendance.

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Cardiovascular Screening of Elite Athletes by Sporting Organisations in Australia: A Survey of Chief Medical Officers

J. Orchard [1,2,*], J. Orchard [2], B. Toresdahl [3], I. Asif [4], D. Hughes [5], A. La Gerche [6], C. Semsarian [7]

[1] HRI/Charles Perkins Centre, University of Sydney, Australia
[2] Faculty of Medicine and Health, University of Sydney, Australia
[3] Hospital for Special Surgery, New York, USA
[4] University of Alabama Birmingham, Birmingham, USA
[5] Australian Institute of Sport, Canberra, Australia
[6] Baker Heart and Diabetes Institute, Melbourne, Australia
[7] Royal Prince Alfred Hospital, Centenary Institute, University of Sydney, Australia

Background: Numerous bodies recommend cardiovascular screening of elite athletes with history and physical examination (H&P) and resting 12-lead electrocardiogram (ECG). Many sports now screen, although uniformity of screening policies in Australia has not been previously documented.

Aim: document/compare cardiovascular screening policies of Australian elite sporting organisations.

Methods: Chief medical officers (CMOs) of sports were invited to complete an online survey about cardiovascular screening. Sports included rugby union and league, cricket, tennis, Australian football and cycling.

Results: CMOs for 21/31 (68%) sports responded, representing >5000 athletes. Of these, 18/21 (86%) perform regular screening. Of the 18 sports performing screening, all included H&P; 89% included ECG. 33% of the CMOs stated they utilised the most recently developed athlete ECG interpretation criteria. No sports included echocardiogram or stress test as standard. Screening was mandatory with enforcement (28%), mandatory without enforcement (50%) and opt-out (22%). 72% screened junior and adult athletes. There was not a strong correlation between the cardiac risk of a sport and whether screening was mandatory. 14/15 sports with a sports physician as CMO screened athletes.

Conclusions: The majority of responding sports have a screening policy, with reasonable uniformity of methods, almost all including ECG. Promoting the latest ECG interpretation criteria may reduce false positives and cost. CMO specialty appeared to influence whether a sport undertook screening. Other relevant factors: ability of the sport to afford screening; whether a cardiac arrest could cause risk to others; and whether resuscitation was impractical. Future work should explore infrastructure needed for screening, cost and long-term follow-up.

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Cognitive Impairment and Outcomes in Patients Aged >85 Years with Non-ST-Elevation Myocardial Infarction (NSTEMI)

G. Meehan [*], A. Koshy, P. Kunniardy, A. Murphy, D. Gayed, J. Ramchand, D. Clark, O. Farouque, M. Yudi

Austin Health, Heidelberg, Australia

Introduction: Cognitive impairment (CI) and myocardial infarction are prevalent in the elderly. However, evidence is limited surrounding the association of CI, acute management and long-term outcomes in very elderly patients presenting with NSTEMI.

Methods: A retrospective analysis of 956 consecutive patients aged >85 years presenting with NSTEMI between 2010–2018 was undertaken. Patients were stratified by the presence or absence of CI, including mild CI and dementia. The primary outcome was mortality as determined by review of medical records.

Results: Of the 956 patients included, 237 (24.8%) had CI; 89 (9.3%) with mild CI and 148 (15.5%) with dementia. Those with CI had less comorbidity with lower rates of diabetes and hypertension ($p < 0.01$) but were less likely to undergo coronary angiography (2.0 vs 12.2%, $p < 0.001$) and receive guideline directed medical therapy ($p < 0.01$). Those with CI had higher in-hospital mortality (23.8 vs 15.2%, $p = 0.002$). CI was associated with poor survival on univariate analyses (HR 1.3, 95%CI 1.1–1.6, $p = 0.002$). However, on Cox proportional hazard modelling, after adjusting for age, gender and cardiac risk factors, CI was not an independent predictor of mortality.

Conclusion: Elderly patients with CI receive lower rates of invasive management and have a high risk of in-hospital mortality. Despite this, CI is not independently associated with long-term mortality. These findings suggest we need to carefully assess cognitive impairment, as particularly those with mild CI may well benefit from optimal medical therapy and invasive management of NSTEMI.

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Creating National Benchmarks for Cardiac Rehabilitation Quality – New South Wales, Australian Capital Territory and Tasmania Snapshot

R. Gallagher [1,*], C. Ferry [2], D. Candelaria [1], L. Ladak [4], R. Zecchin [3]

[1] *University Of Sydney, Sydney, Australia*
[2] *National Heart Foundation of Australia, Australia*
[3] *Western Sydney Local Health District, Australia*
[4] *Aga Khan University, Pakistan*

Background: Cardiac rehabilitation (CR) is recommended to promote recovery and secondary prevention following cardiac events, yet the quality of delivery in Australia has not yet been adequately assessed.

Purpose: To conduct a snapshot of CR as a basis for creating a minimal set of national benchmarks for quality.

Methods: CR sites volunteers were selected to represent metropolitan, rural and regional areas across New South Wales (NSW) ($n = 36$), Tasmania ($n = 2$) and Australian Capital Territory (ACT) ($n = 1$) and provided data on 11 quality indicators (based on pilot) for delivery and outcomes.

Results: Sites delivered centre-based (97%), home-based (44%), education only (44%), telehealth/phone coaching (17.9%) and group (2.5%) programs. Participants ($n = 2436$) mean age was 66.3 ± 12.5 years, 68.5% were male and 17.1% were culturally and linguistically diverse. Most common diagnoses were ACS (45.8%), cardiac surgery (23.4%) and elective PCI (10%).

CR Delivery. Median waiting time was 15days (IQR 9–25), 59% completed, 75% were referred to GP/specialist and 37% to CR follow-up. Participants had entry and discharge assessment for adiposity (62%, 45%), exercise capacity (59%, 42%), guideline medications (97%, 61%) and entry only for depression (89%) and smoking (97%). Of those screened positive for depression and smoking referral discussion occurred for 77% and 78%.

CR Outcomes. Improvements occurred in waist circumference of 1.16cms (95%CI −1.44, −0.89) and exercise of 69.17meters in 6MWT (95% CI, 64.77, 73.61) and 3.06 in metabolic equivalents (95% CI 2.82, 3.36).

Conclusions: This cross-state CR quality snapshot provides a basis for developing benchmarks for CR delivery and outcomes in Australia.

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Delivery of Core Components in New Zealand Cardiac Rehabilitation Programs, Compared to other High-income Countries

B. Roxburgh [1,*], M. Supervia [2], K. Turk-Adawai [3], F. Lopez Jimenez [2], S. Grace [4]

[1] *University Of Otago, Dunedin, New Zealand*
[2] *Mayo Clinic, Rochester, United States of America*
[3] *Qatar University, Doha, Qatar*
[4] *York University, Toronto, Canada*

International guidelines state cardiac rehabilitation (CR) programmes should offer specific core components to optimise cardiovascular risk reduction. It is not known how well New Zealand (NZ) programmes conform with these guidelines, nor how they compare with programmes in other high-income countries (HICs) providing CR.

Secondary analysis of a global, cross-sectional survey of CR programs was undertaken. National CR societies or champions facilitated administration of the survey to each program in their country, via REDCap. American Heart Association-defined core components were considered (total 10). Data from NZ CR programs were compared with the 31 other HICs providing CR (data collected in 28; $n = 619$ surveys).

24/43 (62.7%) NZ CR programs responded. NZ programmes offered a median 8.5 core components (Q25–75 = 6.5–9.0 vs. 9.0, 8.0–10.0; $p < 0.05$), with all programmes ($n = 24$, 100.0%) providing nutrition counselling (vs. other HICs: $n = 525$, 95.3%; $p > 0.05$) and most ($n = 23$, 95.8%) blood pressure management, physical activity counselling and psychosocial management (vs. $n = 536$, 99.1%; $n = 545$, 98.6%; $n = 529$, 96.4%, respectively; all $p > 0.05$). Programmes in other HICs were significantly more likely to offer weight management ($n = 395$, 73.6% vs. $n = 12$, 50.0%; $p < 0.05$), diabetes management ($n = 442$, 82.3% vs. $n = 15$, 62.5%; $p < 0.05$) and exercise training (including exercise prescription; $n = 528$, 96.5% vs. $n = 19$, 79.2%; $p < 0.005$), compared to NZ.

NZ CR programmes deliver somewhat fewer core components, in particular weight and diabetes management as well as exercise training with individualised prescription, compared to other HICs. Given evidence of benefit for each component individually and synergistically, programmes must be resourced and staffed to ensure fully comprehensive, evidence-based care is provided.

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Demographic Profile of Statin-Intolerant Patients at St. Vincent's Hospital Melbourne Lipid Clinic

C. Twindyakirana [1,*], D. Jin [2], D. Hare [1], S. Toukhsati [3], A. Macisaac [2], A. Wilson [1], A. Baradi [2]

[1] University of Melbourne, Parkville, Australia
[2] St Vincent's Hospital, Melbourne, Australia
[3] Federation University of Australia, Melbourne, Australia

Objective: Adherence to statins is poor despite evidence of their safety and effectiveness, potentially complicated by statin intolerance. We aimed to demographically profile statin-intolerant patients in a high cardiovascular risk group at St Vincent's Hospital Melbourne (SVHM) to better understand this population.

Methods: Patients were identified from our clinic list over an 11-month period. Patients' sex, age, postcodes (to determine remoteness), medical history, and statin intolerance status were collected and entered into a spreadsheet. Results were analysed using descriptive statistics.

Results: 22 out of 238 patients (9.2%) had statin intolerance, of which 77.3% were female. Mean age was 62.7 ± 12.5 years. Out of the 22 statin-intolerant patients, 6 (27.3%) were past/current smokers and 6 (27.3%) had diabetes. 2 patients lived in inner regional areas, 1 in outer regional, while the rest resided in major cities. 50% of patients were currently taking >5 pills while only 1 patient took statin alone. Out of the 8 patients who had been prescribed statins for secondary prevention, 50% had a history of either peripheral vascular disease or TIA/stroke. 3 patients had coronary artery bypass grafts, 2 had stents, and 1 had prior myocardial infarction.

Conclusion: There are some patient factors easily identified at first appointment that may predict statin intolerance. Further research into characterizing this population would help identify those who are most at risk of statin intolerance.

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Developing a Waiting Room-based Educational Program: The Difference between Clinician and Consumer Opinion of Educational Videos

D. Mcintyre [1,3,5,*], A. Thiagalingam [1,2,5], J. Redfern [1], A. Singleton [1], M. Hollings [1], R. Reid [4], C. Chow [1,2,5]

[1] University Of Sydney, Camperdown, Australia
[2] Westmead Hospital, Westmead, Australia
[3] University of Notre Dame Australia, Darlinghurst, Australia
[4] Cardiomyopathy Association of Australia, Sydney, Australia
[5] Agency for Clinical Innovation, Chatswood, Australia

Background: Patients with cardiovascular disease (CVD) spend long periods of time in waiting rooms when accessing medical care. This time could provide an opportunity to deliver education that encourages positive lifestyle change. The aim of this study was to develop and evaluate a healthy lifestyle educational intervention for patients in cardiology clinic waiting rooms.

Methods: 11 multi-disciplinary clinicians (cardiology, psychology, dietetics, exercise physiology and nursing) and 21 consumers (9 male, median age bracket 50–59) with confirmed CVD reviewed a mean of 18 and 5 online CVD prevention videos each respectively. Topics included hypertension ($n = 2$), exercise ($n = 3$), diet ($n = 8$) and general health ($n = 8$). The videos were delivered using an online platform with integrated Likert and visual analogue scoring for consumer engagement/interest and behaviour change motivation. Scores were normalised to a 5-point scale for comparison.

Results: In evaluating behaviour change motivation, the highest clinician-rated video was lowest-rated by consumers for hypertension, exercise ($p < 0.05$) and diet ($p < 0.05$) (mean 4.26, 4.37 and 4.49 vs mean 2.8, 3.0 and 3.0, respectively). For general health, the highest-rated clinician video was the 3rd-lowest consumer-rated video (mean 4.67 vs 2.75). For interest/engagement, the highest clinician-rated hypertension and diet videos were the lowest consumer-rated videos (3.93, 4.21 vs 2.80, 3.33), however the same exercise video was highest rated by consumer and clinician (mean 4.4 vs 4.2).

Conclusions: The marked differences observed between clinician and consumer perceptions of health education highlight the vital nature of consumer engagement during development of consumer-directed educational programs.

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Development of Mobile Phone Text Messages Targeting Smoking Cessation in Surgical Patients

W. He [1,2,*], A. Thiagalingam [2,3], F. Ali [3], K. O'Shea [3], K. Phillips [3], D. McIntyre [3], A. Singleton [3], M. Priestley [2,3], S. Thomas [2,3], C. Chow [2,3]

[1] Monash University, Melbourne, Australia
[2] University of Sydney, Sydney, Australia
[3] Westmead Hospital, Sydney, Australia

Background: Mobile health interventions that support smoking cessation can be an effective, low cost, scalable method for reducing cardiovascular complications and improving post-operative morbidity in surgical patients.

Objective: This study aimed to develop a bank of text messages to support and provide information to surgical patients regarding smoking cessation.

Methods: Text messages were developed through a three-phase approach: (i) 91 text messages were initially drafted based on the RACGP national smoking cessation guidelines; (ii) text messages were then evaluated by calculating the Flesch-Kincaid readability scores and reviewed by health experts for comprehensibility, usefulness, appropriateness, and relevance of links to external resources (5-point Likert scale; 1 = strongly disagree, 5 = strongly agree) and open text feedback; (iii) text messages were edited and refined.

Results: 15 clinicians (mean age 39, 60% female, 40% male) reviewed a mean of 40 messages each. 97% (583/601) of messages were found to be easy to understand, 92% (551/600) useful, 90% (538/595) appropriate for surgical patients, 87% (492/567) contained relevant links to external resources and 140 sets of open text feedback were provided. The mean Flesch-Kincaid readability score was 67 for Reading Ease (8th Grade Reading level). Post evaluation, 34% (31/91) of messages were left unchanged, 63% (57/91) were modified and 3% (3/91) were removed based on feedback regarding tone, wording, URL links, comprehensibility and usefulness.

Conclusion: The multi-iterative process resulted in a bank of 88 text messages that will be tested in a randomised controlled trial to support smoking cessation in surgical patients.

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Effectiveness of a Community-based AF Screening Program: A Pilot Study

J. Ball[1,*], T. Marwick[1], J. Kalman[2], S. Ramkumar[1], S. Yiallourou[1], M. Carrington[1]

[1] *Baker Heart and Diabetes Institute, Melbourne, Australia*
[2] *Royal Melbourne Hospital, Melbourne, Australia*

Background: Atrial fibrillation (AF) is the most common cardiac arrhythmia and a significant cause of morbidity. It is most prevalent in individuals 65+ years and those with comorbidity. One third of individuals with AF are asymptomatic and unaware of their elevated risk of complications. Therefore, a targeted, community-based screening programme is likely to be clinically- and cost-effective.

Aim: To investigate the effectiveness of a community-based AF screening program utilising a hand-held single-lead ECG device (Remon RM-100) for AF detection in older individuals (65+ years).

Methods: We screened 106 individuals with no prior diagnosis of AF and comprehensively assessed their risk and clinical profile at a baseline clinic visit. Participants recorded their heart rate and rhythm three times per day for two weeks using the self-activated hand-held ECG device.

Results: Mean age of participants was 70 ± 4 years at baseline and 67% were female. Mean CHA_2DS_2-VASc score was 3 ± 1 indicative of high thromboembolic risk and almost 40% were at greater than 5% risk of developing AF within the next 5 years due to their risk factor profile. Overall, 31% of the cohort were obese, 8% had type 2 diabetes, 12% had sleep apnoea and almost 50% were taking antihypertensive medication. Mild cognitive impairment was identified in 35% (MoCA score >26). Following two weeks of screening, AF was detected in three individuals (2.8%).

Conclusion: A targeted AF screening program has the potential for widespread application and may detect subclinical AF prior to symptoms and/or the occurrence of AF-related complications.

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Effects of Postprandial Lipaemia on Cardiovascular Disease in Familial Hypercholesterolaemia

S. Mirzaee[1,*], J. Doery[1], Z. Lu[1], M. Isa[2], A. Ihdayhid[1], J. Cameron[1], A. Nasis[1], S. Nicholls[1]

[1] *Monash Health, Clayton, Australia*
[2] *Monash University, Monash School of Medicine, Melbourne, Australia*

Background: Impaired postprandial remnant cholesterol (RC) metabolism results in high triglyceride (TG) in plasma and may intensify the risk of atherosclerotic cardiovascular disease (ASCVD) in familial hypercholesterolaemia (FH). However, routine assessment of postprandial lipaemia in FH has not been previously investigated.

Objective: We aimed to assess postprandial lipaemia and chylomicron metabolism by implicating a simplified oral fat tolerance test (OFTT).

Methods: Thirty consecutive subjects with phenotypical FH ($N_1 = 20$ with ASCVD and $N_2 = 10$ without ASCVD) prospectively underwent a simplified OFTT (0,4 h) using a dietary supplement containing 75.0 g monosaturated fat, 41.9 g carbohydrate and 7.2 g protein. FH was diagnosed using the Dutch Lipid Clinic Network criteria. Total cholesterol, TG and high-density lipoprotein (HDL)-cholesterol were measured with enzymatic, colorimetric assays on a Beckman Coulter AU 5800 analyser. RC was calculated as (Total cholesterol-LDL cholesterol-HDL cholesterol).

Results: Delta plasma TG for cases [mean age 49.9 ± 11.6yr, median LDL 2.3 (1.7–4.4), median TG 1.2 (0.95–1.40) mmol/L], and 10 FH patients without ASCVD [mean age 46.4 ± 13.8 yr, LDL 3.5 (2.4–4.5), TG 1.0 (0.60–1.30)] was measured. In cases with ASCVD, there was significant increased postprandial delta TG [1.50 (0.75–2.0) vs 0.35 (0.18–1.56), $p = 0.01$] and RC [1.2 (0.85–1.55) vs 0.35 (0.18–1.56), $p = 0.01$]. Postprandial dyslipidaemia in FH with and without ASCVD was independent to conventional risk factors, lipoprotein (a) level [0.18 (0.06–1.14) vs 0.23 (0.15–0.40) $p = 0.54$], body mass index [(27.3 (3.7) vs 24.4 (4.2), $p = 0.06$], HbA1C [5.8 (0.4) vs 5.6 (0.8), $p = 0.29$] and insulin plasma level [(11.5 (6.3) vs 7.0 (2.4), $P = 0.06$].

Conclusions: Our results suggest that postprandial lipaemia is significantly higher in FH subjects with ASCVD. Further trial is required to evaluate implications for additional lipid lowering therapy for further reduction of ASCVD in this high risk group.

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Haemoglobin, Frailty and Long-Term Cardiovascular Events in Community-Dwelling Older Men

S. Gnanenthiran *, A. Ng, D. Brieger, R. Cumming, V. Naganathan, L. Kritharides, F. Blyth

Concord Hospital, Concord, Australia

Background: The concentration at which haemoglobin is associated with increased cardiovascular events (MACE) in older people, and whether this is modulated by frailty is unknown. We investigated the association between haemoglobin and long-term MACE in older men.

Methods: CHAMP (Concord Health and Ageing in Men Project) is a prospective study following community-dwelling men aged ≥ 70 yrs. The Youden index was used to determine the optimal haemoglobin cut-point in predicting MACE. Frailty was assessed using the Fried index. The relationship between haemoglobin and MACE was analysed using Cox-regression method adjusting for comorbidities.

Results: The cohort comprised 1604 men (mean [$\pm$SD] age: 76.9 ± 5.5y, mean follow-up 6.4 ± 2.7yrs). Decreasing haemoglobin was associated with increased comorbidity burden, frailty and MACE (linear trend $p < 0.001$), with 140g/L the optimal cut-point for predicting MACE. After adjusting for univariable predictors, haemoglobin, age, and frailty independently predicted MACE. A sensitivity analysis in patients with defined frailty status ($n = 1577$), stratified patients into frail/prefrail and robust groups. In frail/prefrail ($n = 790$), each 10 g/L decrement in haemoglobin was associated with increased MACE (hazard ratio [HR]:1.15; 95% confidence interval [CI]:1.06–1.24), mortality (HR:1.25; 95%CI:1.15–1.36), myocardial infarction [MI] (HR:1.18; 95%CI:1.09–1.28), and congestive cardiac failure [CCF] (HR:1.20; 95%CI:1.11–1.30) (all $p < 0.001$). In robust men ($n = 787$), each 10g/L decrease in haemoglobin was associated with MI (HR:1.16; 95%CI:1.01–1.33, $p = 0.04$), but not MACE, mortality or CCF.

Conclusion: A surprisingly high haemoglobin cut-point of 140 g/L predicted long-term MACE in community-dwelling older men, especially in those who were frail/pre-frail. Increased cardiovascular risk was thus observed at a level that does not meet contemporary definitions of anaemia.

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Heart Failure Digital Coach: Pilot Findings of an Avatar Style Application to Improve Symptoms, Self-care and Knowledge

J. Ball [1,2,*], T. Marwick [1,2], G. Zisis [1,2], M. Carrington [1,2]

[1] *Baker Heart and Diabetes Institute, Melbourne, Australia*
[2] *Faculty of Medicine, Dentistry and Health Sciences, University of Melbourne, Melbourne, Australia*

Background: Heart failure (HF) is a clinical syndrome that is associated with high rates of hospital admission, readmission, morbidity and mortality. Effective patient education and self-care can improve clinical status. Use of artificial intelligence to provide education with delivery via a digital avatar figure has been promising in patients with chronic disease and can be a powerful tool for patient engagement.

Aim: We aimed to develop and pilot a digital coaching program delivered via a tablet or mobile phone "app" for patients with HF (HF-Digital Coach) to improve quality-of-life (QoL), symptoms, self-care behaviours and HF knowledge.

Methods: Recently discharged HF patients aged 75+ years were invited to participate and complete 10 sessions over approximately 8 weeks. Validated questionnaires assessing self-care behaviours, QoL and HF knowledge were administered via the app. Daily weight was recorded, education on HF delivered and tailored management and guidance provided. "To-do" tasks and goal setting assignments were also program features. Change in self-care, QoL and knowledge from baseline to programme completion was analysed.

Results: Overall 21 patients completed the full programme. Self-care was improved in 57% of patients and 62% of patients had improved QoL at programme completion with 43% demonstrating a clinically significant improvement. The majority of patients had better HF-specific knowledge at programme end with 45% of those beginning with low level knowledge having high level knowledge by programme end.

Conclusion: HF education using avatar technology holds promise for improving longer-term health outcomes and reducing costly hospital admissions, although, more extensive validation is required.

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Heart Health Checks: Focused Use of Coronary Calcium Score Could Avoid Under and Over-Treatment in Intermediate Risk Patients

P. Venkataraman *, T. Marwick

Baker Heart And Diabetes Institute, Melbourne, Australia

Background: The new Medicare item for heart health checks will likely increase access to conventional coronary risk calculation, identifying more intermediate risk pts. How-

ever, given differing risk thresholds in the US and uncertainty about how to integrate Coronary Calcium Scoring (CCS), their optimal management is not yet established. We assessed the role of CCS at lower thresholds in an Australian context.

Methods: 1048 participants aged between 40 and 70 (total cholesterol 5.6 mmol/L, 62% female) with a family history of premature CAD were recruited from the community in Melbourne and Hobart. Predicted risk was calculated using the Australian Absolute CVD Risk calculator. CT coronary calcium scoring (CCS) was undertaken in pts at intermediate risk by ACC/AHA criteria (defined as 10-yr 4–15%).

Results: Intermediate risk by US guidelines was present in 80%, 571 participants met inclusion criteria for CCS. 285 (27% and 50% of total and CT screened participants respectively) had CCS > 0, with a median CCS of 50 (IQR 12–153). In the subgroup undergoing CCS, scores could guide therapy in all patients aged >60 and in intermediate risk patients aged 50–59. Adopting US thresholds would increase positive CCS scans by 75%, though the yield of positive scans falls to a third in those <60 yo.

Conclusion: Addition of CCS to lower intermediate risk thresholds can identify a third of pts <50 currently ineligible who may benefit from statins. CAD correlates with age even at lower risk and CCS can guide therapy in over 60% of >60 at intermediate risk.

	Age <50 (112)	Age 50–59 (261)	Age >60 (206)	
Low risk	89 (79%)	151 (58%)	82 (40%)	
CCS>0 (%)	29 (33%)	55 (36%)	41 (50%)	0.046
Intermediate risk	23	110	124	
CCS>0 (%)	7 (30%)	63 (57%)	93 (75%)	<0.001
P (CCS>0%)	0.84	<0.001	<0.001	

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High-density Lipoproteins Rescue Diabetes-impaired Angiogenesis by Restoring Cellular Metabolic Reprogramming Responses to Hypoxia

K. Primer [1,*], E. Solly [1,2], P. Psaltis [1,2], J. Tan [1,2], C. Bursill [1,2]

[1] *South Australian Health And Medical Research Institute, Adelaide, Australia*
[2] *Adelaide Medical School, University of Adelaide, Adelaide, Australia*

High-density lipoproteins (HDL) rescue hypoxia-induced angiogenesis in diabetes, however the underlying mechanisms remain unknown. Endothelial cell (EC) metabolic reprogramming is a central component of inducing angiogenesis at a site of ischaemia. Pyruvate dehydrogenase kinase 4 (PDK4) suppresses oxidative cell metabolism in hypoxia to decrease oxygen consumption and preserve cell survival, but diabetes impairs this adaptation and the angiogenic response.

PDK4 knockdown impaired human coronary artery endothelial cell (HCAEC) tubulogenesis in hypoxia by 82% versus controls ($P < 0.0001$). HCAECs were treated with rHDL (20μM) or PBS (vehicle) and exposed to glucose (5 or 25mM, 72h), then hypoxia (1.2% O_2, 6 h). *PDK4* expression was increased by 65% in hypoxia versus the normoxia control ($P < 0.05$). Contrastingly, in high glucose *PDK4* expression failed to increase in response to hypoxia. Incubation with rHDL rescued this and elevated *PDK4* expression by 40% in hypoxia and high glucose ($P < 0.01$). In parallel, rHDL rescued high glucose-impaired tubulogenesis in hypoxia by 64% versus the PBS/normoxia control ($P < 0.001$). In a murine model of diabetic wound healing, topical application of rHDL (50μg/wound/day) increased the presence of wound $CD31^+$ neovessels by 46%. This supported an increased rate of wound closure in diabetic animals of 30% ($P < 0.05$). rHDL treated wounds from diabetic mice had a striking increase in PDK4 gene (180%) and protein expression (350%) in the early-mid stages post-wounding ($P < 0.05$).

rHDL rescues diabetes-impaired expression of metabolic regulator PDK4, which plays a critical role in EC angiogenesis in hypoxia/ischaemia. This has implications for improving cardiovascular outcomes for diabetic patients following myocardial infarction.

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High-intensity Interval Training for Patients with Coronary Artery Disease: Finding the Optimal Balance

A. Keech [2], K. Holgate [3], J. Fildes [3], P. Indraratna [1,*], L. Cummins [1], C. Lewis [4], J. Yu [1]

[1] *Department of Cardiology, Prince of Wales Hospital, Randwick, Australia*
[2] *School of Medical Sciences, University of New South Wales, Sydney, Australia*
[3] *Cardiac Rehabilitation, Prince of Wales Hospital, Randwick, Australia*
[4] *Department of Respiratory Medicine, Prince of Wales Hospital, Randwick, Australia*

Background: There is growing interest in the application of high-intensity interval training (HIIT) for patients with coronary artery disease (CAD) within cardiac rehabilitation (CR), based on the now-robust evidence of the efficacy of HIIT compared to moderate-intensity continuous training (MICT). However, the optimal characteristics of HIIT for optimizing efficacy and patient enjoyment while maintaining patient safety is still unclear. This study aimed to assess a novel HIIT protocol in patients with CAD within CR.

Methods: Twenty-one patients with CAD completed 6-weeks (×2 sessions per week) of HIIT within outpatient (phase 2) CR. HIIT comprised 15 repetitions × 30-seconds cycling at ~85–90% maximum heart rate, interspersed with 30-seconds of active recovery. Training programme progression was individualised based on heart rate and rating of perceived exertion (RPE). Outcome measures included patient safety (exercise-related adverse events), efficacy (peak aerobic capacity, body composition, blood pressure and vascular function) and patient adherence and enjoyment.

Results: No cardiovascular-related adverse events were reported in relation to HIIT sessions. Patients showed significant improvement in peak aerobic capacity (mean +12%, $p < 0.001$, effect size $d = 0.38$), blood pressure (brachial systolic -6%, $p < 0.001$, $d = -0.58$) and total body fat (-5%, $p = 0.001$, $d = -0.52$). Positive adaptations were prominent centrally (aortic systolic BP -6%, $p < 0.001$, $d = -0.57$; visceral fat -12%, $p = 0.002$, $d = -0.47$). Patient enjoyment of training was high (5.6 out of 7 using the Exercise Enjoyment Scale).

Conclusions: This HIIT protocol appears safe, effective and enjoyable for patients with CAD within CR.

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How do We Extend the Reach of Cardiac Coaching to Those That Need It Most? – Factors Affecting Recruitment into the HARP Cardiac Coaching Programme at RMH

N. Jordan [2,*], S. Das [1,2], A. Maywald [1], G. King [1], L. Rowe [1], R. Vincent [1], V. Koufariotis [1], J. McElhinney [1], D. Zentner [1,2], L. Burchill [1,2]

[1] Department of Cardiology, Royal Melbourne Hospital, Melbourne, Australia
[2] Department of Medicine, University of Melbourne, Melbourne, Australia

Background: The Hospital Admission Risk Program (HARP) Cardiac Coaching Program is a phone-based service, where coaches help patients meet their modifiable cardiac risk factor targets. While the benefits of cardiac coach programs have been reported, less is known about factors influencing recruitment and access.

Aims:

1. Compare demographic features of enrolled patients vs non-enrolled
2. Compare the comorbidity burden between enrolled versus non-enrolled patients
3. Interview coaches to understand barriers and priorities for enrolment

Methods: This was a single centre retrospective observational study comparing demographic and clinical characteristics of enrolled vs non-enrolled CABG/PCI patients, spanning 01/01/17 – 31/12/17. Cardiac coach interviews were also undertaken.

Results: Of 794 eligible patients, 204 (26%) were enrolled. Enrolled patients were significantly younger (63.3 years vs 65 years, p-value $= 0.004$), more likely to be smokers (65.7% vs 55.3%, $p = 0.012$), have hypertension (65.7% vs 55.3%; $p = 0.012$) and hyperlipidaemia (2.9%, vs 0.8%, $p = 0.038$). Conversely, enrolled patients were less likely to be coded as having chronic kidney disease (6.9% vs 15.6%, $p = 0.002$) or diabetes mellitus (30.4% vs 37.6%, $p = 0.076$). Marital status varied between groups. The proportion of rural vs metropolitan dwellers were similar. Coaches identified workforce number as one of the main barriers limiting recruitment. Coaches estimated that <10% of patients declined enrolment.

Conclusion: Just over one-quarter of eligible patients were enrolled in the cardiac coach programme in 2017. Solutions that support and expand the reach of cardiac coaches may help to ensure the programme is accessible to a greater proportion of patients.

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Impact of Admission to a Cardiology Unit on Mortality in Patients Aged >85 Years Presenting with Non-ST-Elevation Myocardial Infarction (NSTEMI)

D. Gayed [*], A. Koshy, A. Murphy, N. Khurana, V. Peiris, A. Younes, M. Fernandez, D. Wu, J. Park, D. Clark, O. Farouque, M. Yudi

Austin Health, Heidelberg, Australia

Introduction: Studies have shown that older patients are less likely to be admitted into specialised cardiology units. It is uncertain whether admission under cardiology leads to more aggressive management and potentially improved outcomes.

Methods: In this retrospective analysis, 956 consecutive patients aged >85 years presenting with a non-ST elevated myocardial infarction (NSTEMI) between 2010–2018 were included. Patients were stratified based on whether they were admitted under cardiology or another unit. The primary outcome was all-cause mortality.
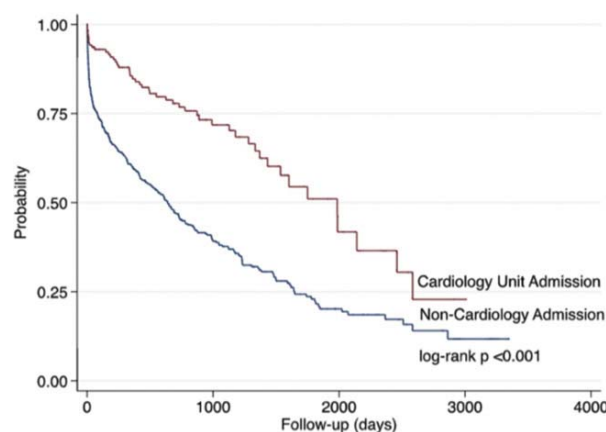
Results: Out of the 956 patients, only 185 (19.4%) were admitted under cardiology unit. The remaining patients were admitted under either a general medical unit (71%) or a surgical unit (9.6%). Patients admitted under cardiology were more likely to be younger and less likely to have cognitive or physical impairments (all $p < 0.001$). They were also more likely to receive guideline directed medical therapy (GDMT; aspirin, statin, beta-blocker) and undergo invasive coronary angiography (46% vs 1%, $p < 0.001$). Long-term mortality was significantly lower in patients admitted under cardiology (HR 0.39 95%CI 0.29–0.52, $p < 0.001$) and this remained significant after adjusting for demographics, mobility aids, cognition, living status, coronary angiogram and medication use (HR 0.63 95%CI 0.44–0.92, $p = 0.01$).

Conclusion: Patients admitted under a cardiology unit received a higher rate of medical therapy and invasive management. A combined cardio-geriatric unit may help stratify a larger proportion of patients who may benefit from aggressive management of NSTEMI.

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Impact of Gender on Meeting Secondary Prevention Targets and Depression Post Acute Coronary Syndromes: Insights from the SMART-REHAB Trial

A. Murphy [*], O. Farouque, D. Clark, J. Ramchand, M. Yudi

Austin Health, Melbourne, Australia

Introduction: It is well publicised that women receive less aggressive secondary preventive therapy post acute coronary syndromes (ACS). Less is known about the cardiovascular risk profile and psychological well-being of females post ACS.

Methods: SMART-REHAB was a randomised controlled tria assessing the impact of a smartphone-based cardiac rehabilitation programme post ACS. In this study, we stratified the cohort by gender. We assessed whether there was a gender difference in the use of optimal medical therapy, achievement of secondary prevention target in blood pressure, cholesterol and diabetes, and prevalence of depression (assessed by Cardiac Depression Scale, CDS) at 8-weeks post ACS.

Results: Only 26 (15%) of the 165 patients with complete follow-up were females. There was no different in the use of aspirin, statin, beta-blocker, ACE inhibitor or a P2-Y12 inhibitor between the groups (all p = NS). Women had similar rates to men of LDL-cholesterol <1.8mmol/L (69% vs 77%, p = 0.4), BP < 130/80 (62% vs 54%, p = 0.5) and HbA1c<7% (100% vs 92%). Women were more likely to have depression (31% vs. 14%, p = 0.04) as evidenced by a CDS score >95.

Conclusion: In this analysis from a contemporary randomised trial, women received guideline-directed medical therapy to the same extent as men. This translated to a similar proportion of patients achieving secondary prevention targets. However, women had significantly higher rates of depression highlighting the need for widespread screening and management of depression post ACS.

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Increasing the Uptake of Cardiopulmonary Resuscitation Training Within Australian Cardiac Rehabilitation Programmes

S. Cartledge [1,2,3,*], J. Bray [1,3,4], B. Abell [5], D. Stub [1,3,6,7,8], J. Finn [1,4], L. Neubeck [9]

[1] *Department of Epidemiology and Preventive Medicine, Monash University, Melbourne, Australia*
[2] *Institute for Physical Activity and Nutrition, Deakin University, Geelong, Australia*
[3] *Alfred Health, Melbourne, Australia*
[4] *School of Nursing, Midwifery and Paramedicine, Curtin University, Bentley, Australia*
[5] *School of Public Health and Social Work, Queensland University of Technology, Brisbane, Australia*
[6] *Cabrini Health, Melbourne, Australia*
[7] *Baker Institute, Melbourne, Australia*
[8] *Western Health, Melbourne, Australia*
[9] *School of Health and Social Care, Edinburgh Napier University, Sighthill, United Kingdom*

Background: People attending Cardiac Rehabilitation (CRehab) are at increased risk of cardiac arrest. We have demonstrated that people attending CR would like to be taught cardiopulmonary resuscitation (CPR) yet provision of CPR training in Australian CRehab programmes is 24%.

Aim: This study aimed to identify the best strategy to implement CPR training into CR programmes.

Methods: A two-arm randomised controlled implementation study is being conducted across Australia. One CRehab coordinator per programme are eligible to participate. Coordinators are randomised 1:1 and receive an information pack (control & intervention) and a face-to-face education session (intervention).

Results: To date 36 programmes (61% metropolitan, 39% rural) have been randomised. Few programmes had (14%) offered past CPR training and only 17% currently include CPR information. Baseline data identified common barriers to incorporating CPR training were time (69%), resources (69%) and a lack of awareness (19%). Coordinators are motivated to include CPR training as they believe that participants are interested in learning CPR (78%). Of the 12 programmes to complete the study to date, 70% have incorporated CPR training into their programmes (80% intervention, 60% control). Time was the most common barrier (67%) to implementation. Brief qualitative interviews with coordinators revealed that staffing, the responsibility of conducting CPR training and a reluctance to change were additional barriers.

Conclusions: CR represents a logical location to provide targeted CPR training to high-risk cardiac groups at scale nationally. This study will aid understanding of how CR coordinators can be supported to enable more programmes to incorporate CPR training.

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Long-term Trends in Coronary Risk Factor Prevalence and Adherence to Guideline Therapies in Australians with Coronary Heart Disease: 9-year Comparison with European Outcomes

D. Eccleston [1,2,*], D. Cehic [2], M. Lucas [3], S. Worthley [2]

[1] University of Melbourne, Parkville, Australia
[2] GenisCare, Sydney, Australia
[3] Monash University, Melbourne, Australia

Background: Cardiovascular prevention continues to demonstrate significant gaps between guidelines and clinical practice. Recent European data indicates rates of obesity, diabetes and smoking continue to rise in patients with coronary heart disease.

Methods: We enrolled 10986 patients in the GenesisCare Outcomes Registry (GCOR) from November 2008-January 2018. Baseline patient data and treatment were compared with that from two European surveys, EUROASPIRE III and IV.

Results:

Risk factor %	Euroaspire III $n = 2392$	GCOR 2009% $n = 865$	Euroaspire IV $n = 4357$	GCOR 2018 $n = 1330$	P value[*]
Smoking	18.2	12.7	37.7	8.66	0.09
Obesity (BMI > 30)	38	33.3	31.7	38.9	0.27
Hypertension	60.9	79.3	75.4	62.7	<0.0001
Elevated lipids	46.2	86.3	72.1	59.4	<0.0001
Diabetes mellitus	28.0	26.6	34.2	22.5	0.79
Cardioprotective Drugs					
Antiplatelet therapies	93.2	98.7	96.4	99.2	0.0016
Beta blockers	85.5	63.2	82.1	68.3	<0.001
All Blood pressure drugs	96.8	90.8	89.7	92.1	0.0005
All Lipid lowering drugs	88.8	93.3	90	93.6	0.09

[*] Comparison of EUROASPIRE vs GCOR for each generation of survey.

Conclusion: The prevalence of adverse coronary risk factors continues to rise in Europeans with CHD despite increases in the use of and high rates of medical therapies. Australians smoke less and are less obese, however both groups still have a significant treatment gap in patients with coronary artery disease with regard to guideline therapies that warrants further targeted intervention.

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Masters Age Football (Soccer) and Cardiac Risk: A Survey of Risk Factors, Symptoms, and Understanding Regarding Cardiac Disease and its Prevention

M. Francis [1,*], T. Buckley [1,2], A. Tofler [3], G. Tofler [1,2]

[1] University Of Sydney Medical School, Camperdown, Australia
[2] Royal North Shore Hospital, St Leonards, Australia
[3] Moriah College, Queens Park, Australia

Background: Masters-age football (≥35 years) is increasingly popular, however participant characteristics are not well defined.

Aim: To investigate in Masters-age footballers, cardiac risk factors, symptoms, knowledge and understanding, and support for prevention.

Methods: A web-based survey (Masters Age Footballers and Cardiac Risk (MAFACARI)) of 153 Sydney footballers (age 49 ± 8 years, 92% males); A-grade competition ($n = 24$), ≤B-grade ($n = 95$), or social ($n = 34$). Combined group data are shown. Knowledge, attitudes and beliefs were assessed by the ACS Response Index.

Results: Most were Caucasian (89%), tertiary educated (90%), motivated by social interaction/enjoyment (94%) and health/exercise (90%). Risk factors: overweight-obese (54%), hypercholesterolaemia (37%), family history (23%), hypertension (20%), current smoker (8%), and prior PTCA/cardiac surgery (5%). 33 (22%) reported ≥1 potential cardiac symptom during activity in prior year but only 8 of them (24%) sought medical attention. Knowledge score was 13.7 ± 2.3 (range 8–20), Attitudes 11.9 ± 2.7 (5–18) Beliefs 22.1 ± 3.2 (16–28). Knowledge was high (≥80%) for typical heart attack (MI) symptoms but poorer (<40%) for atypical ones. Only half felt confident to recognise MI. 45% preferred someone drive them to hospital than wait for an ambulance. 46% were less likely to stop playing with pain/discomfort during a final. Only 40% were aware that warning signs may precede MI by days or longer. Strong support was expressed for AED and CPR training (99%), AEDs at games (97%), and education (>90%).

Conclusion: Cardiac risk factors and potential symptoms are common in Masters footballers, with gaps in knowledge and understanding. Players strongly support AED availability and training, and cardiac education.

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Mobile Health (mHealth) Cardiovascular Risk Reduction Strategies in Cancer: A Systematic Review and Meta-Analysis

A. Murphy [1,*], A. Koshy [1], O. Farouque [1], D. Clark [1], B. Yeo [1,2,3], J. Mousley [1], G. Meehan [1], P. Kunniardy [1], M. Yudi [1]

[1] Austin Health, Heidelberg, Australia
[2] Olivia Newton-John Cancer Research Institute, Heidelberg, Australia
[3] School of Cancer Medicine, La Trobe University, Melbourne, Australia

Background: Cardiovascular disease (CVD) is the leading cause of death in survivors of cancer. Attention to reducing the risk of CVD should thus be a priority in their long-term management. Implementation of mHealth strategies have been proposed for CV risk reduction in this population, although limited by a paucity of evidence surrounding their efficacy.

Methods: A systematic review of MEDLINE, PubMed and EMBASE was conducted by 2 authors for studies investigating mHealth-based cardiovascular risk reduction strategies in adult patients treated for cancer. Pre-specified outcomes assessed included physical activity, weight and cardiac risk factor parameters. Intervention and effect on the specified outcomes were assessed.

Results: Nineteen trials representing 2021 patients were included. Thirteen were randomized controlled trials. Majority were app ($n = 7$) or telephone-guided interventions ($n = 7$). Follow-up varied widely, ranging from 4 weeks to 2 years. Most studies reported on physical activity ($n = 17$), with 9 studies demonstrating a significant improvement. However, endpoints were heterogenous and unable to be synthesised. Random effects meta-analysis showed significant improvements in body weight (five studies; standardised mean difference (SMD) = −0.400; CI −0.628, −0.172) and waist circumference (three studies; SMD = −0.518; CI −0.880, −0.157). There was a paucity of literature reporting on cardiac risk factor parameters with only 2 studies assessing blood pressure change ($p = $ ns).
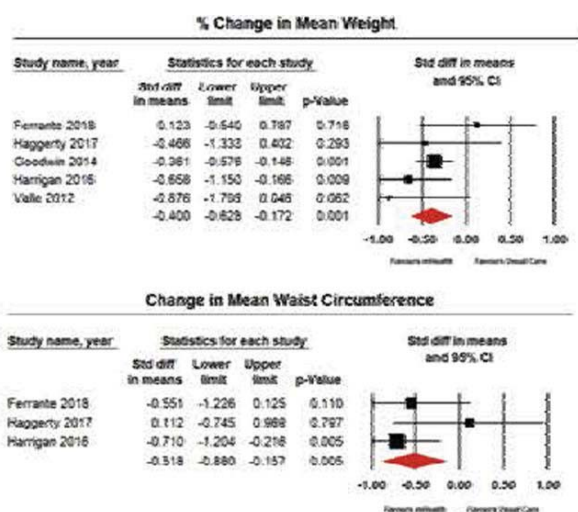
Conclusion: Publicly available mHealth programs are a convenient and easily disseminated intervention which may improve physical activity and weight among cancer survivors. Feasibility of cardiovascular risk factor reduction using mHealth technology in this population should be addressed in future research.

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Nature of Community-based Cardiac Rehabilitation in New Zealand

B. Roxburgh [1,*], K. Turk-Adawi [2], M. Supervia [3], F. Lopez Jimenez [3], S. Grace [4]

[1] University Of Otago, Dunedin, New Zealand
[2] Qatar University, Doha, Qatar
[3] Mayo Clinic, Rochester, United States of America
[4] York University, Toronto, Canada

Community-based cardiac rehabilitation (CR) is recommended as a potentially more accessible delivery model for patients, and it could be more cost-effective. No data are available on the nature of community-based CR. This study described the nature of community-based CR in New Zealand (NZ), and compared it with other high-income countries (HICs).

Secondary analysis of a global, cross-sectional survey of CR programmes was undertaken. National CR societies or champions facilitated administration of the survey to each programme in their country, via REDCap. Data from NZ CR programmes were compared with the 31 other HICs providing CR (data collected in 28).

Responses were received from 27 (62.7%) CR programmes in NZ, and 619 (43.1%) in other HICs. NZ was significantly more likely to offer community-based CR ($n = 11$, 40.7% vs. other HICs $n = 75$, 11.6%, $p < 0.001$). Programmes were primarily overseen by nurses ($n = 3$, 30.0%) and exercise physiologists ($n = 2$, 20.0%), serving a median of 40.0% (10.0–70.0%) of total CR programme patients/year. NZ programmes run for a median of 8.0 weeks (Q25–75 = 7.0–12.0), with 10.0 (9.5–13.0) patients/session, attending 12.0 (3.5–12.0) sessions/month. NZ community-based programmes predominantly served moderate ($n = 9$, 90.0%) and low ($n = 4$, 40%) cardiac risk patients. NZ CR patients were most often offered community-based programmes based on their choice ($n = 10$, 70.0%) and distance to main CR centre ($n = 4$, 40.0%); this did not differ from other HICs ($n = 53$, 74.6% & $n = 33$, 46.5%).

NZ is a global leader in community-based CR. Availability, quality, safety, efficacy and cost-effectiveness of community-based CR should be considered, in NZ and beyond.

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Of Mice and Men: Metabolic Effects of Chronic Exercise

Y. Koay [1,2,*], K. Stanton [1], V. Kienzle [1], D. Celermajer [1,3], J. O'Sullivan [1,2,3]

[1] *Heart Research Institute, Newtown, Australia*
[2] *Charles Perkins Centre, The University of Sydney, Camperdown, Australia*
[3] *Department of Cardiology, Royal Prince Alfred Hospital, Camperdown, Australia*

Aims: To determine the effects of an exercise program on fatty liver disease and metabolite markers of cardiometabolic health.

Methods: 42 apolipoprotein E knockout mice fed on a high-fat diet (HFD) were randomized: 16 were administered the diet for 12 weeks. 10 mice took the HFD for 26 weeks (late control); and 16 mice took the diet for 16 weeks and underwent exercise for 10 weeks (late exercise). For the human study, 55 males with mean age 21 ± 3 years and mean BMI $24.4 \pm 2.73 \, \text{kg/m}^2$ underwent an 80-day exercise programme. 10 μL plasma from mice and humans was subjected to metabolomic analysis using LC-MS/MS.

Results: We found increased circulating serotonin metabolites in both mice (late exercise *vs* late control) and men ($p < 0.05$). Intriguingly, the endocannabinoid anandamide, purported to be responsible for the "runner's high", was significantly increased in HFD exercising mice ($p = 0.01$). Liver fat measured by total triglyceride content was significantly decrease in HFD exercise mice ($p < 0.05$). Several metabolic pathways were changed by exercise in humans undergoing the exercise programme. A microbiome-derived tryptophan metabolite ($p = 9.4 \times 10^{-6}$) was also significantly elevated by exercise. Acetylcholine, a marker of neuromuscular fatigue, was decreased post exercise compared to baseline ($p = 0.008$), as was arginine ($p < 0.0001$) –the major substrate of NOS. Several plasma non-essential amino acids were also elevated in humans post exercise program.

Conclusion: Exercise reduces liver fat and reveals plasma markers of improved psychological, physiological, vascular, and metabolic health.

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Perioperative Management of Antiplatelets in Elective Surgery at a Tertiary Hospital

J. Sindone [1,*], R. Day [1,2], M. Stefani [1,2], J. Joseph [1,2]

[1] *University of New South Wales, Sydney, Australia*
[2] *St Vincent's Hospital, Sydney, Australia*

Background: Many undergoing elective surgery receive antiplatelets for cardiovascular secondary prevention. European Society of Cardiology (ESC) Guidelines (2017) outlined factors to assist perioperative management of antiplatelets in elective surgery.

Aims: Evaluate: 1. Perioperative management of patients taking antiplatelets. 2. Bleeding, thrombosis & rehospitalisation rates. 3. Compliance with Guidelines.

Methods: Retrospective analysis of adults undergoing elective surgery from 01/01/2017–01/04/2018 who received antiplatelets pre-operatively. Compliance with ESC Guidelines was rated according to thrombosis and bleeding risk factors.

Results: Evaluated 182 patients, age 69 ± 12 years. Interrupting antiplatelets was compliant in 76.4%, duration of cessation was compliant in 26.4%. No difference between antiplatelet type/combinations and compliance was found. Of the 134 non-compliant patients, 73.1% had antiplatelets ceased later than advised. Aspirin cessation was closer to surgery than advised (80.3%, $p = 0.027$) and associated with increased bleeding (83.1%, $p = 0.004$). Clopidogrel monotherapy was associated with reduced bleeding (33.3%, $p = 0.017$). Less bleeding occurred in patients with gastro-oesophageal reflux disease: 17/26 (65%) vs 54/64 (84%) ($p = 0.046$). Cardiac surgery was associated with increased bleeding (89.0%, $p < 0.001$) despite higher compliance for interrupting or continuing antiplatelets (85.4%, $p < 0.01$). Thromboembolism occurred in 2 (1.1%), transfusion in 32 (17.6%), and 14 (7.7%) required rehospitalisation within 3 months.

Conclusion: There is considerable compliance with recommendations regarding interruption/continuation of antiplatelets, but widespread discordance concerning duration of antiplatelet interruption, suggesting requirements for further Guideline dissemination/education.

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Pre-Morbid Mobility Status and Long-Term Outcomes in Patients Aged >85 years with Non-ST-Elevation Myocardial Infarction (NSTEMI)

G. Meehan [*], A. Koshy, P. Kunniardy, A. Murphy, D. Gayed, J. Ramchand, D. Clark, O. Farouque, M. Yudi

Austin Health, Heidelberg, Australia

Introduction: Mobility limitations are common in the elderly and contribute significantly to frailty. The impact of

mobility status on long-term outcomes in elderly patients with NSTEMI is unknown.

Methods: A retrospective analysis included 956 consecutive patients aged >85 years presenting with NSTEMI between 2010–2018. Mobility status was classified as independent, single point stick (SPS), 4-wheel frame (4WF) or wheelchair dependent. Guideline-directed medical therapy (GDMT) included aspirin, beta-blockers and statins. The primary outcome was all-cause mortality.
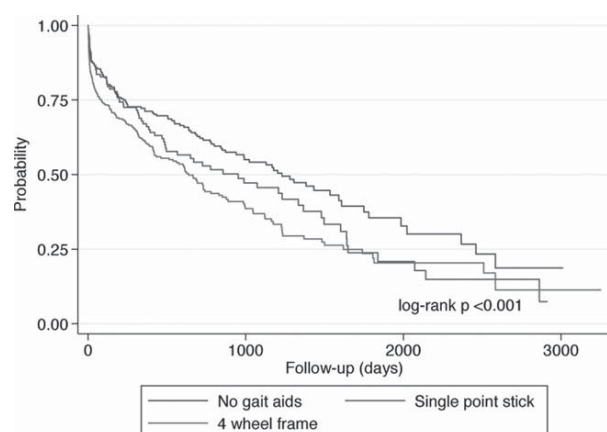
Results: Of 956 patients, 304 (33.7%) had independent mobility, 161 (17.9%) used a SPS and 402 (44.6%) used a 4WF. GDMT adherence did not vary significantly between the SPS and independent groups. However, adherence to GMDT was significantly lower in 4WF users ($p < 0.001$). Independent patients had higher rates of coronary angiography (19.5% vs 10% SPS vs 2% 4WF, $p < 0.001$) and had improved long-term survival (HR 0.68, 0.55–0.84, $p < 0.001$). SPS users did not experience reduced long-term survival ($p = 0.3$, whereas 4WF users had significantly greater long-term mortality (HR 1.5, 1.2–1.9, $p < 0.001$). This risk remained significant, albeit reduced (HR 1.3 1.1–1.7, $p = 0.02$) after Cox-proportional hazard modelling.

Conclusion: There is an association between mobility status and prescription of GDMT and coronary angiography in elderly patients. Using a 4WF, but not a SPS, was associated with higher mortality.

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Prognostic Value of Abdominal Aortic Calcification: A Systematic Review and Meta-analysis of Observational Studies

K. Leow [1,*], P. Szulc [2], J. Schousboe [3], D. Kiel [4], A. Teixeira-Pinto [1], H. Sheikh [1], M. Sawang [1], N. Bondonno [5,6], J. Hodgson [5,6], A. Sharma [1], P. Thompson [7], R. Prince [6,8], J. Craig [1,9], W. Lim [5,10], G. Wong [1], J. Lewis [1,5,6]

[1] *The University of Sydney, Centre for Kidney Research, School of Public Health, Sydney Medical School, Children's Hospital at Westmead, Westmead, Australia*
[2] *INSERM UMR 1033, University of Lyon, Hospices Civils de Lyon, Lyon, France*
[3] *Park Nicollet Osteoporosis Center and HealthPartners Institute, Division of Health Policy and Management, University of Minnesota, Minneapolis, United States of America*
[4] *Hinda and Arthur Marcus Institute for Aging Research, Hebrew Senior Life, Department of Medicine, Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, United States of America*
[5] *School of Medical and Health Sciences, Edith Cowan University, Joondalup, Australia*
[6] *Medical School, University of Western Australia, Perth, Australia*
[7] *Department of Cardiology, Sir Charles Gairdner Hospital, Perth, Australia*
[8] *Department of Endocrinology and Diabetes, Sir Charles Gairdner Hospital, Perth, Australia*
[9] *College of medicine and public health, Flinders University, Adelaide, Australia*
[10] *Department of Renal Medicine, Sir Charles Gairdner Hospital, Perth, Australia*

The abdominal aorta is one of the first vascular beds where atherosclerotic calcification is observed. Abdominal aortic calcification (AAC) can be identified at a fraction of the cost and radiation of coronary artery calcification tests. However its prognostic significance remains unclear. We searched MEDLINE and Embase databases until March 2018 for studies reporting AAC and incident cardiovascular (CV) events, fatal CV events and all-cause mortality (ACM). Of 454 studies identified, 52 (46 cohorts, $n = 36,092$) were eligible. Summary risk ratios (RR) were estimated using random effects models comparing the lowest AAC group (referent) to all other AAC groups (any-more advanced AAC). Studies were mainly in chronic kidney disease (CKD) patients (57%) and the general population (26%), which were meta-analysed separately due to clinical heterogeneity. In studies of the general population, we identified moderate quality evidence that people with any-more advanced AAC had substantially higher risk of CV events; RR 1.83 (95% CI, 1.40 to 2.39); fatal CV events; RR, 1.85 (95%CI, 1.44 to 2.39) and ACM; RR, 1.98 (95%CI, 1.56 to 2.53. In studies of CKD patients, we identified moderate-high quality evidence showing people with

any-more advanced AAC are at higher risk of CV events; RR, 3.47 (95%CI, 2.21 to 5.45), fatal CV events, RR, 3.69 (95%CI, 2.32 to 5.85) and ACM; RR, 2.30 (95%CI, 1.86 to 2.85). In conclusion, AAC identifies individuals at a clinically significant increased CV risk, particularly CKD patients' or those with advanced AAC. Capturing and providing this information may help clinicians manage patients' cardiovascular risk.

Table: Summary of findings table.

General population*	Illustrative comparative risks		Relative risk (95% CI)	No. studies (no. people)	Quality of the evidence (GRADE)
	No or low AAC	Any or more advanced AAC			
CV events	2 in 100	4 in 100	1.83 (1.40-2.39)	6 (8,498)	Moderate[1]
Fatal CV events	0 out of 100	1 out of 100	1.85 (1.44-2.39)	5 (8,004)	Moderate[1]
All-cause mortality	3 out of 100	6 out of 100	2.11 (1.61-2.76)	6 (8,663)	Moderate[1]

Chronic kidney disease patients†	Illustrative comparative risks		Relative risk (95% CI)	No. studies (no. people)	Quality of the evidence (GRADE)
	No or low AAC	Any or more advanced AAC			
CV events	4 in 100	14 in 100	3.47 (2.21, 5.45)	8 (1,426)	Moderate[1]
Fatal CV events	1 out of 100	4 out of 100	3.69 (2.32, 5.85)	4 (1,163)	High[1]
All-cause mortality	5 out of 100	12 out of 100	2.30 (1.86-2.85)	9 (2,050)	High[1]

1. Quality of evidence scoring based on GRADE for prognostic studies (Iorio A et al. 2015. BMJ 350:h870).
*Baseline risk for CV events, fatal CV events and all-cause mortality calculated from Criqui MH et al. 2014. ATVB 34:1574-1579, (n=1,974). AAC assessed by CT in men and women with a mean age of 65 years with a mean follow up of 5.5 years.
†Baseline risk calculated from the Tatami Y et al. 2015 Atherosclerosis 243:349-355, (n=347), for CV events, fatal CV deaths and all-cause mortality. AAC assessed by CT in men and women with chronic kidney disease a mean age of 67 years and duration of follow-up 3.5 years.

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Readiness of Chinese Immigrants Diagnosed with CVD to use Web-based Health Information

L. Zhang [1,*], D. Ding [1], L. Neubeck [2], R. Gallagher [1]

[1] The University Of Sydeny, Camperdown, Australia
[2] Edinburgh Napier University, Sighthill, UK

Background: Web-based interventions may potentially overcome linguistic and cultural barriers to secondary prevention for immigrants. However, the readiness to use the web for health is not known in this population.

Purposes: We examined readiness to use the web for health among Chinese immigrants with cardiovascular disease (CVD) and in comparison for the presence of another chronic condition and explored the factors associated with confidence in web utilisation.

Methods: Chinese immigrants were recruited from Chinese communities across New South Wales and surveyed for usage, confidence and perceptions of web-based health information, and health literacy. Participants with CVD ($n = 90$), chronic musculoskeletal conditions ($n = 87$) and without chronic condition ($n = 154$) were compared.

Results: Participants were aged mean 59 ± 16 years and 69% female. Participants with CVD were the oldest (71, 65, 49 years) and 48% perceived web-based health information as useful and important (46%). The most accessed information concerned lifestyle and medication (56% and 32%) which were similar to the other groups.

Confidence in web use was not associated with CVD diagnosis, but negatively associated with additional year in age (OR:.96; 95% CI: .93-.99; $p = .014$), being female (OR:.53; 95% CI:29-.95; $p = .033$), not having university education (OR:.41; 95% CI:.24-.71; $p = .002$), and inadequate health literacy (OR:.57; 95% CI:.33-0.98; $p = .042$) after adjusting for age of migration and social support.

Conclusions: There is a strong potential to provide support and information for CVD secondary prevention via the web for Chinese immigrants with CVD if support is provided to improve confidence.

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Sex Disparities in the Management of Coronary Heart Disease in Primary Care in Australia

C. Lee [1,*], G. Mnatzaganian [2], M. Woodward [3,4], C. Chow [5,6], F. Sitas [7,8], S. Robinson [9], R. Huxley [4,10]

[1] School of Psychology and Public Health, La Trobe University, Melbourne, Australia
[2] Department of Community and Allied Health, La Trobe Rural Health School, La Trobe University, Bendigo, Australia
[3] The George Institute for Global Health, University of Oxford, Oxford, UK
[4] The George Institute for Global Health, University of New South Wales, Sydney, Australia
[5] Westmead Applied Research Centre, University of Sydney, Sydney, Australia
[6] Westmead Hospital, Sydney, Australia
[7] Centre for Primary Care and Equity, School of Public Health and Community Medicine, University of New South Wales, Sydney, Australia
[8] Menzies Centre for Health Policy, School of Public Health, University of Sydney, Sydney, Australia
[9] School of Public Health, Curtin University, Perth, Australia
[10] College of Sciences, Health and Engineering, La Trobe University, Melbourne, Australia

Introduction: Primary care has been shown to be an important component for the secondary prevention of cardiovascular disease. Small-scale studies in Australia have reported coronary heart disease (CHD) management gaps in primary care from the late 1990s. Using the largest and most contemporary Australian general practice dataset (MedicineInsight), the aim of this study was to determine whether sex differences exist in the management of CHD patients.

Methods: General practice records of patients aged ≥ 18 years with a history of CHD and at least three visits in two years were analysed. Sex-specific, age-standardised proportions of patients (1) currently prescribed with medications; (2) assessed for cardiovascular risk factors; and (3) achieved treatment targets; that were recommended in the General Practice Management Plan for CHD and could be evaluated with MedicineInsight were reported.

Results: Altogether, records of 130,926 patients (46.7% women) from 438 sites across Australia were available from 2014–2018. Compared to men, women were less likely to be prescribed with recommended medications (prescribed ≥ 3 medications: women 44%, men 61%; $p < 0.001$) and to be assessed for risk factors. In contrast, women were more

likely to have achieved treatment targets (achieved ≥4 targets in those assess for all risk factors: women 82%, men 76%; $p < 0.001$).

Conclusion: Despite assessment, prescribing and treatment gaps have been reported previously, this large-scale analysis of general practice data indicate they still persist. Moreover, the gaps are larger in women compared to men. New approaches are needed to address the CHD management gaps and related gender inequality.

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SNAPSHOT ACS Cohort Follow-Up – What Happens to Australian Patients in the 3 Years after Hospital Discharge: A National Data Linkage Study

J. Redfern [1,2,*], K. Hyun [1], D. Brieger [1,3], D. Chew [4,5,9], J. French [6], C. Hammett [7], C. Ellis [8], C. Astley [9], B. Carr [10], J. Lefkovits [11], K. Nalliaih [2], K. Lintern [12], T. Briffa [13], on behalf of SNAPSHOT Investigators

[1] The University Of Sydney, Australia
[2] The George Institute for Global Health, Australia
[3] Cardiologist, Concord Hospital, Australia
[4] Flinders University, Australia
[5] Adelaide Health Service, Australia
[6] University of NSW, Australia
[7] Queensland Health, Australia
[8] Auckland City Hospital, New Zealand
[9] South Australian Health and Medical Research Institute, Australia
[10] NSW Agency for Clinical Innovation, Australia
[11] Monash University, Australia
[12] South Western Sydney Local Health District, Australia
[13] University of Western Australia, Australia

Aim: High quality person-centred data linkage in all-comers admitted for suspected acute coronary syndrome (ACS) provides robust population estimates of mortality and morbidity. This study aimed to determine the proportion of patients hospitalised, deaths and medication dispensed at 6, 12, 24 and 36 months post ACS.

Methods: The original Australian SNAPSHOT ACS cohort included 3381patients admitted to 252 hospitals from 14–27 May 2012. For the present study, the 1773 Australian patients who were discharged alive with a primary diagnosis of ACS were followed-up via data linkage of cross-jurisdictional morbidity, National Death Index and Pharmaceutical Benefit Schedule at time points from the date of hospital separation.

Results: All ACS patients who were discharged alive with data successfully linked ($n = 1663$) had a mean age of 68 ± 13 years, 1088 (65%) were male. In total, during the 36 months after discharge 302 (18%) patients died and 536 (39%) had at least one hospitalisation for cardiovascular disease (CVD) as detailed in Table 1. Among survivors at 36 months, medications dispensed included antiplatelets 75%, statins 85%,

Table 1. *Number (%) of patients with outcomes/procedures in 3 years post ACS.*

	0–6 mths	6–12 mths	12–24 mths	24–36 mths	0–36 mths
Death	66 (4)	32 (2)	86 (5.5)	118 (8)	302 (18)
STEMI	27 (1.7)	6 (0.4)	10 (0.7)	2 (0.1)	34 (2.5)
NSTEMI	101 (6.3)	32 (2)	58 (3.9)	37 (2.7)	143 (11)
UA	130 (8.1)	54 (3.5)	66 (4.5)	50 (3.7)	191 (14)
PCI/CABG	124 (7.8)	29 (1.9)	45 (3)	21 (1.5)	187 (14)

beta-blockers 60%, ACEI/ARBs 64%. In total, ≥3 evidenced-based medications were dispensed for 70% of patients.

Conclusion: Amongst Australian ACS survivors, two in five were readmitted for CVD and nearly one in five died within the three years after discharge. This study highlights the importance of secondary prevention to improve outcomes for ACS survivors.

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Suboptimal Secondary Prevention Post Acute Coronary Syndromes: Insights from the SMART-REHAB Trial

A. Murphy [*], O. Farouque, D. Clark, J. Ramchand, M. Yudi

Austin Health, Melbourne, Australia

Introduction: International guidelines clearly state optimal secondary prevention with targets for blood pressure, cholesterol and diabetes as well as optimal medical therapy and smoking cessation. It is uncertain how many of these targets are met post acute coronary syndromes (ACS).

Methods: SMART-REHAB was a randomised controlled trial assessing the impact of a smartphone-based cardiac rehabilitation programme post ACS. Patients were recruited from 6 major tertiary hospitals in Victoria. We assessed the proportion of patients receiving optimal medical therapy (dual antiplatelet therapy, statin, beta-blocker, ACE inhibition) and those not achieving target BP (<130/80 mmHg), cholesterol (total cholesterol <4 mmol/L and LDL-C <1.8 mmol/L) or diabetic control (HbA1c < 7%) as well as those continuing to smoke at 8-week post ACS.

Results: 168 patients were included (mean age 56 ± 10 years, 57% STEMI). At 8-weeks, the majority of patients were receiving aspirin (99%), a second anti-platelet agent (99%) and statin therapy (98%). The rate of beta-blocker (82%) and ACE/ARB (83%) use was lower. Suboptimal secondary prevention was evident, as seen below, but was not improved with smartphone technology.

	Smartphone	Usual Care	p-value
TC >1.8mmol/L	24%	21%	0.42
LDL-C >1.8mmol/L	38%	45%	0.42
BP >130/80mmHg	24%	74%	0.93
HbA1C > 7%	8%	6%	0.52
Current Smokers	15%	15%	0.76

Conclusion: A significant proportion of patients are not meeting secondary prevention targets, particularly for blood pressure, cholesterol and smoking, despite the use of smartphone technology. An updated approach with the use artificial intelligence and mhealth can be used to up-titrate medication to meet secondary prevention targets.

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Systematic Review of Patient Attitudes Towards Statins and how they Relate to Statin Intolerance

C. Twindyakirana [1,*], D. Jin [2], D. Hare [1], S. Toukhsati [3], A. Macisaac [1], A. Wilson [1], A. Baradi [2]

[1] University of Melbourne, Parkville, Australia
[2] St Vincent's Hospital, Melbourne, Australia
[3] Federation University of Australia, Melbourne, Australia

Objective: Adherence to statins is poor despite evidence of their safety and effectiveness, potentially complicated by statin intolerance. The reasons for statin intolerance are debated; however patient attitudes and beliefs towards statins is an important factor. We conducted a systematic review of the literature exploring the relationship of patient attitudes and beliefs towards statins to statin non-adherence and intolerance.

Methods: Search of three (EMBASE, Medline and PsycINFO) databases for the last 20 years up to March 2019 revealed 28 studies encompassing 31,525 patients.

Results: Mean age was 61.9 ± 4.4 years. Two studies investigated primary prevention, four investigated secondary, while the rest included both. Three studies used open-ended qualitative discussions while the rest used structured quantitative questionnaires, 75% of which tailored their own study-specific questionnaires while the Beliefs about Medicine Questionnaire was the most commonly used standardised questionnaire. Among non-adherers, the most common attitudes and beliefs included lack of perceived benefit, lack of perceived cardiovascular risks, fear of side effects, poor knowledge, disliking medication, and being negatively influenced by media. Statin intolerance was the most common reason for intentional non-adherence. All but one study found that negative health beliefs are associated with non-adherence. None examined the direct relationship between attitudes and beliefs and statin intolerance.

Conclusion: There is consensus in the literature that attitudes and beliefs regarding statins can predict non-adherence and that statin intolerance is the most common reason for intentional non-adherence. Further research is needed regarding the relationship between attitudes and beliefs and statin intolerance.

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The Case for Extended Thromboprophylaxis in Medically Hospitalised Patients – Not Yet Made

J. Cao [1,2,4,*], S. Lee [2], S. Dunkley [3], M. Adams [1], A. Keech [1,2,4]

[1] Department Of Cardiology, Royal Pince Alfred Hospital, Sydney, Australia
[2] Sydney Medical School, Camperdown, Australia
[3] Department of Haematology, Royal Prince Alfred Hospital, Camperdown, Australia
[4] NHMRC Clinical Trial Centre, Camperdown, Australia

Background: The role of extended thromboprophylaxis is established for surgical patients, but not yet for hospitalised medical patients. This systematic review and meta-analysis sought to explore the role of extended thromboprophylaxis for medically ill hospitalised patients.

Methods: Medline, EMBASE and Cochrane Libraries were searched and five randomised controlled trials (EXCLAIM, ADOPT, MAGELLAN, APEX, MARINER) were identified, comprising 20,046 extended and 20,078 standard duration thromboprophylaxis patients.

Results: Extended treatment, compared with standard duration therapy, significantly reduced the risk of symptomatic deep vein thrombosis (RR = 0.47, 95% CI: 0.29–0.78, $p = 0.003$; Fig. 1) and non-fatal pulmonary embolism
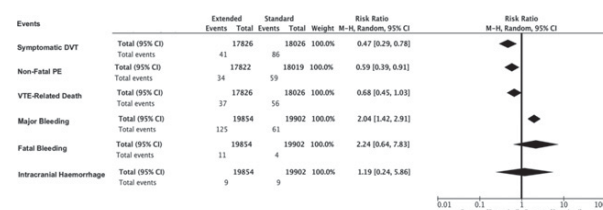

Fig. 1. *Forrest plot of efficacy and safety outcomes between extended and standard duration thromboprophylaxis.*

(RR = 0.59, 95% CI: 0.39–0.91, $p = 0.02$). The risk of venous thromboembolism-related death was comparable between the two groups (RR = 0.81, 95% CI: 0.6–1.09, $p = 0.16$). Extended treatment also doubled the risk of major bleeding (RR = 2.04, 95% CI: 1.42–2.91, $p < 0.001$), without significantly affecting the risk of intracranial bleeding or bleeding-associated death. The cost of preventing one symptomatic deep vein thrombosis and non-fatal pulmonary embolism was found to be $44,960 and $81,306 respectively, which

outweigh the direct cost of managing established venous thromboembolism as previously reported.

Conclusions: Extended duration thromboprophylaxis reduced venous thromboembolic events, but also comparably increased major bleeding. Further trials are warranted in high risk populations who may derive mortality benefits from treatment. Only then could a change in current policy and practice be supported.

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The Impact of Cardiovascular Prevention on the Cost Benefit of Influenza Vaccination for Australian Adults aged 50–64 years old

S. Mahendra Raj[1,*], A. Chughtai[2],
A. Sharma[2], T. Tan[1,3,4,5], R. MacIntyre[6]

[1] Faculty of Medicine University of New South Wales, Kensington, Australia
[2] School of Public Health and Community Medicine University of New South Wales, Kensington, Australia
[3] Westmead Hospital Cardiology Department, Westmead, Australia
[4] Blacktown Hospital Cardiology Department, Blacktown, Australia
[5] University of Western Sydney, Sydney, Australia
[6] Kirby Institute Biosecurity Program University of New South Wales, Kensington, Australia

Increasing evidence suggests that influenza vaccination can reduce coronary heart disease (CHD) outcomes. CHD and influenza cause a significant burden among Australian adults aged 50–64, however, vaccine coverage remains suboptimal. The National Immunisation Program (NIP) funds vaccinations in this group only for those at high risk. The aim of this study was to determine whether expanding the NIP to all adults aged 50–64 to prevent acute myocardial infarction (AMI) and respiratory hospitalisations will be cost beneficial.

A cost-benefit analysis from a governmental perspective was performed using parameters informed by publicly available databases and available literature. Costs included cost of vaccinations and general practitioner consultation while benefits included savings from averted AMI and respiratory hospitalisations.

In the base-case scenario, the proposed policy would prevent 1,482 AMI, 314 influenza/pneumonia and 388 other respiratory hospitalisations in a year. The government would save $8.03 million with an incremental benefit-cost ratio of 1.40. Most savings were from averted AMI hospitalisations. In alternative scenarios cost savings ranged from saving $31.4 million to an additional cost of $15.4 million, with sensitive variation in vaccine administration practices (through general practitioner or pharmacists) and vaccine effectiveness estimates.

Extension of the NIP to adults aged 50–64 is likely cost beneficial to the government, owing to substantial savings in averted AMI hospitalisations. This is sensitive to vaccine administration cost, which varies if provided through general practitioners or pharmacists; and to variation in vaccine effectiveness. Routine influenza vaccination should be considered in all adults at risk of CHD to prevent associated costs.

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The Prevalence of Anxiety and Depression in a Cardiac Rehabilitation Population and its Impact on Adherence: A Cohort Study

A. Rao[1,*], R. Zecchin[2], P. Newton[3],
J. Phillips[1], M. DiGiacomo[1], A. Denniss[3,4],
L. Hickman[1]

[1] IMPACCT, Faculty of Health, University of Technology Sydney, Ultimo, Australia
[2] Western Sydney Local Health District, Blacktown, Australia
[3] Western Sydney University, Parramatta, Australia
[4] Westmead Hospital, Westmead, Australia

Background: Co-morbid depression and anxiety symptoms are frequently under-recognised and under treated in heart disease and negatively impact adherence to medications and recommended lifestyle changes.

Aims: To determine the prevalence, associations and predictors of depression and anxiety in cardiac rehabilitation (CR) participants, the impact of CR on moderate psychological health symptoms, and the relationship between moderate psychological health symptoms and adherence to CR.

Methods: Retrospective cohort study involving people attending CR programs ($n = 5908$) at two hospitals in Western Sydney from 2006–2017. Variables included demographics, diagnoses, cardiovascular risk factors, medication use, participation rates, health-related quality of life (MOS SF-36) and psychological health (DASS-21).

Results: Moderate depression, anxiety or stress symptoms were prevalent in 18%, 28% and 13% of adults attending CR programmes respectively. Adherence to CR was significantly reduced in adults with moderate depression (24% vs 13%), anxiety (32% vs 23%) or stress (18% vs 10%) symptoms compared to those with normal-mild symptoms ($p < 0.001$). Anxiety (Odds Ratio (OR): 4.395; 95% CI 3.363–5.744 $p < 0.001$) and stress (OR: 4.527; 95% CI 3.315–6.181 $p < 0.001$) were the strongest predictors of depression. Depression (OR: 3.167; 95% CI 2.411–4.161) and stress (OR: 5.577; 95% CI: 4.006–7.765; $p < 0.001$) increased the risk of anxiety on entry by more than three times, above socio-demographic, lifestyle factors, diagnoses and quality of life.

Conclusion: Monitoring depression and anxiety symptoms on entry and during CR may assist to improve adherence and identify the need for adjunct psychological health support. Exploring the relevance and use of psychological support strategies within CR programmes is warranted.

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The Unique Contribution of Sociodemographic Factors to Health Literacy in Patients Undergoing Coronary Catheterisation

J. Khoo [1,3,*], L. Ellwood [1], A. Lee [2], E. Curtis [2], J. Weaver [1,4], R. Fernandez [1]

[1] St George Hospital, Sydney, Australia
[2] Wollongong Hospital, Wollongong, Australia
[3] Liverpool Hospital, Sydney, Australia
[4] Royal Prince Alfred Hospital, Sydney, Australia

Aims: This study examined health literacy and its correlations with sociodemographic factors in patients undergoing cardiac catheterisation.

Methods: A cross-sectional survey of patients scheduled for cardiac catheterisation in a tertiary teaching hospital in Sydney was undertaken. Health literacy was measured using a 16 item screening questionnaire comprising six domains. Data was analysed using SPSS version 25.

Results: The 194 participants included 123 males and 71 females. The mean scores for each domain were; navigation 4.05 (SD = 0.91), completing forms 3.84 (SD = 0.79), following medication instructions 4.24 (SD = 0.72), provider-patient interaction 3.86 (SD = 0.80), appointment slips 4.07 (SD = 0.88), and coping strategies 4.04 (SD = 1.25).

Caucasians compared to non-Caucasians had significantly higher overall health literacy ($p = 0.017$) and higher scores in the domains; 'completing forms' ($p = 0.030$), 'following medication instructions' ($p = 0.041$), 'provider-patient interaction' ($p = 0.007$) and 'coping strategies' ($p = 0.011$). Employed compared to unemployed participants had higher overall health literacy ($p = 0.036$) and higher scores in the domains; 'completing forms' ($p = 0.003$) and 'coping strategies' ($p = 0.032$). Participants who completed only primary school education had lower overall health literacy and lower scores in the domain 'completing forms' compared to participants who completed high school ($p = 0.012$ & $p = 0.000$ respectively) and university ($p = 0.000$ & $p = 0.000$ respectively). Females compared to males had higher scores in the domain 'following medication instructions' ($p = 0.049$). Participants who lived with a partner compared to participants who did not had higher scores in the domain 'navigation' ($p = 0.017$).

Conclusion: Our study is one of few to examine health literacy among cardiac catheterisation patients. It demonstrated a complex relationship between health literacy and sociodemographic factors.
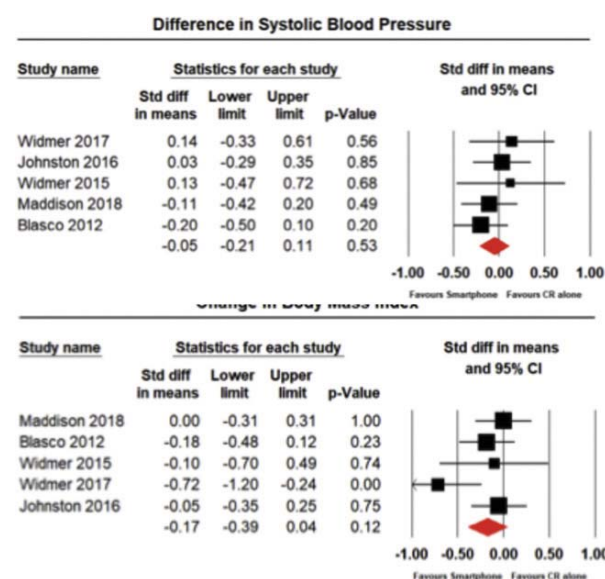
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The Use of Secondary Preventative Smartphone Applications in Coronary Heart Disease (CHD): A Systematic Review and Meta-Analysis

G. Meehan *, P. Kunniardy, A. Murphy, D. Clark, O. Farouque, M. Yudi

Austin Health, Heidelberg, Australia

Background: With the rise of mHealth, a smartphone application (SA) represents a potential secondary preventative strategy for use in cardiac rehabilitation (CR), in the context of CHD.

Difference in Systolic Blood Pressure

Study name	Std diff in means	Lower limit	Upper limit	p-Value
Widmer 2017	0.14	-0.33	0.61	0.56
Johnston 2016	0.03	-0.29	0.35	0.85
Widmer 2015	0.13	-0.47	0.72	0.68
Maddison 2018	-0.11	-0.42	0.20	0.49
Blasco 2012	-0.20	-0.50	0.10	0.20
	-0.05	-0.21	0.11	0.53

Change in Body Mass Index

Study name	Std diff in means	Lower limit	Upper limit	p-Value
Maddison 2018	0.00	-0.31	0.31	1.00
Blasco 2012	-0.18	-0.48	0.12	0.23
Widmer 2015	-0.10	-0.70	0.49	0.74
Widmer 2017	-0.72	-1.20	-0.24	0.00
Johnston 2016	-0.05	-0.35	0.25	0.75
	-0.17	-0.39	0.04	0.12

Methods: A systematic review of 9 studies and a meta-analysis were performed. Databases searched included PubMed, MEDLINE, Embase, DARE, ACP Journal Club and Cochrane Library. Outcomes included were cardiovascular risk factors, clinical events and medication adherence.

Results: A systematic review found that the addition of a SA to CR lead to significantly improved medication adherence, weight loss, body mass index (BMI) and waist circumference. A SA alone, compared to CR, lead to significantly larger reductions in smoking and diastolic blood pressure (BP). However, a meta-analysis found no significant additional improvements when a SA was added to CR, for systolic BP (standardised mean difference (SMD) = −0.05; CI = −0.21–0.11), BMI (SMD = −0.17; CI = −0.39–0.04), or low-density lipoprotein cholesterol (SMD = −0.03; CI = −0.51–0.44).

Change in LDL-cholesterol
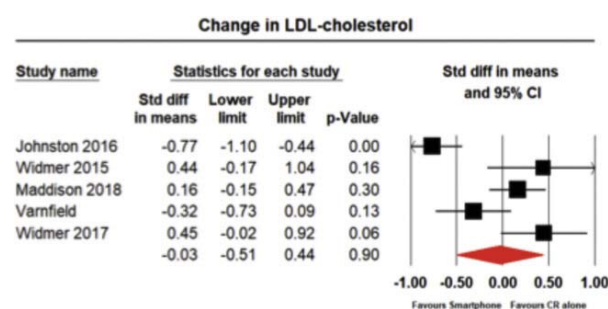
Conclusion: Secondary preventative SAs have potential in CR, in the context of CHD, but further studies must focus on reducing bias and improving SA adherence.

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Trends in Cardiovascular Risk Factors in STEMI Patients at an Urban Centre

S. Kazi [1,*], A. Narayan [1], A. Ong [1],
A. Denniss [1,2,3], D. Tanous [1],
G. Sivagangabalan [1,2], J. Chong [1,2],
D. Wynne [1], J. Thakkar [1], P. Kovoor [1,2],
P. Fahmy [1], C. Chow [1,2,4,5]

[1] Westmead Hospital, Westmead, Australia
[2] Sydney Medical School, University of Sydney, Sydney, Australia
[3] School of Medicine, Western Sydney University Australia, Sydney, Australia
[4] The George Institute for Global Health, Sydney, Australia
[5] Westmead Applied Research Centre, Faculty of Medicine and Health, University of Sydney, Sydney, Australia

Introduction: The profile of cardiovascular risk factors (RF) have been changing in our community with recent reports suggesting they are also changing among patients with myocardial infarction (MI). We sought to examine the RF profile of our ST-elevation MI (STEMI) population and whether the RF profile of STEMI patients have changed over time.

Cardiovascular Risk Factor Profiles Over Time in the STEMI population
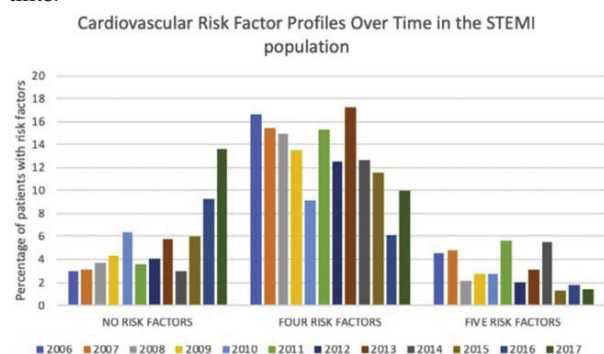
Methods: We performed a retrospective analysis of patients from the Westmead Hospital STEMI database, which includes consecutive patients presenting with STEMI between January 2006 to December 2017. We examined the prevalence of five key RF and prevalence of the number of these RF. The RFs were hypertension, hypercholesterolaemia, diabetes, smoking and family history of ischaemic heart disease (IHD) at age <60 yr.

Results: Of the 3256 STEMI patients during the 12-year period, 20.5% were female, average age 61years, 52% of patients had hypertension, 52% had hypercholesterolaemia, 29% diabetes, 61% smokers and 37% reported a family history of IHD. Over the 12 years, patients with no RFs rose from 3 to 13.6% and there was a reduction from 21 to 11% in patients with a total of >4 RFs. The trends were similar for younger (<60 years of age) versus older patients, patients with and without a history of IHD, and gender.

Conclusion: This study confirms an increasing proportion of patients with fewer risk factors for STEMI over time. This may help identify patient populations in which novel mechanisms may contribute to the aetiology of their STEMI and allow further research into targeted secondary prevention.

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Uptake of a Primary Care Atrial Fibrillation Screening Program (AF-SMART): A Realist Evaluation of Implementation in Metropolitan and Rural General Practice

J. Orchard [1,*], J. Li [1], R. Gallagher [2],
B. Freedman [1], N. Lowres [1], L. Neubeck [3]

[1] HRI/Charles Perkins Centre, University of Sydney, Australia
[2] Susan Wakil School of Nursing, Faculty of Medicine and Health/Charles Perkins Centre, University of Sydney, Sydney, Australia
[3] Edinburgh Napier University, Edinburgh, UK

Background: Atrial fibrillation (AF) screening in people aged ≥65 years is recommended by international guidelines. The AF Screening, Management, and guideline-Recommended Therapy (AF-SMART) implementation studies in general practice include custom-designed eHealth implementation tools.

Aim: To use realist evaluation of an AF screening programme to explain the circumstances in which AF screening worked.

Methods: Realist evaluation of the AF-SMART studies. To develop preliminary theories, we conducted 35 semi-structured interviews with 17 general practitioners (GPs), 9 nurses, 9 practice managers in 13 practices (8 metropolitan, 5 rural). Interview and quantitative screening data were analysed, and contributed to refinement of the programme theory.

Results: Mechanisms through which implementation was most effective related to local practice dynamics, trust, belief in the value of screening, ease of use of the technology and a local champion. Staff/setting characteristics affected development of mechanisms and outcomes e.g. nurses tailored screening approaches according to practice culture and structure. All practices faced similar issues, including time pressure, competing priorities, and occasional technology problems, but these were overcome in certain practices. Where senior GPs felt eHealth tools reflected well on the practice, a greater proportion of patients were screened. In contexts with well-organised workflow and good computer systems, screening was most successful. Regular feedback of data was beneficial for quality improvement and motivation.

Conclusions: an AF screening programme is more successful when the following contextual features are found: team commitment, including a screening champion; well-organised workflow and computer systems; and an overall feeling that AF screening was worthwhile.

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Variations in Responding to Chest Pain, Ambulance Utilisation and Clinical Outcomes Among 10 Ethnic Groups: Time, Ethnicity, and Delay (TED) Study III

K. Wechkunanukul[1,*], S. Ullah[2]

[1] Flinders University, Bedford Park, Australia
[2] South Australian Health and Medical Research Institute, Adelaide, Australia

Objective: This study aimed to determine ethnic differences in responding to chest pain and clinical outcomes in Australia.

Method: The total of 607 patients from nine ethnic groups and Australian who presented with chest pain to a hospital between 2012 and 2014 were included. Data from the emergency department and medical records were extracted and linked for analyses.

Results: The overall median prehospital delay time was 3.7 (1.5, 10.7) hours and the median decision time was 2.0 (0.8, 7.9) hours. Five ethnic groups had significantly longer decision times compared to the Australian group (1.5 hrs); the Sub-Saharan African (4.5 vs 1.5, $p = 0.001$); the North African and the Middle Eastern (4.1 vs 1.5, $p < 0.013$); the South-East Asian (3.9 vs 1.5, $p = 0.001$); the North-East Asian (3.0 vs 1.5, $p = 0.006$); and the Oceanian groups (2.4 vs 1.5, $p = 0.035$). Ethnic patients were 60% less likely to respond to chest pain within one hour (odds ratio 0.40, (0.23–0.68), $p = 0.001$). There

was no significant ethnic difference in ambulance utilisation and receiving the Percutaneous Coronary Intervention and angiogram. However, ethnic patients had significantly higher readmission rates at 30-day and 6-month than Australian patients (33.3% vs 9.4%, $p = 0.021$; and 11.85% vs 5.0%, $p = 0.003$ respectively).

Conclusions: Ethnic differences in responding to chest pain do exist, and ethnicity is an associated factor with a longer delay in seeking care and with a higher readmission rate. To reduce the delays and improve patient outcomes, appropriate health campaigns focusing on ethnic populations and implementing cultural competency into practice are recommended.

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ANZET Interventional (568–712)

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A Retrospective Analysis of Patients with Severe Aortic Stenosis at The Townsville Hospital, the Only Tertiary Interventional Cardiology Centre in North Queensland

M. Munoz[1,2,*], K. Gopal[1,2], N. Danda[1,2], R. Schrale[1,2]

[1] The Townsville Hospital, Townsville, Australia
[2] James Cook University, Townsville, Australia

Introduction: Surgical aortic valve replacement (AVR) and transcatheter aortic valve replacement (TAVR) are the only effective treatments for severe aortic stenosis (AS) however, a significant proportion of patients do not receive interventions due to excessive risk factors. Literature suggests that as AVR techniques continue to improve the threshold for AVR, particularly in asymptomatic AS will become less stringent.

Aim: To describe the burden of untreated severe aortic stenosis at the Townsville hospital.

Method: Retrospective single centre audit of patients with severe AS on transthoracic echocardiography (TTE) between January 2012 and December 2014. Criteria was defined by a mean aortic valve gradient (MG) of ≥ 40 mmHg in the context of a visually stenosed valve. Non-valvular causes were excluded. Patients who received AVR or TAVR by 1 year were grouped under the intervention arm, those who did not were grouped in the non-intervention arm. Mortality rates were calculated with the cohorts.

Results: 146 patients were identified, with range MG 61 mmHg, mean 52 mmHg. 71 patients (49%) underwent intervention with AVR (69; 42%) or TAVR (2; 1%) and 75 (51%) patients did not. One year mortality data was available in 138 patients (66 intervention group, 49 non-intervention arm). One year mortality was 11% (7 patients) in the interventional group vs 53% (26 patients) in the non-interventional group. Nine patients (6%) received AVR after 1 year and 14 patients underwent balloon aortic valvuloplasty (BAV).

Conclusion: Consistent with the existing literature, there is a significant proportion of patients with severe AS who do not receive valvular intervention.

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A Study on the Safety of Performing Rotational Atherectomy (RA) without Upfront Temporary Transvenous Pacing (TTP) Compared to Upfront TTP

R. Lim*, E. Kalman, S. Burgess, S. Lo, S. Zaman

Monash Heart, Clayton, Australia

Introduction: Bradycardia and heart block are common complications of rotational atherectomy (RA) often necessitating temporary transvenous pacing (TTP). We aimed to establish if RA is safe without up-front TTP.

Methods: Consecutive patients undergoing percutaneous coronary intervention from a tertiary teaching hospital were entered into a registry with procedural, in-hospital and 30-day outcomes prospectively obtained. Further RA data was retrospectively collected regarding procedural up-front TTP, bradycardia and chronotropic stimulants. Patients without up-front TTP were compared to patients with up-front TTP. The primary endpoint was intraprocedural hypotension (systolic BP drop to ≤90 during RA), inotropic or chronotropic pharmacological support and urgent intraprocedural TTP. Secondary outcomes included intraprocedural bradycardic events and TTP-related complications.

Results: RA was used in 129 patients with up-front TTP in 17.1% (22/129). There was no significant difference between up-front versus no-upfront TTP patients in the primary endpoint (27.2% versus 33.6%, $p = 0.80$)), need for intraprocedural pharmacological support (9.1% versus 17.8%, $p = 0.49$), intraprocedural hypotension (14.9% versus 15%, $p = = 0.74$). Subgroup analysis for RCA and LCx lesions (60 non-upfront versus 17 upfront) revealed no significant difference for all primary endpoints (40.0% versus 35.2% $p = 0.47$). Bradycardic events occurred in 23.4% (25/107) of the no-upfront TTP patients including 4.7% (5/107) ventricular standstills, 4.7% (5/107) 3rd degree HB and 5 (4.7%) 2nd degree HB. Urgent intraprocedural TTP was required in 0.9% (1/107).

Conclusion: Upfront TTP did not significantly reduce events of haemodynamic instability during RA. While bradycardic events were frequent in patients without upfront TTP, pharmacological chronotropic support appeared sufficient to maintain haemodynamic stability.

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A Systematic Review and Meta-analysis on Epidemiology, Angiographic Variants and Outcomes in Spontaneous Coronary Artery Dissection

K. Franke[1,2,*], H. Marshall[1], M. Worthley[1,2,3], P. Psaltis[1,2,3]

[1] *The University Of Adelaide, Adelaide, Australia*
[2] *South Australian Health and Medical Research Institute, Adelaide, Australia*
[3] *Department of Cardiology, CALHN, Adelaide, Australia*

Background: Spontaneous Coronary Artery Dissection (SCAD) is an elusive but increasingly recognised cause of Acute Coronary Syndrome (ACS), particularly among females. Most knowledge about SCAD has arisen from small to medium sized cohort studies that have been published since 2012.

Purpose: This systematic review and meta-analysis aimed to provide an update on SCAD's association with cardiovascular risk factors, angiographic variants and outcomes.

Methods: The term "Spontaneous Coronary Artery Dissection" was searched in PubMed, EMBASE and SCOPUS on the 2nd of February 2019, yielding a total of 1517 articles. Following exclusion, 31 original studies that reported at least one desired parameter in patients with SCAD were included. Statistical analysis was performed independently for each parameter using random mixed effects models.

Results: Of the k = 31 studies ($n = 77,025$ patients), only 3 were published before 2012 ($n = 68$). Mean age was 62.4 years and 85.1% [78.9%–89.8%, $I^2 = 91.7$] were female. Importantly, only 37.4% [30.0%–45.4%, $I^2 = 77.0$, k = 10] were associated with a traditional Type 1 angiographic appearance. Yearly incidence was 3.4% [2.4%–4.4%, $I^2 = 73.4$] for SCAD recurrence and 5.8% [4.1%–7.5%, $I^2 = 85.7$] for MACE. Incidence of MACE at follow-up was 4.1% [1.7%–9.9%, $I^2 = 74.0$] for conservative treatment and 7.2% [5.1%–10.3%, $I^2 = 43.7$] for PCI ($p = 0.14$).

Conclusions: This meta-analysis reveals a small but important risk of recurrence and MACE. Furthermore, a majority of SCAD cases present with non-traditional angiographic appearances highlighting the need for increased familiarity with this condition among treating interventionalists.

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A Systematic Review of Transcatheter Mitral Valve-in-valve Replacement for Failed Prosthesis

K. Hyasat*, R. Markham, C. Raffel, K. Poon

The Prince Charles Hospital, Chermside, Australia

Transcatheter mitral valve-in-valve (TMVIV) for failed bioprosthetic valves is an emerging alternative to surgical re-

operation in high risk patients. In this systematic review, we assessed the outcomes of mitral valve-in-valve replacement.

Methods: A thorough computer-based search was performed using 4 major databases. We included studies utilising TMVIV replacement in failed bioprosthetic valves, mitral ring repairs and mitral clips. The 30-day and outcome of all-cause mortality, stroke, major bleeding and reintervention was analysed.

Results: Seventeen observational studies were included in the analysis which comprised of 558 patients (437 bioprosthetic mitral valves, 110 mitral rings and 11 mitral clips). The mean age was 75 years with 39% of patients being male. 42.7% (238 patients) had New York Heart Association class 3 or 4 symptoms. The mean Society of Thoracic Surgeons score was 12.5%. Mean preoperative left ventricular ejection fraction was 55.5%. Patients with underlying mitral valve disease included 13.1% (73 patients) with mitral stenosis, 28% (158 patients) with mitral regurgitation and 10% (58 patients) with mixed mitral disease. Overall analysis demonstrated a low 30-day all-cause mortality of 2.5%. The rates of stroke and bleeding were also low at 0.7% (4 patients) and 6.8% (38 patients) respectively. 2.7% (16 patients) required reintervention with 0.4% (2 patients) needing surgical replacement and 0.4% (2 patients) with further valve-in-valve procedure.

Conclusion: TMVIV is a safe and feasible option in patients with failed mitral valve prosthesis who are high surgical risk for re-operations.

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Abnormal Nail Fold Capillaroscopy Findings in Patients with Chronic Total Occlusions (CTO)

U. Allahwala [1,2,*], M. Ward [1], J. Weaver [3], R. Bhindi [1,2]

[1] Department of Cardiology, Royal North Shore Hospital, Sydney, Australia
[2] The University of Sydney, Sydney, Australia
[3] Department of Cardiology, Royal Prince Alfred Hospital, Sydney, Australia

Aims: Nail fold capillaroscopy (NFC) allows a simple, non-invasive direct examination of the microvasculature. NFC abnormalities have previously been associated with a number of coronary artery disease processes, in particular microvascular dysfunction. We sought to determine the prevalence of NFC abnormalities in patients with a CTO.

Methods & Results: 81 patients presenting for coronary angiography between June 2018 and January 2019 were studied. NFC was performed in 77 patients using a standardised protocol, prior to coronary angiography. An abnormal NFC was defined as the presence of microhaemorrhages, dilated capillaries or tortuous capillaries. Of those patients who underwent NFC, 27 (35.1%) had a CTO, whilst 50 (64.9%) had non-obstructive coronary artery disease (CAD).

An abnormal NFC was seen more commonly in patients with a CTO as compared to those with non-obstructive CAD (33.3% vs 8%, $p < 0.05$). Patients with an abnormal NFC were more likely to have hypercholesterolaemia, than those with-

out (100% vs 89.1%, $p < 0.01$). In patients with an abnormal NFC compared with those without, there was no difference in age, gender, presence of atrial fibrillation or other cardiovascular risk factors. In those with a CTO, there was no correlation between NFC findings and degree of collateralisation.

Conclusions: An abnormal NFC is more commonly seen in patients with a CTO, which may reflect higher degree of coronary artery disease and microvascular dysfunction. NFC should be further investigated to determine its utility in routine cardiovascular screening and assessment (Fig. 1).

Fig. 1. *Example of a patient with a microhaemorrhage (white arrow) identified on NFC.*

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Activated Clotting Time Does Not Predict Radial Access Bleeding Complications

A. Bailey[*], M. Fryer, K. Hall, E. Hogg, E. Levy, S. Cox

Sunshine Coast University Hospital, Sunshine Coast, Australia

Background: In femoral access, activated clotting time (ACT) is used to guide sheath removal to reduce bleeding access site complications. Our local radial access protocol mandates immediate sheath removal followed by a standardised compression time irrespective of heparin dosing. We hypothesized that end-of-case ACT was an independent predictor of radial access bleeding complications.

Method: We prospectively collected end-of-case ACT for the majority of procedures performed over a 3-month period and documented clinical bleeding events – forearm haematoma graded as per EASY criteria and pseudoaneurysm.

Results: Complete data was available for 235 patients, 52% of procedures were performed for acute coronary syndromes and 35% underwent PCI. The mean heparin dose was 5987 units (0–20 000 units) with a mean ACT 169 s (95–393). 8 patients experienced a significant bleeding complication – 6 patients with significant haematoma, 2 pseudoaneurysms.

ACT, however, was not a statistically significant predictor of complications (OR 1.006, CI 0.990–1.023, $p = 0.46$).

Discussion: Although the complication rate in radial access remains low, bleeding complications can have a significant impact on post procedural recovery. From our data, ACT did not correlate with bleeding complications. We suggest other factors, such as blood pressure, compression time and compression device technique are associated. A negative aspect of our study is that we did not assess routinely for radial artery occlusion. We are currently performing a larger study to better understand the association between bleeding complications and radial artery access whilst still maintaining a low rate of radial artery occlusion.

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Acute Coronary Collaterals Reduce Mortality and Improve Left Ventricular Function in Patients Presenting with ST Elevation Myocardial Infarction (STEMI)

U. Allahwala [1,2,*], D. Nour [1,4], M. Ray [1], H. Rasmussen [1,2], P. Hansen [1], G. Figtree [1,2], G. Nelson [1], J. Weaver [3], M. Ward [1], R. Bhindi [1,2]

[1] Royal North Shore Hospital, Sydney, Australia
[2] The University of Sydney, Sydney, Australia
[3] Department of Cardiology, Royal Prince Alfred Hospital, Sydney, Australia
[4] James Cook University, Townsville, Australia

Aims: The rapid recruitment of coronary collaterals at the time of an ST elevation myocardial infarction (STEMI) is observed frequently during primary percutaneous coronary intervention (pPCI), although their impact on prognosis remains uncertain.

Methods & Results: We reviewed patients presenting for pPCI or rescue PCI from February 2012 to December 2018. 1,416 patients were included in the analysis. Mean age was 64.8 (±13.66) with 22.8% females, and mean BMI 27.3 kg/m^2 (±4.87). The left anterior descending artery was the most common culprit vessel (46.8%) followed by the right coronary artery (38.6%) and the left circumflex artery (14.5%). 1,099 patients (77.6%) had poorly developed collaterals (Rentrop grade 0/1), with 317 (22.4%) having well developed collaterals (Rentrop grade 2/3).

Patients with well-developed collaterals were younger (63.1 vs 65.3, $p < 0.01$), less likely to be female (18.6% vs 24.0%, $p < 0.05$) and had a greater symptom onset to angiography time (656.3 mins vs 444.5 mins, $p < 0.0001$). Well-developed collaterals had a higher opening systolic blood pressure (127.4 mmHg vs 122.3 mmHg, $p < 0.01$).

The presence of well-developed collaterals was associated with a lower in-hospital (2.4% vs 7.1%, $p < 0.0001$) and 1-year (7.5% vs 18.7%, $p < 0.01$) mortality and lower rates of left ventricular dysfunction (38.8% vs 68.3%, $p < 0.0001$). On multivariate analysis, after correcting for age, sex and ischaemic time, coronary collaterals remained independently predictive of in-hospital mortality ($p < 0.05$).

Conclusions: In patients presenting with STEMI, well-developed collaterals is associated with improved left ventricular function and independently associated with lower in-hospital and 1-year mortality. The pathophysiological mechanism of collateral formation should be further studied to elucidate any potential therapeutic targets.

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An Overview of the Melbourne Interventional Group Registry: Results from 34,797 Percutaneous Coronary Intervention Procedures 2005–2017

L. Dawson [1,*], D. Dinh [2], S. Duffy [2,3], D. Clark [4], C. Reid [2], A. Brennan [2], N. Andrianopoulos [2], C. Hiew [5], M. Freeman [6], E. O'Queli [7], W. Chan [3], A. Ajani [1,2]

[1] Royal Melbourne Hospital, Melbourne, Australia
[2] Monash University, Melbourne, Australia
[3] Alfred Health, Melbourne, Australia
[4] Austin Health, Melbourne, Australia
[5] University Hospital, Geelong, Australia
[6] Eastern Health, Melbourne, Australia
[7] Ballarat Hospital, Melbourne, Australia

Background: The Melbourne Interventional Group (MIG) Registry has collected data on percutaneous coronary intervention (PCI) outcomes as practice has evolved over the last 15 years. We aim to describe the current MIG PCI cohort at large and to identify contemporary trends in Australian PCI.

Methods: Data were prospectively collected on 34,797 consecutive PCI procedures at six Victorian public hospitals from 2005 to 2017. Patients were divided into three time groups (A: 2005–2008, B: 2009–2013, C: 2014–2017) for trends analysis.

Results: Overall cohort mean age was 64 ± 12 years, 77% were male. Across the three time periods, total procedural numbers remained similar, but with increasing rates of STEMI, out-of-hospital cardiac arrest (OHCA), and cardiogenic shock (CS) as indication for PCI (all $p < 0.001$). Drug-eluting stents were more frequently used (A: 40%, C: 71%, $p < 0.001$), radial access more frequently used (A: 5%, C: 50%, $p < 0.001$), and treated lesions were more frequently of higher complexity (ACC/AHA type B2/C, A: 50%, C: 58%, $p < 0.001$). Hospital length-of-stay and 30-day mortality slightly increased, while 12-month mortality remained stable. 30-day mortality among common subtypes was 0.2% following elective PCI, 0.9% following NSTEMI, 2.3% post STEMI (in the absence of CS or OHCA), and 33% in patients with OHCA or CS. Long-term mortality for patients surviving to 30-days was similar between indication subtypes out to 13 years.

Australian PCI Outcomes Over 14 years 2005–2017

	2005–2008	2009–2013	2014–2017	*p*-value
No. of procedures	10,623	13,126	11,048	
30-Day Mortality:	233 (2.2)	374 (2.9)	356 (3.2)	<0.001
12-Month Mortality	460 (4.3)	641 (4.9)	479 (4.3)	0.06

Conclusions: Patient selection, procedural technique and outcomes continue to evolve among PCI cohorts. 30-day mortality after PCI has slightly increased and may relate to increased presentation with OHCA and CS.

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Anatomical Assessment of Coronary Collaterals Predicts Procedural Success in Patients Undergoing Chronic Total Occlusion Percutaneous Coronary Intervention (CTO-PCI)

U. Allahwala [1,*], K. Kott [1,2], A. Bland [1], M. Ward [1], R. Bhindi [1,2]

[1] Department of Cardiology, Royal North Shore Hospital, Sydney, Australia
[2] The University of Sydney, Sydney, Australia

Aims: The coronary collateral circulation has numerous benefits during CTO PCI, including visualisation of the distal vessel, as a conduit to cross the distal cap and maintaining perfusion to the occluded vessel. The degree of collateralisation is not included in current predictive scoring tools. We sought to determine whether the degree of collateralisation was associated with CTO PCI outcomes.

Methods & Results: We reviewed patients undergoing CTO PCI at our centre from April 2010 to February 2019. After excluding patients with only bridging collaterals or a bypass graft as the major collateral vessel, 275 patients were assessed. 94 patients (34.2%) had an extensive collateral formation as defined as Rentrop grade 3, whilst 65.8% had less developed collaterals.

Those with well-developed collaterals were more likely to be females (26.6% vs 12.2%, $p < 0.01$) than those without, although there were similar ages in both cohorts (69.0 vs 69.1, $p = 0.94$).

The presence of well-developed collaterals was associated with a higher rate of procedural success (92.5% vs 62.4%, $p < 0.0001$). When an antegrade approach was the only strategy attempted ($n = 193$), well developed collaterals remained predictive of success (95.5% vs 65.1%, $p < 0.0001$). When a retrograde approach was initially trialled ($n = 45$), well developed collaterals had a trend towards higher CTO PCI success rate (94.4% vs 77.8%, $p = 0.10$).

Conclusions: The degree of collateralisation is predictive of CTO PCI being successful, even in those undergoing an anterograde revascularisation strategy. Collateral circulation grading should be considered in the development of scoring tools aiming to predict CTO PCI outcomes.

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Are Older Women More at Risk Following Percutaneous Coronary Intervention in Australia? Cohort Analysis from the GenesisCare Outcomes Registry

D. Eccleston [1,2,*], A. Conradie [2], J. Chandrasekhar [2], E. Chowdhury [3], P. Sage [2], T. Rafter [2]

[1] University of Melbourne, Parkville, Australia
[2] GensisCare, Sydney, Australia
[3] Monash University, Melbourne, Australia

Introduction: Older patients are have a greater risk of in-hospital death and bleeding compared with younger patients after percutaneous coronary intervention (PCI). Older patients are more frequently women, and women have worse outcomes after PCI than men. However, the effect of sex on outcomes after PCI in elderly patients is unknown.

Methods: Patients undergoing PCI in the GCOR multicenter Australian dataset were stratified by age (≤ 75, >75). We assessed the association of 1 year outcomes (death, MACE) with age group and sex adjusted for baseline clinical/lesion characteristics.

Results. Data were available for 10,986 patients including 2507 (22.8%) women and 8479 (77.2%) men. Women were older (71.6% ± 10.3 vs 67.3 ± 10.5 years $p < 0.001$). Older women were more likely to have heart failure (8.8% vs 6.4% $p < 0.01$), but less likely to have smoked, have prior MI, PCI, CABG or CKD than elderly men. Overall, at 1-year women had higher rates of mortality (1.9% vs 1.2% $p = 0.012$), and unplanned readmission (10.9% vs 8.8% $p = 0.004$) however less TVR (0.8% vs 1.5% $p = 0.01$) than men although there was no interaction by sex ($p = 0.83$) (Table 1).

Table 1.

Outcome	Women ≤75	Men ≤75	*p*	Women >75	Men >75	*p*
Radial	30.6%	32.8%	0.12	25.4%	29.3%	0.03
DES	77.5%	78.7%	0.32	66.0%	71.2%	0.004
Readmission	7.6%	6.4%	0.07	7.9%	7.6%	0.77
1 year death	1.0%	0.7%	0.25	3.3%	2.9%	0.51
1 year MACE	2.4%	2.5%	0.81	4.4%	4.3%	0.98

Conclusion: Although elderly patients do have a gradient of risk of adverse events after PCI compared to younger patients, in patients over 75 years of age there was no difference in risk-adjusted 1-year outcomes between women and men.

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Are Women Managed Differently in Terms of Guideline-directed Medication Usage and Adherence After Percutaneous Coronary Intervention for Acute Coronary Syndromes? Analysis from the GenesisCare Outcomes Registry

J. Chandrasekhar [1,2,*], E. Chowdhury [1], S. Worthley [2], D. Eccleston [1,2]

[1] Monash University, Melbourne, Australia
[2] Genesis Care, Melbourne, Australia

Introduction: Patients undergoing percutaneous coronary intervention (PCI) are susceptible to decreasing adherence to medications over long term follow-up. We sought to evaluate sex-differences in the rates of guideline directed medications at discharge and during 1-year follow up after PCI for acute coronary syndrome (ACS) from the multicenter prospective GenesisCare Outcomes Registry (GCOR) dataset.

Methods: We assessed the rates of guideline directed discharge medications and compliance to medications over 1-year follow up in men and women undergoing ACS PCI from the prospective multicenter GCOR Australian dataset.

Results. Out of 4956 patients undergoing PCI for ACS, including 1195 women and 3759 men, there were no differences in the rates of ASA, $P2Y_{12}$ inhibitors, ACEI/ARB and beta-blockers, but women received statins less often than men (93.3% vs. 95.5%, $p = 0.003$). Women received potent $P2Y_{12}$ inhibitors less often than men (ticagrelor 23.7 vs. 27.3%, $p = 0.015$; prasugrel 4.8% vs. 9.4%, $p < 0.01$). At 1-year women received lower rates of aspirin and statins than men without differences in rates of ACEI/ARB and beta blockers (Table 1).

Table 1.

1-year adherence	Women	Men	p-value
ASA	787 (87.8%)	2622 (92.4%)	<0.001
P2Y12 inhibitor	612 (65.2%)	1988 (67.8%)	0.14
Statin	799 (89.2%)	2655 (93.8%)	<0.001
ACEI/ARB	614 (65.4%)	2014 (68.8%)	0.054
Beta blockers	500 (56.2%)	1513 (53.6%)	0.17

Conclusion: Women undergoing ACS PCI received significantly lower rates of ASA and potent $P2Y_{12}$ inhibitors at discharge than men. At 1-year women continued to receive lower rates of ASA as well as statins with a trend for lower rates of ACEI/ARB than men.

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Assessment of Coronary Artery Obstruction Risk During Transcatheter Aortic Valve Replacement Utilising 3D Printing

J. Russo *, R. Gurvitch, T. Yuen

Royal Melbourne Hospital, Melbourne, Australia

Introduction: Current imaging techniques inadequately rule out coronary artery obstruction (CAO), a potentially fatal complication during transcatheter aortic valve replacement (TAVR). Advancements in 3D-printing may allow the development of models capable of replicating cardiac anatomy and predicting CAO. We sought to simulate TAVR utilising this 3D-technology to improve CAO risk assessment and procedural safety.

Methodology: Eleven patients with aortic stenosis at high risk of CAO during TAVR were selected for 3D-printed modelling. The relevant anatomy to perform TAVR was precisely reconstructed from CT imaging with Materialise Heart Print-Flex technology. An appropriately sized valve prosthesis was deployed in vitro in each 3D-printed model and coronary ostia were assessed for obstruction.

Results: Model-derived results were compared to clinical outcomes. Two high-risk TAVR cases were abandoned following transient CAO during balloon aortic valvuloplasty (BAV). In both cases, the 3D-model precisely simulated the clinical findings, demonstrating complete CAO either by a prominent calcium nodule or by the valve leaflet itself. In another case, the BAV outcome was uncertain, but the 3D-simulation demonstrated patency and successful TAVR implantation was undertaken with no obstruction. In other cases, no obstruction was demonstrated, and all underwent successful and uncomplicated TAVR.

Conclusion: In this proof of concept study, model-derived TAVR simulation appears to correlate well to clinical outcomes. 3D-printed models of patients at high-risk of CAO may be utilised in pre-procedural planning to accurately predict this complication. 3D-models may help minimise TAVR complications leading to safer patient outcomes, especially as lower-risk surgical cohorts are considered in the future.

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Association Between Gender and Quality of Life Post Acute Coronary Syndrome: A Victorian Cardiac Outcomes Registry (VCOR) Study

Y. Koh [3,*], J. Stehli [3], M. Alvarenga [1,2], A. Brennan [4], D. Dinh [4], J. Lefkovits [4,5], S. Zaman [1,2]

[1] Monash Cardiovascular Research Centre, Monash University, Melbourne, Australia
[2] Monash Heart, Monash Medical Centre, Melbourne, Australia
[3] Cardiology Department, The Alfred, Melbourne, Australia
[4] Monash University, Centre of Cardiovascular Research and Education in Therapeutics, Melbourne, Australia
[5] Cardiology Department, Royal Melbourne Hospital, Melbourne, Australia

Background: Women have reported higher mortality and major adverse cardiovascular events (MACE) following acute coronary syndrome (ACS) compared to men. Gender differences in quality of life (QoL), depression and anxiety following ACS are not well described.

Methods: Consecutive patients from 2012–2016 who received percutaneous coronary intervention (PCI) for ACS were prospectively recruited as part of the Victorian Cardiac Outcomes Registry (VCOR). Patients were followed throughout their time in hospital and at 30 days. QoL was assessed using the EuroQol-5D (EQ-5D) instrument by telephone at 30 days. Multivariate analysis to determine independent predictors of QoL was performed.

Results: A total of 16,355 patients underwent PCI for ACS (23.4% females). Female patients were significantly older (mean age 67.9 +/-12.7 yrs vs 63.8 +/− 12.5 yrs) with more diabetes, history of cerebrovascular disease or renal failure. However, significantly more males than females presented with cardiac arrest or required intubation. At 30 days, 2,368 (61.7%) females and 7,905 (63.1%) males completed the EQ-5D instrument. Males were significantly less likely than females to have persistent issues in all EQ-5D domains including mobility (OR 0.55, 95% CI 0.48–0.62), personal care (0.63; 0.52–0.77), activities of daily living (0.61; 0.55–0.69), pain/discomfort (0.68; 0.60–0.78), and anxiety/depression (0.63; 0.56–0.71).

Conclusions: Female gender is an independent predictor of poorer QoL, anxiety and depression at 30 days following PCI for ACS, independent of age, comorbidities and severity of ACS presentation, as determined by presentation with cardiac arrest or intubation requirement.

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Association of Peri-Procedural Intravenous Morphine Use on Clinical Outcomes in ST-Elevation Myocardial Infarction (STEMI) Treated by Primary Percutaneous Coronary Intervention: Systematic Review and Meta-Analysis

R. Batchelor [*], D. Liu, J. Bloom, S. Noaman, W. Chan

Department of Cardiology, Alfred Health, Melbourne, Australia

Background: Morphine analgesia may affect absorption of co-prescribed P2Y12 antagonists attenuating platelet inhibition. The impact of peri-procedural intravenous (IV) morphine administration on clinical outcomes in patients undergoing primary percutaneous coronary intervention (PPCI) for ST-elevation myocardial infarction (STEMI) is not well-defined.

Methods: Analysis of the electronic databases MEDLINE, EMBASE, CENTRAL, Scopus, Web of Science and Clinical-Trials.gov for association of peri-PCI IV morphine use with myocardial infarction (MI) and mortality.

Results: Eleven studies (1 randomised controlled trial; 10 cohort studies) were included for systematic review. Five studies, including 3,748 patients were included in meta-analysis of the primary outcome. Of 3,748 patients, 2,239 were treated concurrently with ticagrelor, 1,256 treated with clopidogrel and 253 with prasugrel. As shown in the Figure 1, there
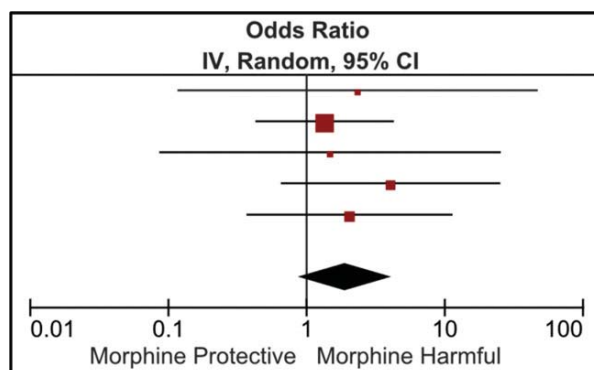

Figure 1. *Meta-analysis of in hospital or 30 day MI with peri-PCI IV morphine in STEMI.*

was a trend towards increased risk of in-hospital or 30-day myocardial infarction with IV morphine (odds ratio 1.88; 95% CI 0.87–4.09, I2 0%). Across seven studies and 6,585 patients, no increased risk of mortality at the same time points was evident (odds ratio 0.70, 95% CI 0.40–1.23, I2 19%).

Conclusion: Peri-PCI IV morphine administration during STEMI was associated with a greater risk of in-hospital or 30-day recurrent MI. While not reaching statistical significance, this signal of increased risk warrants further randomised trial data.

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Association of Pollen Count with Short Term Clinical Outcomes in Different Subtypes of Acute Coronary Syndrome (ACS)

O. Al-mukhtar[1,*], S. Vogrin[1,2], S. Noaman[1,2,3], D. Dinh[4], A. Brennan[4], C. Reid[4], J. Lefkovits[4], Y. Cheng[1], N. Cox[1,2], W. Chan[1,2,3]

[1] *Western Health, Melbourne, Australia*
[2] *University of Melbourne, Melbourne, Australia*
[3] *Alfred Health, Melbourne, Australia*
[4] *Victorian cardiac Outcomes Registry, Melbourne, Australia*

Background: Changes in levels of environmental particulate matter may affect human health such as exacerbation of asthma with severe pollen count. We aimed to assess the association of pollen count as a variable environmental factor with incidence and outcomes of different subtypes of ACS.

Methods: We retrospectively reviewed data for 15,379 patients presenting with ACS treated with percutaneous coronary intervention between January 2014 and December 2017 enrolled in the Victorian Cardiac Outcomes Registry. Baseline, clinical and procedural characteristics were analysed and compared with daily pollen count data (low pollen <50 grains/m^3, high pollen $\geq$ 50 grains/m^3) of the same period obtained from the Melbourne Pollen Registry. 30-day major adverse cardiac and cerebrovascular events (MACCE) were assessed.

Results: Of 15,379 ACS patients, 7,122 were ST-elevation myocardial infarction (STEMI), 6,781 were Non-ST-elevation myocardial infarction (NSTEMI) and 1,476 were unstable angina (UA). Mean age was 62.5 with predominant male gender of 76%. There was no correlation observed between daily pollen count and the incidence of subtypes of ACS (correlation coefficients (r) for all ACS, STEMI, NSTEMI and UA were 0.06, 0.009, 0.083 and 0.003 respectively, all $p > 0.05$). Similarly, neither high nor low pollen count on the day of ACS presentation was associated with increased odds of in-hospital (OR 1.03, 0.63–1.72; OR 1.01, 0.82–1.24) or 30-day MACCE (OR 0.71, 0.47 −1.07; OR 0.94, 0.81–1.09), all $p > 0.05$.

Conclusions: Variability in daily and seasonal pollen count did not appear to be associated with incidence or clinical outcomes of different subtypes of ACS.

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Australian Experience with Left Atrial Appendage Closure in Atrial Fibrillation Post Medicare Benefits Scheme (MBS) Approval

Y. Yu[1,*], A. Berger[2], K. Chan[1]

[1] *Royal Prince Alfred Hospital, Camperdown, Australia*
[2] *Liverpool Hospital, Liverpool, Australia*

Introduction: Percutaneous left atrial appendage closure (LAAC) was approved by the Therapeutic Goods Administration as an alternative therapy for non-valvular AF patients who are eligible for/or contraindicated to anticoagulation. MBS listing followed, expanding access for patients with restricted indications. An increase in new operators was noted. This study evaluates the procedural success and complication rates following a broader adoption of the WATCHMAN device.

Methods: First 200 consecutive cases using the WATCHMAN device (Boston Scientific) post MBS listing were analysed. Data on clinical characteristics, device parameters, acute procedural outcomes and complications were available.

Results: Mean age was 78 years (range 59–95), with a male predominance. AF was paroxysmal, persistent and permanent, in 52%, 16%, and 32%, respectively. Median CHA_2DS_2-VASc score was 4 (range 2–7). Indication for LAAC was bleeding or stroke on oral anticoagulation (OAC) in 62%, contraindication to OAC in 10%, intolerant to OAC in 4%, personal choice in 2% and unknown in 22%. Devices used per case was 1.2 (range 1–3), median device size was 27 mm, with 40% performed by inexperienced implanters. Deployment was successful in all patients. Absence of peri-implant leak was seen in 196 patients. Complications included 1 case of pericardial effusion and 1 case of the device been inadvertently disconnected from the core wire.

Conclusions: Safety concerns relating to real world experience of therapeutic devices are warranted. Despite an increase in inexperienced operators, procedural success with the WATCHMAN device was high with a low incidence of complications.

Continued surveillance is required to establish long-term clinical outcomes.

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Balloon Aortic Valvuloplasty in the Era of Transcatheter Aortic Valve Implantation - A Review of Complications, Mortality and Destination Therapy

A. Mowbray [1,*], J. Ciofani [1], A. Soomro [1], R. Bhindi [1,2], K. De Silva [3,4], K. Asrress [1,4,5]

[1] University Of Sydney, Sydney, Australia
[2] Royal North Shore Hospital, Sydney, Australia
[3] Bristol Heart Institute & University of Bristol, Bristol, United Kingdom
[4] King's College London British Heart Foundation Centre of Excellence, The Rayne Institute, St. Thomas' Hospital, London, United Kingdom
[5] Bankstown-Lidcombe Hospital, Sydney, Australia

Aims: To review the complications, mortality and destination therapy of patients undergoing balloon aortic valvuloplasty (BAV) in the era of transcatheter aortic valve implantation (TAVI).

Methods: A systematic literature search identified journal articles reporting the outcomes of adult patients undergoing BAV procedures. Cohorts of 50 or more patients undergoing BAV between January 2002 and May 2018 were included in the review. Patient baseline characteristics, surgical risk scores, complications, short- and long-term mortality and reported destination therapy were extracted and aggregated, with estimated mean and standard deviation weighted by cohort size.

Results: A total of 29 papers were included, describing the outcomes of 9,602 patients. The mean age of the patient cohorts was 82.3 ± 1.3 years. 51.6% of the patients were female and the mean STS score was 12.3 ± 3.2. The rates of stroke, myocardial infarction, major vascular complications and greater than BARC 2 bleeding post-BAV were $1.2\% \pm 0.7$, $1.2\% \pm 1.5$, $2.4\% \pm 1.1$ and $8.9\% \pm 2.2$ respectively. Periprocedural and intrahospital mortality rates were $1.7\% \pm 2.8$ and $7.0\% \pm 4.2$. Mortality rates at 30 days and 12 months were $7.7\% \pm 6.0$ and $34.4\% \pm 12.7$. Reported rates of patients undergoing TAVI, surgical aortic valve replacement or medical management post-BAV were $17.2\% \pm 12.1$, $4.9\% \pm 4.0$ and $77.0\% \pm 14.0$.

Conclusions: Short and medium-term outcomes following BAV are similar to contemporary cohorts undergoing TAVI. The vast majority of patients do not proceed to further intervention, with BAV being their destination therapy. The clinical and economic impact of such practice in the era of TAVI requires further study.

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Better Outcomes with New P2Y12 Antiplatelet Agents in ACS Patients in Australia

V. Moosavi [*], Q. Yang, C. McCallum, N. Ariyarathna, B. Nkoane-Kelaeng, P. Marley, A. Farshid

Department of Cardiology, Canberra Hospital and Health Services, Garran, Australia

Objective: To determine the outcome of patients who received new P2Y12 antiplatelet agents (Ticagrelor or Prasugrel) compared with Clopidogrel following successful percutaneous intervention (PCI) for acute coronary syndrome (ACS).

Methods: Retrospective analysis on patients undergoing successful PCI for ACS between January 2006 and June 2017. Follow-up was after one year with letter, phone call and file review.

Results: 4941 patients (76% male) underwent successful PCI (57% BMS vs 43% DES) for ACS. In addition to aspirin, 87% of patients received Clopidogrel compared with 13% treated with new agents (mean age 64.4 and 59.3 years respectively). The use of new P2Y12 agents increased from 3.2% in 2010 to 28.5% in 2017. In 2017, new P2Y12 agents were used in 58% of STEMI, 32% of NSTEMI and 10% of unstable angina patients. Univariate analysis demonstrated that new P2Y12 agents were associated with lower incidence of death (2.44% vs 4.58% $p = 0.01$) and major adverse cardiac events (MACE) (7.46% vs 9.90% $p = 0.04$) but increased bleeding risk (BARC 2–3) (2.13% vs 1.05% $p = 0.0176$) at 1 year. There was no significant difference in myocardial infarction (2.74% vs 2.85% $p = 0.87$) or target lesion revascularisation (2.28% vs 3.13% $p = 0.2$). On multivariate analyses (including STEMI, cardiac arrest and shock), the new agents were an independent predictor of lower mortality (HR 1.85; 95%CI 1.11–3.28).

Conclusions: The use of new P2Y12 agents in ACS was associated with lower mortality and MACE, but higher bleeding events. The higher bleeding rates with new P2Y12 agents may partly explain why these agents were under-utilised.

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Bleeding Severity in Percutaneous Coronary Intervention (PCI) and its Impact on Short-Term Clinical Outcomes

S. Murali [1,2,*], S. Vogrin [1], D. Dinh [5], S. Noaman [1,2], A. Brennan [5], J. Lefkovits [6], C. Reid [3], N. Cox [1], W. Chan [1,2,4,5]

[1] Western Health, Melbourne, Australia
[2] University of Melbourne, Melbourne, Australia
[3] Curtin University, Perth, Australia
[4] Alfred Hospital, Melbourne, Australia
[5] Monash University, Melbourne, Australia
[6] Melbourne Health, Melbourne, Australia

Background: Bleeding is a common complication in patients undergoing Percutaneous Coronary Intervention

(PCI). There is paucity of data pertinent to the clinical impact of PCI-related bleeding, defined by the Bleeding Academic Research Criteria (BARC), in contemporary Australian practice.

Method: 37,913 patients undergoing PCI were enrolled in the Victorian Cardiac Outcomes Registry (VCOR) between 2014 and 2017. We compared 30-day Major Adverse Cardiac and Cerebrovascular Events (MACCE) between BARC0 (no bleeding), BARC1–2 (minor) and BARC≥3 (major) bleeds. Independent predictors associated with major bleeding, and 30-day MACCE were also assessed.

Results: Of 37,913 patients, there were 34,555 (91.1%) with BARC0, 3,007 (7.9%) with BARC1–2, and 351 (0.9%) with BARC≥3 bleeds. Differences in baseline and procedural characteristics were observed among the 3 BARC categories including, but not limited to, age, gender, radial access, renal function, and PCI indication (all $p < 0.001$). There was a step-wise increase in 30-day MACCE with greater severity of bleeding; BARC0 (4.1%), BARC1–2 (7.3%), and BARC≥3 (35.6%), $p < 0.001$. Selected independent predictors of bleeding include female gender (OR 1.34, 1.23–1.47), age (OR 1.02, 1.01–1.02), fibrinolytic therapy (OR 1.76, 1.45–2.14), ticagrelor (OR 1.42, 1.31–1.55), and radial access (OR 0.67, 0.61–0.73), all $p < 0.001$. Following adjustment of clinically important variables, BARC≥3 bleeding was still predictive of 30-day MACCE (OR 3.42, 2.50–4.69, $p < 0.001$).

Conclusions: BARC≥3 bleeding is uncommon but potentially fatal complication associated with greater 30-day MACCE. Efforts to mitigate bleeding occurrence, including radial access, may ameliorate the risk of short-term adverse outcomes.

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Borderline Coronary Physiology – Are All Vessels Equal?

C. Greer*, A. Puri, J. Sutherland, J. Blake, D. McClean, J. Elliott, D. Smyth

Christchurch Hospital, Christchurch, New Zealand

Background: Instantaneous wave-free ratio (iFR) is used to guide decision making in percutaneous coronary intervention. A ratio of ≤0.89 is reported as indicating haemodynamic significance. Earlier iFR studies suggested a grey zone of significance of 0.86 – 0.93. We report outcomes of patients with a single interrogated lesion deemed non-significant by iFR.

Method: 324 lesions were assessed by iFR. 89 patients had one lesion assessed as non-haemodynamically significant by iFR and left untreated. In this cohort we compared adverse outcomes–defined as ongoing angina,myocardial infarction,revascularization, death.

Results: 47(53%) lesions were in LAD: mean iFR 0.93(SD0.03). 14(16%) lesions were LCx: mean iFR 0.99(SD0.03). 28(31%) lesions were RCA: mean iFR 0.96(SD0.03).

At follow up 17% of LAD group reported angina, 6% had MIs, 2% had undergone further revascularisation. 7% of RCA group reported angina. None in LCx group reported events.

If 0.93 'grey zone' cut off were used for LAD lesions, 62.5% patients with angina at follow up, and 100% of those with further MI may have been been treated with PCI. However, this would come at the cost of 20 patients being treated by PCI who were already destined to be asymptomatic at follow up.

Conclusion: In this observational study we have noted an increased proportion of patients with non-significant LAD lesions reporting ongoing angina at follow up as compared to LCx or RCA. A large proportion of these may have avoided adverse outcomes if a higher cut off value was used. More work is required to determine if this trend indicates the need for different cut off values or 'grey zone' for different vessels.

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Building for the Future – Educating the Novice Nurse in the Interventional Cardiovascular Suite

K. Andrews*, J. Parkinson, J. Colgan, W. Lennox-Bradley

Central Coast Local Health District, Gosford, Australia

Background: Interventional cardiology requires highly specialised registered nurses, with an advanced level of theoretical and practical knowledge. Gosford Hospital is a regional centre providing the only public cardiac angiography service to the area. Recruitment of experienced staff offers significant challenges. Experienced casual pool nurses are extremely limited, and the local health district does not employ agency nurses. The Novice Cardiac Angiography Nursing Program was created to provide specialised education required to develop skilled staff to relieve the Cardiac Angiography Unit (CAU) during times of staff shortage.

Methods: The program framework was based on the Consensus Statement for Standards for Interventional Cardiovascular Nursing Practice published by The Cardiac Society of Australia and New Zealand (July 2017). The programme content aimed to provide education at Level 1 – foundation knowledge and skills. Expert consultation for local context allowed the development of a programme covering a broad range of contemporary content. Participants were exposed to didactic content, interactive tutorials, immersive simulation and hands-on experience over a three week period. Working in a supernumerary role alongside highly skilled cardiac angiography nurses, participants were provided the opportunity to link theory to practice, providing care with minimal supervision.

Results: Participants were evaluated utilising a knowledge test and a perceived confidence level. Results demonstrated a 32.5% increase in knowledge and a 34.5% increase in confidence in working within the CAU environment.

Conclusion: This highly specialised programme demonstrated a rapid improvement in skills, knowledge and confidence associated with the care and education of patients receiving treatment within the CAU.

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Cardiac Arrest in The Cardiac Catheterisation Laboratory (CCL): Initial Experience with the Role of Simulation Set-up and Training

O. Al-mukhtar [1,*], I. Bilgrami [1],
S. Noaman [1,2,3], R. Lapsley [1], C. Marane [1],
F. Groen [1], H. Cutter [1], N. Cox [1,2],
W. Chan [1,2,3]

[1] *Western Health, Melbourne, Australia*
[2] *University of Melbourne, Melbourne, Australia*
[3] *Alfred Health, Melbourne, Australia*

Background: With rising numbers and complexity of percutaneous coronary interventions being performed, the incidence of cardiac arrest in CCL is likely to increase. We undertook a series of multi-disciplinary simulation sessions to systematically define problematic areas, practice deficiencies and to propose solutions to improve cardiac arrest care in the CCL.

Methods: In 2018, ten simulation sessions were held at Western Health CCL to simulate different cardiac arrest scenarios. Participants included cardiologists, cardiology and anaesthetic registrars, intensive care registrars, nursing staff and CCL technicians. Post-simulation feedback was analysed qualitatively into common themes.

Results: Problematic areas and challenges encountered during a cardiac arrest scenario in CCL were identified and grouped into four areas of 1) equipment (e.g. CCL C-arm), 2) vascular access and drugs (e.g. standardising concentrations and venous access site), 3) physical environment (e.g. spatial limitations) and 4) resource management (e.g. leadership and role allocation). Proposed solutions included scheduling of regular simulation training for all health professionals who are likely to be involved in management of cardiac arrest in CCL; increasing familiarity with the unusual physical environment and equipment in CCL including automated cardio-pulmonary resuscitation devices and radiation-exposure safety awareness; and rapid formation of 2 team leaders to improve cardiac arrest care efficiency.

Conclusions: Cardiac arrest in CCL is a unique clinical event that differs from other emergency scenarios in hospitals. This necessitates specific training, which can be provided in a structured simulation program to improve technical and non-technical skills with potential to improve cardiac arrest care and clinical outcomes.

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Characteristics of Patients with Cardiogenic Shock Complicating Acute Coronary Syndrome and its Influence on Clinical Outcomes

S. Noaman [1,2,3,4,*], N. Andrianopolous [5],
A. Brennan [5], C. Reid [5], D. Stub [3,4],
S. Biswas [3,4], A. Walton [3], D. Clark [6],
A. Ajani [1], M. Freeman [7], J. Shaw [3],
E. Oqueli [9], T. Yip [8], S. Duffy [3],
W. Chan [1,2,3,4]

[1] *University Of Melbourne, Melbourne, Australia*
[2] *Western Health, Melbourne, Australia*
[3] *Alfred Hospital, Melbourne, Australia*
[4] *The Baker IDI, Melbourne, Australia*
[5] *Monash University, Melbourne, Australia*
[6] *Austin Health, Melbourne, Australia*
[7] *Eastern Health, Melbourne, Australia*
[8] *Geelong University Hospital, Geelong, Australia*
[9] *Ballarat Health Services, Ballarat, Australia*

Background: Cardiogenic shock (CS) complicates ~5% of patients with acute coronary syndrome (ACS) undergoing percutaneous coronary intervention (PCI), with the highest mortality in certain subgroups despite contemporary ACS treatment.

Methods: Patients with ACS enrolled in the Melbourne Interventional Group registry (2005–2013) with CS ($n = 636$) were analysed according to pre-specified subgroups. Those with STEMI were compared to non-STEMI, and multivessel PCI compared to single-vessel PCI. Short-term MACE (death, MI, target-vessel revascularisation) and long-term National Death Index (NDI)-linked mortality were assessed between the subgroups.

Results: Patients with CS presented with high rates of STEMI (89%) and a preponderance of multivessel disease (70%), however, only 12% underwent multivessel PCI. In-hospital and 30-day MACE were high in the CS cohort (46% and 47% respectively). Long-term NDI-linked mortality was 51% in the entire CS cohort. Subgroup analyses revealed greater in-hospital, 30-day and NDI-linked mortality among those who presented with non-STEMI compared to those with STEMI (63% vs. 38%, 64% vs. 38%, and 79% vs. 47%, respectively, all $p < 0.01$). There was a trend towards higher in-hospital and 30-day mortality among those who underwent multivessel PCI (50% vs. 39%, $p = 0.07$ and 50% vs. 40%, $p = 0.09$). Higher long-term NDI-linked mortality was observed in the multivessel PCI subgroup (63% vs. 49%, $p < 0.05$).
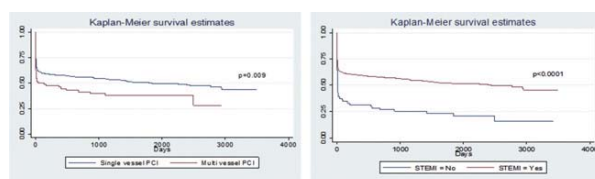
Conclusion: Cardiogenic shock complicating ACS portends very poor short and long-term survival with particularly high mortality in the non-STEMI and multivessel PCI subgroups.

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Clinical Benefits of Prolonged DAPT Following Complex Percutaneous Coronary Intervention

D. Subhaharan [1,2,4], N. Mridha [1,2,*], K. Singh [1,2,3]

[1] *Department of Cardiology, Gold Coast University Hospital, Gold Coast, Australia*
[2] *Department of Medicine, Griffith University, Gold Coast, Australia*
[3] *Department of Medicine, Adelaide University, Adelaide, Australia*
[4] *Department of Medicine, Bond University, Gold Coast, Australia*

Aims: Prolonged DAPT requires consideration of both reduced thrombotic events and increased bleeding risk. The associated subtle balance between the benefits and harms depends upon patient's clinical factors and complexity of the coronary anatomy. Our aim was to assess the safety and efficacy of prolonged ($\geq$12 months) in patients undergoing complex PCI.

Methods and Results: A thorough computer-based search was performed using 4 major databases. Complex PCI was defined as a procedure with at least 1 of the following angiographic characteristics: 3 vessels treated, >3 stents implanted, >3 lesions treated, bifurcation lesions, total stent length >60 mm, left main or proximal LAD, a vein graft stent or chronic total occlusion as target lesion. Of the 3453 titles searched, 3 randomised and 2 observational studies met the inclusion criteria comparing short and prolonged DAPT therapy. We applied a random-effects model to acknowledge the variation in study design, treatment duration, and length of follow-up among studies. There was a reduction in cardiac mortality (OR 1.77, 95% CI 1.09 –2.86, $P = 0.02$, $I^2 = 0\%$) and MACE (OR 1.32, 95% CI 1.04 –1.68, $P = 0.02$, $I^2 = 22\%$) with prolonged DAPT. Major bleeding was increased with prolonged DAPT (OR 0.57, 95% CI 0.39 –0.83, $P = 0.004$, $I^2 = 0\%$). There was no difference in the all-cause mortality (OR 1.16, 95% CI 0.82 –1.63, $P = 41$, $I^2 = 0\%$).

Conclusion: Prolonged DAPT reduces cardiac mortality and MACE in complex PCI. The results would need confirmation in a larger randomised study.

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This abstract has been withdrawn

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Clopidogrel Versus Ticagrelor on Coronary Microvascular Function After Non-ST Elevation Acute Coronary Syndrome (NSTE-ACS): A Randomised Trial

J. Xu [1,*], S. Lo [1], C. Mussap [1], J. French [1], R. Rajaratnam [1], K. Kadappu [2], U. Premawardhana [2], P. Nguyen [2], C. Juergens [1], D. Leung [1]

[1] *Liverpool Hospital, Sydney, Australia*
[2] *Campbelltown Hospital, Sydney, Australia*

Introduction: Ticagrelor has been shown to reduce microvascular injury compared to clopidogrel in ST-elevation myocardial infarction patients. However, comparable data is lacking in NSTE-ACS.

Methods: From Mar 2018-Jan 2019, patients hospitalised for NSTE-ACS were prospectively randomised 1:1 to clopidogrel (300 mg loading then 75 mg daily) or ticagrelor (180 mg loading then 90 mg twice-daily). Coronary microvascular function was assessed with index of microcirculatory resistance (IMR) in the infarct related artery (IRA) and non-IRA before and after percutaneous coronary intervention (PCI) using a standard pressure-temperature coronary wire.

Results: 40 patients were included (17 clopidogrel, 23 ticagrelor). Median age 53.5 (IQR 49.0–61.5) years, 35(87.5%) were male, 11(27.5%) had diabetes, 19(47.5%) were smokers. Median peak troponin T was 527 (175–1006.5)ng/L, median GRACE score 91.5 (78.3–103.3) and median SYNTAX score 13 (6–20). Baseline characteristics were similar between the 2 groups. There was no significant difference in the median baseline IMR between the 2 groups in both the IRA (clopidogrel 14.4 [IQR 12.2–18.6] vs ticagrelor 20.8 [11.3–27.4], $p = 0.22$) and non-IRA (14.0 [11.0–22.0] vs 14.0 [10.0–29.5] respectively, $p = 0.74$). 28 patients underwent PCI to the IRA (12 clopidogrel, 16 ticagrelor). There was no significant difference in the median post-PCI IMR between the 2 groups (19.5 [14.5–24.5] vs 29.0 [19.0–35.6] respectively, $p = 0.11$). However, there was significant worsening of post-PCI compared with pre-PCI IMR in the clopidogrel group (19.5 vs 15.0, $p = 0.049$) but not in the ticagrelor group (29.0 vs 25.4, $p = 0.47$).

Conclusion: In our NSTE-ACS patients undergoing PCI, ticagrelor resulted in less disruption of coronary microvascular function compared to clopidogrel.

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Comparison of Aortic Gradient Assessment Modalities in Balloon Aortic Valvuloplasty; is there a Correlation Between Echocardiograpic and Invasively Obtained Aortic Gradients?

D. Nour *, U. Allahwala, T. Hansen, N. Muthukrishna, C. Choong, P. Hansen, R. Bhindi

Royal North Shore Hospital, Sydney, Australia

Aim: Percutaneous balloon aortic valvuloplasty (BAV) has regained popularity with the increasing utilisation of transcatheter aortic valve implant (TAVI). Currently, aortic gradients are measured both invasively and with echocardiographic measurements. The validity of both methods has not been previously investigated. We sought to determine if there was any correlation between invasive and echocardiographic aortic gradients before and following BAV.

Methods and Results: We reviewed 119 consecutive patients who received BAV therapy at a single high volume centre. The mean age of patients was 82.2 ± 6.9 with 60% being males. Pre and post-operative aortic gradients recorded both invasively and by echocardiography were analysed. Assessment of pre-BAV gradients demonstrated a positive correlation between invasively determined peak-gradient and echo mean-gradient ($p < 0.0001$ & $R^2 = 0.59$[95% CI = 0.67–0.84]). Furthermore, there was a positive correlation between invasive mean-gradient and echo mean-gradient ($p < 0.0001$ & $R^2 = 0.52$[95% CI = 0.59–0.81]), as well as invasive peak-gradient with echo peak-gradient ($p < 0.0001$ & $R^2 = 0.60$[95% CI = 0.68–0.84]). Similarly, analysis of post-BAV gradients revealed a positive correlation between invasively determined peak-gradient and echo mean-gradient ($p < 0.0001$ & $R^2 = 0.46$[95% CI = 0.56–0.77]), invasive mean-gradient and echo-mean gradient ($p < 0.0001$ & $R^2 = 0.32$[95% CI = 0.41–0.69]), as well as invasive peak-gradient with echo peak-gradient ($p < 0.0001$ & $R^2 = 0.41$[95% CI = 0.51–0.74]).

Conclusion: Success is determined by the significance of aortic pressure reduction pre and post therapy. Current practice favours the use of both invasive and echocardiographic pressure measurements. This study has shown a positive and statistically significant correlation between aortic gradients obtained both invasively and by echocardiography, before and after BAV. Aortic gradients can therefore be obtained by either modality, which may improve logistics in the catheter laboratory.

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Comparison of Modified Manual Compression Technique with Traditional Manual Compression for Haemostasis After Transfemoral Coronary Angiography: Analysis of a Randomised Controlled Study

S. Jayanti [1], L. Sharma [1,*], J. Xu [1,2], V. Taylor [1], J. Duggan [2], P. Velasquez [2], N. Brown [2], E. Dictado [2], R. Rajaratnam [1,2,3], S. Lo [1,2], C. Juergens [1,2], D. Taylor [2]

[1] *South Western Sydney Clinical School, Liverpool Hospital, Australia*
[2] *Department of Cardiology, Liverpool Hospital, Australia*
[3] *Western Sydney University, Liverpool Hospital, Australia*

Background: A recent pilot study showed that a modified manual compression (MMC) technique significantly reduced time to haemostasis (TTH) for patients undergoing elective transfemoral coronary angiography compared to traditional manual compression (TMC). The aim of this randomised controlled study was to conduct a larger-scale trial to validate the results of the pilot study.

Methods: Between February 2017-December 2018, 122 patients undergoing transfemoral cardiac catheterisation were randomised to post-procedural haemostasis with TMC or MMC in a 1:1 fashion. The primary endpoint was TTH, defined as time at which no further blood ooze was seen at the puncture site for 5 minutes. Secondary outcomes included ACUITY minor bleeding post-procedure and at a 1 week follow-up. Both compression techniques were conducted by the same experienced nurses and registrars.

Results: Mean age was 64.66 years, 74% were male ($n = 91$), mean heparin dosage was 3602 units and 38.5% had diabetes ($n = 47$). 28.7% of patients underwent percutaneous coronary intervention (PCI) ($n = 35$). Baseline clinical characteristics were well watched between the groups, with also no significant difference in antiplatelet and anticoagulant usage or intra-procedural heparin dosage. TTH was significantly reduced in the MMC group compared to TMC [median (IQR): 8.10 (7.1–11.1) vs. 11.75 (9.85–15.1) minutes; $p < 0.001$]. There was no significant difference in minor bleeding post-procedure and at 1 week.

Conclusion: MMC significantly reduces TTH for a broader patient group, including those undergoing transfemoral PCI. This reduction may translate to earlier patient ambulation and increased efficiency of hospital resource utilisation.

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Cone Flare Crush Modified T Stenting for Complex Bifurcation lesions, a Novel Technique

W. Peverill *, T. Fetahovic, A. Camuglia

Princess Alexandra Hospital, Brisbane, Australia

Introduction: Coronary bifurcation percutaneous coronary intervention (PCI) remains an area of ongoing clinical challenge and active research. Cone Flare Crush Modified T Stenting is a novel technique for bifurcation stenting. We performed a prospective cohort registry study to assess the clinical outcomes of patients who underwent this technique.

Methods: We include 15 patients with bifurcation lesions who underwent percutaneous coronary intervention (PCI) using the CFCT technique between January and December 2018. Baseline, procedural (including optical coherence tomography) and post procedural analyses were performed as well as clinical outcomes at follow up were assessed.

Results: All 15 patients had bifurcation lesions successfully treated with the CFCT technique. Baseline procedure time was in keeping with other common bifurcation techniques. Final kissing balloon inflation was performed in all patients as was optical coherence tomography of at least the main vessel branch. After PCI all patients had thrombolysis In Myocardial Infarction 3 blood flow. None of the patients had a residual stenosis >5% at the conclusion of the case. 30 day MACE rates were 0 in this cohort.

Conclusions: The CFCT technique is a safe and feasible strategy for patients with bifurcation lesions. Larger studies with longer follow up are required to determine whether this is the optimal bifurcation technique.

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Contemporary Trends in Stroke Complicating Cardiac Catheterisation

N. Whitehead[1], T. Williams[1], S. Brienesse[1], D. Ferriera[1], N. Murray[1], K. Inder[2,3], S. Beautement[1], N. Spratt[1,2,3], A. Boyle[1,2,3,*], N. Collins[1]

[1] *John Hunter Hospital Newcastle NSW Australia, Hamilton, Australia*
[2] *Hunter Medical Research Institute, Newcastle, Australia*
[3] *University of Newcastle, Newcastle, Australia*

Background: Stroke remains an important complication of diagnostic cardiac catheterisation and percutaneous coronary intervention and is associated with high rates of in-hospital mortality.

Aims: We sought to evaluate the incidence of stroke over a ten-year period and assess the long-term influence of stroke following cardiac catheterisation and percutaneous coronary intervention (PCI) on functional outcomes, based on modified Rankin score (mRS), and mortality.

Methods: The study was performed using a case control design in a single tertiary referral centre. Patients were identified by correlating those patients undergoing cardiac catheterisation between October 2006 and December 2016 with patients who underwent neuroimaging within 7 days to identify possible cases of suspected stroke or TIA.

Results: A total of 21510 patients underwent cardiac catheterisation during the study period. Sixty patients (0.28%) experienced stroke or TIA. Compared to control patients, those who patients who did experience cerebral ischaemic events were older (70.5 vs 64 years; $p < 0.001$), with higher rates of atrial fibrillation, hypertension and diabetes mellitus. Stroke complicating cardiac catheterisation was associated with an increased risk of readmission, with a significantly higher hazard of readmission for stroke noted. Despite minimal functional impairment based on mRS, stroke was associated with a significant risk of early and cumulative mortality. Stroke incidence remained stable over the study period despite changes in procedural practice.

Conclusions: The incidence and functional severity of stroke remains low despite evolving procedural practice with a stable incidence over time despite changes in procedural practice, however, post-procedural stroke confirms an increased mortality hazard.

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Coronary Angiography and Percutaneous Coronary Intervention Post Transcatheter Aortic Valve Implantation with Self-Expanding CoreValve

M. Yudi[1,*], G. Tang[2], S. Sharma[2], A. Kini[2]

[1] *Austin Health, Heidelberg, Australia*
[2] *Mount Sinai Medical Centre, New York, United States of America*

Introduction: Coronary artery disease is common in patients with severe aortic stenosis. As transcatheter aortic valve implantation (TAVI) moves into intermediate risk patients, coronary angiography (CA) and percutaneous coronary intervention (PCI) post TAVI will become increasingly common. Selective coronary re-access has been reported to be particularly challenging with the self-expanding CoreValve.

Methods: A retrospective analysis of patients who underwent TAVI from 2012 to 2017 from a high-volume tertiary institution was performed. Those who underwent CA and PCI post TAVI with a Medtronic CoreValve were included. Baseline clinical, angiographic and procedural characteristics were collected. The primary endpoints were proportion of cases with selective coronary engagement and successful PCI.

Results: 32 patients were included who underwent 46 coronary angiograms post TAVI. They had a mean age of 84.8 years, 48% were females and the average STS score was 7.5%. Selective left and right coronary angiography using standard Judkins left and Judkins right coronary catheters was only achieved in 50% and 30% respectively. Non-selective but diagnostic coronary angiography was achieved in 93% and 89% for left and right coronary arteries. Successful PCI was achieved in 96% of cases. Of those undergoing PCI, coronary

engagement was achieved in 36% of cases with guide catheter alone, 24% with guide catheter and wire and in 24% of cases with the aid of guide-extension catheter.

Conclusion: CA and PCI after TAVI with the self-expanding CoreValve is challenging but feasible. Intricate knowledge of the prosthesis design and its interaction with the coronary ostia, sinus of Valsalva and sino-tubular junction is essential to navigate the procedural challenges.

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Coronary Artery Aneurysms Following Bioresorbable Vascular Scaffolds

L. Murray

Flinders Medical Centre, Bedford Park, Australia

Introduction: Coronary artery aneurysm (CAA) following coronary intervention are relatively uncommon with reported rates of less than 6.0%. To date, the rate of CAA's following insertion of bioresorbable vascular scaffolds (BVS) remains unknown. The published literature is limited to case reports and cases series. This study summarises the clinical presentations and parameters for BVS; time to aneurysm formation post stent insertion, location of aneurysm, the associations with in-stent restenosis (ISR), and in-stent thrombosis (IST).

Methodology: Data was extracted from multiple online libraries including PubMed, EMBASE, SCOPUS, Medline, Google Scholar, and Cochrane Central Register of Controlled Trials.

Results: Twenty articles were identified from the search criteria, totalling 24 CAA following BVS. The average age of the patients was 56 years and the average time to diagnosis was 12.2 months. 13 cases of CAA were incidental discoveries during planned follow up, whilst 11 cases involved patients who underwent urgent angiography for symptoms of angina or ACS. Management included PCI (42%), watchful waiting (25%), dual antiplatelet therapy (12%). In some cases (16%), no management was reported. There were 4 reported cases of ISR and 4 cases of IST, with the majority presenting with angina or acute coronary syndromes (ACS).

Conclusion: It is important to establish rates of CAA in BVS as their clinical utility is still being explored. There is currently a paucity of published trials data about incidence. This paper compiles all reported clinical parameters for BVS to facilitate clinical decision making around implantable scaffolds.

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Coronary Outcomes in Patients with Negative Fractional Flow Reserve (FFR) Studies

F. Zaky *, V. Vijayarajan, R. Cohen, A. Ekmejian, P. Shetty

Wollongong Hospital, Wollongong, Australia

Fractional Flow Reserve (FFR) is a lesion-specific pressure index tool used to assess haemodynamic significance of intermediate coronary lesions on coronary angiography. An FFR of 0.8 is considered the cut off for haemodynamic significance. Few studies have looked at outcomes in patients with a negative FFR at values approaching haemodynamic significance.

The purpose of this study is to evaluate hospital re-admission, repeat coronary angiography and intervention rates in patients with negative FFR results.

A retrospective analysis was performed on 109 FFR cases performed in a tertiary hospital between 2015 and 2017. FFR data was stratified into four groups; positive (≤ 0.80), high-moderate risk (0.81-0.85), low-moderate (0.86-0.90) and low risk (>0.90).

64	65.2	21.7	4.3	4.3
67	66.7	16.7	4.2	4.2
68	55.6	27.8	8.3	5.6
76	61.6	19.2	7.7	7.7

Low-risk FFR cases were associated with higher age and higher rates of repeat coronary angiography and percutaneous intervention compared to moderate risk patients. The variance in the population data and repeat angiography rates between low and intermediate risk patients suggests that a graded rather than a binary assessment of FFR may be beneficial.

Furthermore, the increase in age observed with lower FFR readings suggests a bias towards performing FFR in elderly patients with non-haemodynamically significant lesions. However, a more comprehensive multi-centre trial would provide further insight.

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Correlation Between Coronary Collaterals and Systemic Endothelial Biomarkers: MCP-1 and ICAM-1 are Associated with the Coronary Collateral Circulation

U. Allahwala [1,2,*], M. Ward [1], J. Weaver [3], R. Bhindi [1,2]

[1] Department of Cardiology, Royal North Shore Hospital, Sydney, Australia
[2] The University of Sydney, Sydney, Australia
[3] Department of Cardiology, Royal Prince Alfred Hospital, Sydney, Australia

Aims: The coronary collateral circulation matures through the process of arteriogenesis. We sought to correlate the presence and maturity of collaterals with biomarkers of arteriogenesis; fibroblast growth factor-beta (FGF-β), monocyte chemoattractant protein-1 (MCP-1) and intracellular adhesion molecule-1 (ICAM-1).

Methods & Results: 81 patients presenting for coronary angiography between June 2018 and January 2019 were studied. Arterial and venous samples were obtained and batch analysed using enzyme-linked immunosorbent assay (ELISA).

30 patients (37.0%) had a chronic total occlusion (CTO), whilst 51 (63.0%) had non-obstructive coronary artery disease. In those with a CTO, the mean Rentrop grade was 2.4. Patients with a CTO were older (73.1 vs 67.0, $p < 0.01$), more likely to have a history of peripheral vascular or carotid disease (23.3% vs 3.9%, $p < 0.05$) and a greater New York heart association class (2.17 vs 1.78, $p < 0.05$). Concentrations of FGF-β, MCP-1 and ICAM-1 were similar in the arterial and venous circulation with a high interclass correlation coefficient (0.99, $p < 0.0001$; 0.97, $p < 0.0001$ and 0.81, $p < 0.001$ respectively). Serum MCP-1 was higher in patients with a CTO than in those without (36.1 pg/ml vs 25.2 pg/ml, $p < 0.05$), as was serum ICAM-1 (35.0 ng/ml vs 27.4 ng/ml, $p < 0.05$), with a trend toward higher FGF-β (43.0 pg/ml vs 33,0 pg/ml, $p = 0.48$). Concentration of ICAM-1 was significantly lower in patients with well matured collaterals (Rentrop grade 3) as compared to those with less developed collaterals (Rentrop grade 1 or 2) (29.0 ng/ml vs 39.6 ng/ml, $p < 0.05$).

Conclusions: MCP-1 and ICAM-1 concentrations correlate with the presence of coronary collaterals. These molecules and their activation pathways should be further investigated.

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Correlation Between Radial Artery Anomalies and Procedural Outcomes of Trans-radial Coronary Catheterisation

A. Ekmejian, R. Cohen *, V. Vijayarajan, F. Zaky, J. Moragues, T. David, A. Yeung, D. Owensby, P. Shetty, T. Nguyen-Dang, P. Shetty, A. Lee, E. Danson

Wollongong, Wollongong, Australia

Background: Trans-radial access is the current gold standard approach for coronary angiography, with reduced access-site complications, early patient ambulation, and reduced all-cause mortality and major adverse cardiac events (MACE). Radial artery anomalies are common and may be associated with access related failure or complications.

Methods: Between the years 2011 and 2012, angiographic assessment of radial arteries was commonly performed by trans-radial operators at Wollongong Hospital. For patients who had angiography of the access site, data were collected on baseline characteristics, procedural details, radial anatomical anomalies, and procedural complications.

Results: A total of 313 forearm angiographic images were taken during this period. Access was attained used a 6Fr Radial sheath on 265 occasions, and 5Fr Radial sheath on 48 occasions. The TIG was the most common catheter used, being the diagnostic catheter of choice on 285 occasions (90.4%). Diagnostic angiography alone was performed 265 times (81.2%). 8 cases of radial artery loops were identified (2.5%). Radial artery tortuosity was described in 70 cases (22.3%). There were 12 cases of access crossover to the femoral artery, which were mostly associated with radial anatomical abnormalities (66.7%), including 5 cases associated with radial artery loops and 3 associated with radial artery tortuosity.

Conclusion: Radial artery anomalies were common and were associated with a higher risk of access site crossover.

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Current indications and Outcomes of Veno–Arterial Extra-Corporeal Membrane Oxygenation (VA–ECMO) in a Non-transplant Centre

P. Pender *, V. Dang, O. Gibbs, A. Faour, A. Hopkins, D. Leung, C. Mussap, L. French, C. Juergens, S. Lo

Liverpool Hospital, Smithfield, Australia

Background: Peripheral VA-ECMO is an established treatment for refractory cardiogenic shock (CS) despite a paucity of data. Guidelines have a IIb recommendation for use. We retrospectively analysed indications and outcomes of VA-ECMO. **Methods**: From January 2010 to January 2019,the Cardiac Catheterisation and ICU database at Liverpool Hospital was interrogated for consecutive patients receiving VA-ECMO. **Results**: 57 patients underwent VA-ECMO [mean

age 61.3 ± 13.9 years (range 26-82)]. VA-ECMO was initiated before left main stenting in 4 cases, after revascularisation in the remaining. 27 patients had received IABP prior to VA-ECMO and remained in-situ in 12. Mean duration of therapy 5.9 ± 5.4 days (range 3-612hours). VA-ECMO was initiated semi-electively in 5 cases. In the remaining cases, average decision to cannulation time was 1.8 ± 1.6 hrs (range 1-7). All cases performed under GA with ICU admission, mean ICU LOS 12.4 ± 17 days (range 1-99d). Mortality rates varied according to indication: Failure to wean off bypass (16 cases) 62.5% mortality; Elective High risk PCI (6 cases) 0% mortality; STEMI CS (20 cases) 70% mortality; Refractory LV failure (7 cases) 43% mortality; Myocarditis, (4 cases) 50% mortality, Mechanical complications of AMI (2 cases) 100%; Post PEA cardiac arrest (2 cases) 100%. Total mortality 33 cases (57.9%). 43 Access related complications occurred in 28 patients [minor bleeding (11);major bleeding (14);limb ischaemia (18); 2 amputation].

Conclusions: In our experience, VA-ECMO is commonly used after IABP-support failure but mortality remains high. Appropriate patient selection and timely VA-ECMO institution remains challenging. VA-ECMO supported high-risk PCI had favorable outcomes.

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Diagnostic Accuracy of Quantitative Flow Ratio (QFR) Compared to Instantaneous Flow Wave Free Ratio (iFR) and DILEMMA Score to Predict Fractional Flow Reserve (FFR)

O. Mehta [*], R. Lim, M. Hay, A. Ildayhid, M. Zhang, J. Cameron, D. Wong

Monash Health, Mount Waverley, Australia

Background: Quantitative flow ratio (QFR) is a novel 3D quantitative coronary angiography and computational fluid dynamics technique to calculate fractional flow reserve (FFR). The DILEMMA score is a recent angiographic technique that has incremental predictive value over diameter stenosis to predict FFR. Unlike FFR, instantaneous wave-free ratio (iFR), diastolic pressure ratio (dPR), QFR and DILEMMA score do not require a pressure-wire or hyperaemia induction.

Purpose: To compare the diagnostic accuracy of QFR compared to iFR, dPR and DILEMMA score to predict FFR.

Methods: Patients who underwent invasive coronary angiography and FFR assessments were retrospectively studied. iFR and dPR were derived from FFR pressure tracings using a proprietary technique. QFR was computed using a commercially available software.

Results: 85 lesions (33% FFR significant) were included. Mean FFR was 0.86 ± 0.09. QFR ($r_s = 0.801$; $p < 0.001$), iFR ($r_s = 0.710$; $p < 0.001$), dPR_{25-75} ($r_s = 0.715$; $p < 0.001$) and DILEMMA score (H test statistic $= 40.56$, $p < 0.001$) were

strongly correlated with FFR. QFR <0.8 had a sensitivity, specificity, PPV and NPV of 84%, 92%, 76% and 95% respectively of predicting significant FFR (<0.001). On comparison of AUC, QFR (0.94) is a better predictor of FFR compared to iFR (0.88), DPR (0.88) and DILEMMA score (0.9), $p < 0.001$.

Conclusion: QFR is a better predictor of FFR compared to iFR, DPR and DILEMMA score. Further studies are required to confirm its diagnostic accuracy as well as its cost effectiveness for routine clinical practice.

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Direct Stenting Versus Stenting After Pre-dilation in Primary PCI for ST-Elevation Myocardial Infarction

V. Vijayarajan [*], A. Ekmejian, R. Cohen, S. Eather, A. Lee, F. Zaky, J. Femia, T. Fetahovic, P. Shetty, A. Yeung, E. Danson, T. Dang, A. Sepahpour, D. Owensby, J. Gohil

Wollongong Hospital, Wollongong, Australia

Background: Direct stenting and stenting after pre-dilation are strategies used in the setting of Primary PCI for ST-elevation Myocardial Infarction (STEMI). There is a paucity of evidence to guide one treatment strategy over the other.

Methods: We performed a retrospective review of a registry of Primary PCI for STEMIs between April 2013 and November 2018. Procedures were performed at Wollongong Hospital, a large tertiary centre in NSW, Australia. We collected data on baseline characteristics, procedural characteristics, procedural complications, and follow up data on Major Adverse Cardiovascular Events (MACE).

Results: Data were collected on a total of 310 patients who were treated with Primary PCI for STEMI. Of these, 260 (83.9%) were treated with stenting after pre-dilatation, 38 (12.3%) were treated with a direct stenting strategy (including 11 with aspiration thrombectomy, 28 without), and 12 (3.9%) of patients were treated with "Plain Old Balloon Angioplasty" (POBA). Mean follow up duration was 29 months. There was a complication rate of 7.9% in the direct stenting arm (including a 5.3% risk of slow flow or no-reflow). This was higher than the rate for stenting with pre-dilatation, with a 6.9% rate of procedural complication (including a 1.9% risk of slow flow/no-reflow), though this did not reach statistical significance ($p = 0.83$). Incidence of MACE on follow up was 15.8% for the direct stenting arm vs 17% for the stenting with pre-dilatation ($p = 0.86$).

Conclusion: In our cohort, there was no statistically significant difference in incidence of peri-procedural complications and MACE between direct stenting and stenting after pre-dilation.

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Does Sex Affect Outcomes After Percutaneous Coronary Intervention in Patients with Insulin-treated Diabetes Mellitus? Cohort Analysis from the Multi-centre GenesisCare Outcomes Registry (GCOR)

D. Eccleston [1,2,*], J. Chandrasekhar [2], E. Chowdhury [3], T. Rafter [2], A. Conradie [2], A. Whelan [2], S. Worthley [2]

[1] University Of Melbourne, Parkville, Australia
[2] GenesisCare, Sydney, Australia
[3] Monash University, Melbourne, Australia

Introduction: Patients with insulin-treated diabetes mellitus (ITDM) are known to have worse outcomes after percutaneous coronary intervention (PCI) than non-ITDM. Whether long-term outcomes after PCI vary by sex and ITDM at baseline is unknown.

Methods: Patients with diabetes discharged following PCI were stratified into ITDM and non-ITDM. We assessed the association of ITDM vs non-ITDM by sex with 1-year MACE (death, MI, unplanned PCI) adjusted for baseline clinical/lesion characteristics.

Results: Data were available for 7091 patients undergoing PCI from November 2008 - January 2018, with 99% follow-up at 1 year. At baseline 37.4% were diabetic; of these 33.3% of women and 26.8% of men had ITDM. Women with ITDM were less likely to smoke (38.4% vs 60.0% $p = 0.024$), have previous MI (22.0% vs 38.5% $p < 0.001$) PCI (37.2% vs 47.3% $p = 0.001$) or renal impairment (14.4% vs 21.7% $p < 0.001$) than men.
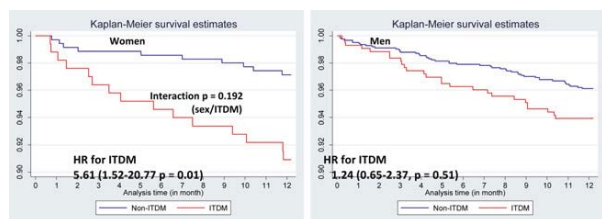
Conclusion: Patients with ITDM undergoing PCI have higher 1-year MACE rates than non-ITDM, however there is no interaction by sex. Despite fewer high-risk baseline characteristics women have higher rates of risk-adjusted MACE at 1 year than men. This indicates a need for improved treatments for diabetic women undergoing PCI.

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Effect of Long-term Compliance with Statin Therapy on All-cause Mortality After Percutaneous Coronary Intervention in Australia; the GenesisCare Cardiovascular Outcomes Registry (GCOR) Observational Cohort Study

D. Eccleston [1,2,3,*], T. Rafter [2], A. Whelan [2], E. Chowdhury [3], S. Worthley [2], J. Chandrasekhar [2]

[1] University Of Melbourne, Parkville, Australia
[2] GenesisCare, Sydney, Australia
[3] Monash University, Melbourne, Australia

Introduction: Secondary prevention therapies including statins are recommended after percutaneous coronary intervention (PCI). However, little data exists regarding outcomes of patients who achieve long-term compliance with medication after PCI.

Methods: Patients discharged on evidence-based medications were stratified into those continuing statin at 1 and 2 years or not. Baseline characteristics, hospital and 2 and 3-year outcomes were compared between groups.

Results. Data were available for 8087 patients undergoing PCI to from November 2008 - December 2018. At discharge 93.4% of patients were prescribed a statin, and compliance at 1 and 2 years was 89.5%, 88.1% respectively. Predictors of improved statin compliance at 2 years were age (OR 0.97, $p < 0/001$), male sex (OR 1.4, $p = 0.005$), hypercholesterolaemia (OR 1.6, $p = 0.003$), previous PCI (OR 1.28 $p = 0.03$),
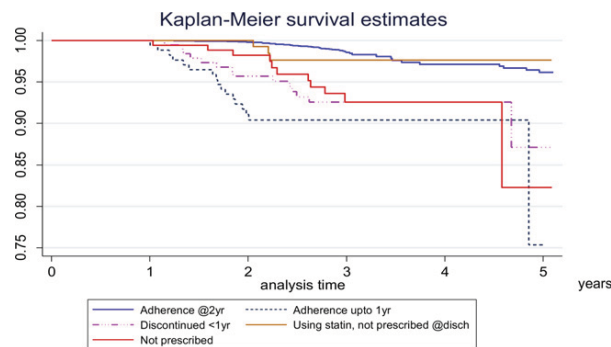
Conclusion: Patients discharged on evidence-based statin after PCI who continue this for 2 years continue to have greater freedom from death at 5 years than those who discontinue medication earlier. Those who cease statin therapy at 1 year have similar rates of mortality to those who are not prescribed statins post-PCI.

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Establishment of the Australian Transcatheter Aortic Valve Implantation Registry

T. Hooper [1,*], J. Bennetts [2], M. Ng [3],
L. Griffith [1], A. Deakin [1], R. Bhindi [4],
D. Brieger [5], D. Muller [12], A. Walton [8],
A. Camuglia [9], R. Gooley [13], R. Whitbourn [6],
G. Yong [14], W. Wilson [11], J. Stewart [7],
MacA. Isaac [6], D. Walters [10], A. Sinhal [2]

[1] SAHMRI, Adelaide, Australia
[2] Flinders Medical Centre, Bedford Park, Australia
[3] Royal Prince Alfred Hospital, Sydney, Australia
[4] North Shore Private Hospital, Sydney, Australia
[5] Concord Hospital, Sydney, Australia
[6] St. Vincent's Hospital Melbourne, Melbourne, Australia
[7] Auckland District Health Board, Auckland, New Zealand
[8] Alfred Hospital, Melbourne, Australia
[9] Princess Alexandra Hospital, Brisbane, Australia
[10] University of Queensland, Brisbane, Australia
[11] Royal Melbourne Hospital, Melbourne, Australia
[12] St Vincent's Hospital Sydney, Darlinghurst, Australia
[13] Monash Health, Clayton, Australia
[14] Mount Hospital, Perth, Australia

Objective: To define, improve and maintain the safety and quality of care for Australian patients undergoing TAVI procedures.

Methods: The National TAVI Registry was mandated by the Health Insurance Commission (HIC) for patients with severe aortic stenosis who are treated with a TAVI procedure. The HIC decision was based on the Commonwealth Medicare Benefits Scheme agreeing to reimburse TAVI procedures and the joint recommendations provided by CSANZ and ANZSCTS. These recommendations are the basis for hospitals and practitioners to initiate and maintain a TAVI programme and furthermore comply with the accreditation requirements outlined by the TAVI Accreditation Committee. The Australasian Cardiac Outcomes Registry (ACOR) was tasked with designing and implementing a national TAVI Registry. The South Australian Health and Medical Research Institute (SAHMRI) was appointed by ACOR as the Registry Operator to develop and manage the registry.

All accredited Australian hospitals performing TAVI procedures are mandated to participate to ensure data is collected from the entire eligible population.

Results: The TAVI Steering Committee agreed on a minimum data set, including information on demographics, diagnosis, treatment, outcomes and patient reported quality of life. As of February 2019, 39 hospitals (100%) have received ethics approval, 37 (95%) have local governance approval, 32 (82%) have received training and 30 (77%) are contributing data.

Conclusion: The TAVI Registry will identify areas of excellence, opportunities for improvements in quality of care and provide an accurate and transparent assessment of the safety of the TAVI procedure and devices in the Australian population.

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This abstract has been withdrawn

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Evaluating Frailty in the Elderly NSTEMI Population: A Single Centre Experience

L. Segan [*], R. Samuel, H. Martin,
R. Harniman, B. Payne, C. Hiew,
A. Hutchison

Barwon Health, Melbourne, Australia

Background: Elderly patients comprise an increasing proportion of non-ST-elevation myocardial infarction (NSTEMI) presentations, representing a heterogeneous group with regard to cardiovascular profile and frailty. They are less likely to receive evidence-based therapies or an invasive strategy due to age and perceived frailty, despite a lack of consensus regarding objective frailty assessment.

Aim: To assess the impact of frailty in the elderly ($\geq$80 years) NSTEMI management.

Methods: This retrospective study described baseline characteristics and NSTEMI management in 149 consecutive elderly patients. The Geriatric Risk Nutritional Index (GNRI - frailty defined as score < 92)) and Canadian Study of Health and Ageing Clinical Frailty Scale (CSHA-CFS) were utilised to assess frailty (score $\geq$5).

Results: Male gender predominated (52.3%), mean age 86 ± 4 years. Hypertension, ischaemic heart disease and chronic kidney disease were prevalent (76.5%, 59.1% and 55%, respectively), left ventricular ejection fraction (EF) was preserved in 77.9% (mean EF $57 \pm 11\%$). Most lived at home (91%) and had high GNRI (>92) and low CSHA-CFS (<5) scores (82% and 90.6% respectively), (mean GNRI 100 ± 11), suggesting low frailty profiles. 19.1% were defined as frail. Of those, 43% underwent angiography vs. 63% (not frail, $p = 0.04$). Of those undergoing angiography, 10.7% with frailty vs. 23.1% without frailty were revascularised ($p = 0.20$). Rates of surgical revascularisation vs. percutaneous coronary intervention (PCI) were similar between groups (13.4% vs 7.4%, $p = 0.23$). The Heart team was infrequently utilised in both surgical and non-surgical groups (25% and 28.6%, respectively).

Conclusion: Despite low frailty scores, low rates of revascularisation were observed in this cohort.

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Excimer Laser Atherectomy in the Management of Undilatable Coronary Stents

M. Salib [1,*], R. Giles [1,2], M. Pitney [1,2]

[1] *Eastern Heart Clinic, Randwick, Australia*
[2] *Sutherland Heart Clinic, Caringbah, Australia*

Introduction: Excimer laser has been reported to be safe and effective in the management of undilatable stents. We report our initial experience.

Methods: From March 2016 to January 2019, 10 patients (ages 62-84, 9 male) were treated for constrained stents despite high-pressure balloon inflation (>26 atmospheres). Indications were threatened stent-thrombosis in 1 and recurrent restenosis (>3) with refractory symptoms in 9. All patients had clear angiographic evidence of a poorly expanded stent showing > 30% stent constraint, and 7 patients had multiple layers of stent. The procedure was performed under GA via 7F guiding catheter with a 0.9mm 80mJ/mm^2/80Hz catheter (Spectranetics). Tissue debulking with a bloodless field was first performed followed by multiple contrast runs (average 6, 4-12). Lesions were post-dilated at >20 atmospheres and then treated with DEB. Target vessels included RCA (5), LAD (2), LCx (1), Intermediate (1), and SVG-to-1MCx (1).

Results: Complete angiographic success (full stent-expansion, zero residual stenosis) occurred in 6 patients and partial-success (stent-constraint <15%, <30% residual stenosis) in 4. Multiple layers of stent were associated with partial-success. Micro-bubbles, slow-flow and pronounced ST-elevation occurred transiently in all patients. None required re-stenting. There were no procedural complications, all vessels had TIMI-3-flow and isoelectric ECGs on completion. Average next-day high-sensitivity-troponin-T level was 420ng/L. At 30-days and 1-year follow-up, there have been no deaths, and only one patient required TVR downstream in an untreated area 3 months later.

Conclusion: Excimer laser represents a therapeutic option for the management of a small group of highly selected and symptomatic patients.

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Exponential Use of DES in the Last Decade Associated with Superior 1 year MACE Independent of Patient Characteristics

Q. Yang [*], B. Nkoane-Kelaeng, N. Ariyarathna, V. Moosavi, C. McCallum, P. Marley, A. Farshid

The Canberra Hospital, Canberra, Australia

Background: With increasing evidence of efficacy and safety of drug-eluting stents (DES), our institution was interested in identifying any subgroups that may not benefit from DES compared with BMS.

Method: We collected registry data on all PCI patients between January 2006 and June 2017. Primary outcomes were MACE and target lesion revascularisation at 1 year. Restenosis and stent thrombosis lesions, balloon angioplasty and unsuccessful procedures were excluded.

Results: 6711 consecutive patients were included. The proportion of DES use increased from 25% in 2006 to 87% in 2017. Age was 64.1 years in DES v 64.6 years in BMS ($p = 0.047$). Prevalence of diabetes mellitus was higher in DES compared to BMS (30.3% vs 16.3%, $p < 0.0001$). On univariate analysis MACE at 1 year was lower in DES than BMS (6.1% vs 10.9%, $p < 0.0001$). On multivariate analysis including age, sex, diabetes, STEMI, 3 vessel disease, shock and access site, DES was an independent predictor of lower MACE (RR 0.61 CI 0.51-0.73, $p < 0.0001$). On subgroup analysis including age >75, non-diabetics, STEMI, short lesions, large vessels and stent brand, the only group where there was no significant MACE advantage from DES was vessels >=3.5 mm (7.0% v 8.3%, $p = 0.299$). The MACE benefit was consistent with all second generation DES brands compared to BMS brands.

Conclusions: We report a dramatic increase in DES use over a decade. DES was an independent predictor of lower MACE in our population, which suggests that this major shift in practice has resulted in superior outcomes for patients at 1 year.

615

This abstract has been withdrawn

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Fever in the Setting of TAVI – Post-Implantation Fever vs Infection

D. Jin [1,2,*], A. Baradi [1,2], P. Trevella [2], R. Whitbourne [1,2], J. Darby [1], S. Palmer [1,2]

[1] *St Vincent's Hospital Melbourne, Melbourne, Australia*
[2] *University of Melbourne, Melbourne, Australia*

Introduction: Fever in the setting of endovascular intervention has been well described. There are limited studies in patients post transcatheter aortic valve implantation (TAVI). We aim to look at both the frequency and cause of fever in a TAVI population.

Method: A retrospective cohort study was conducted at our institution. All patients who had a TAVI between 2009-2018 were analysed. We identified those who had a fever ($\geq 38.0°C$). White cell count (WCC), c-reactive protein (CRP) and septic screen results (blood/urine cultures, chest x-ray) were also reviewed.

Results: A total of 135 patients were included, with 19 (14.2%) presenting with fever. The mean age of these was 81.1yrs ± 4.47, seven (36.8%) were male, five (26.3%) were diabetic. A cause of fever was only found in 5 of 19 (26.3%) patients, with three cases of pneumonia, two of urinary tract infection and one cellulitis. There was no significant difference between the average temperature (38.2, $p = 0.76$), WCC (10.5 vs 9.0. $p = 0.30$) or CRP (97.0 vs 60.3, $p = 0.21$) between those with a source and those without. However the aver-

age time to fever was shorter in those without an identifiable cause (32.9 hrs vs 70.8 hrs $p = 0.024$), with no further complications beside fever in this group.

Conclusion: Fever following TAVI is common. The majority (73.7%) do not have an identifiable infectious cause. We suspect that this is related to a systemic inflammatory syndrome. The timing of the fever may be suggestive of post implant related fever.

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FFR Guided Deferral of PCI is Safe in a Mixed Stable Angina and ACS Cohort– A Regional Centre Experience

M. Parkinson[*], S. Cheruvu, L. Weir, C. Said, H. Wadsworth, J. Qin, P. Bamford, R. Spina

Gosford Hospital, Gosford, Australia

Background: Fractional flow reserve (FFR) guided coronary intervention has gained recognition in assessment and management for stable angina however its utility in ACS patients remains uncertain.

Objective: To evaluate the safety and efficacy of FFR guided treatment in angiographically-determined moderate-lesions (typically luminal stenosis 50-70%) in ACS/stable angina patients.

Methods: A single-centre, retrospective analysis of all patients undergoing FFR over an 8-year period (2011-2019). Demographics, angiographic findings, management strategy and one- and twelve-month outcome data were assessed and compared for haemodynamically significant (FFR ≤ 0.8) versus non-significant lesions (FFR > 0.8). The primary end-point was a composite of major adverse cardiac events (MACE) including myocardial infarction (MI), unplanned revascularisation, readmission for heart failure and all-cause mortality.

Results: FFR was performed in 120 patients on 154 lesions during the study period, of which 26% presented with ACS. The average age was 66.5 years and 67% were male. 48/154 lesions (31%) were considered haemodynamically significant, of which 42 (88%) underwent immediate or semi-urgent revascularisation. No statistically significant differences were detected for the outcome or safety data of the two groups. At 12-months 8.7% of patients met the primary outcome for the haemodynamically significant group vs 10.8% for the non-significant group (p-value = 0.71). There was a non-significant trend was towards unplanned revascularisation at 12 months in the FFR > 0.8 group (6.8% vs 2.2%, $p = 0.26$), however none of these patients suffered MI.

Conclusion: Our data shows FFR guided intervention for moderate coronary lesions, regardless of indication, is safe with no clinically significant differences in 12-month outcomes.

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Frailty in Very Elderly Patients Undergoing Percutaneous Coronary Intervention for Acute Coronary Syndromes

B. Wong[*], K. Lee, S. El-Jack

North Shore Hospital, Auckland, New Zeeland

Background: With increasing life expectancy, very elderly patients (≥ 85 years old) presenting with acute coronary syndromes (ACS) are increasingly likely to undergo percutaneous coronary intervention (PCI). Benefit of PCI in this group is less predictable, particularly in the frail.

Method: Very elderly patients undergoing PCI for ACS in the Auckland region between 2014-2016 were retrospectively assessed for frailty using the Essential Frailty Toolset (EFT). Demographics, angiographic data and clinical outcomes were extracted from ANZACS-QI database and hospital electronic records.

Results: PCI was performed in 180 very elderly patients with ACS during this period (52% men, mean age 87.6 ± 2.8 years). Frailty defined as EFT ≥ 3 of 5 was present in 26% of patients. Frailty was associated with increased length of hospital stay (8.9 vs 5.6 days, $p = 0.015$) and with increased mortality (43% vs 13%; HR 4.4, 95% CI:2.3-8.4, $p < 0.0001$) at a mean follow-up of 23.4 months. Frailty was predictive of death, independent of demographics and comorbidities. Medically managed patients were older than the PCI group (88.9 vs 87.6 years, $p = 0.011$) and more frail (mean EFT score 2.1 vs 1.8, $p = 0.027$). Although PCI was associated with reduced mortality compared to medical management overall (21% vs 53%; HR 0.4, 95% CI:0.2-0.6, $p < 0.0001$), there was no difference in mortality when patients were frail (43% vs 54%; HR 1.0, 95% CI:0.5-2.0, $p = $ ns).

Conclusion: Frailty is an important predictor of length of hospital stay and mortality amongst very elderly patients undergoing PCI for ACS. Although PCI improves mortality, there appears to be no benefit when patients are frail.

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Gender Differences in Adherence to Healthy Lifestyle Following Percutaneous Coronary Intervention for Coronary Artery Disease

S. Perera [1,*], A. Aslam [1], J. Stehli [4], M. Watts [4], D. Kaye [4,5], J. Cameron [2,3], S. Zaman [2,3]

[1] *Monash University, Melbourne, Australia*
[2] *Monash Heart, Monash Medical Centre, Melbourne, Australia*
[3] *Monash Cardiovascular Research Centre, Monash University, Melbourne, Australia*
[4] *Alfred Hospital, Melbourne, Australia*
[5] *The Baker Heart and Diabetes Institute, Melbourne, Australia*

Background: Exercise, a heart-healthy diet and smoking cessation reduce mortality in coronary artery disease (CAD)

patients. However, gender differences in adherence rates to recommendations for healthy lifestyle aren't well known.

Aims: To ascertain gender differences in healthy lifestyle adherence at 12-month follow-up after percutaneous coronary intervention (PCI) for CAD.

Methods: Patients who underwent PCI at three hospitals were prospectively followed throughout hospital admission, at 30 days and 12 months. The primary endpoint was adherence to a healthy lifestyle defined as 3/3 of heart-healthy diet, physically active and no current smoking. Secondary endpoints included each aspect of this primary endpoint, change from baseline cholesterol levels and cardiac rehabilitation attendance.

Results: 729 people (26% female) were recruited. Women were older, with more diabetes and lower baseline TC and LDL. Adherence to healthy lifestyle at 12 months post-PCI was 56.6% with no significant difference between genders (51.3% vs 58.5%, $p = 0.084$). Women were more sedentary compared to men (38.7% vs 21.8%, $p = <0.001$). Men smoked more (13.8% vs 7.7%, $p = 0.029$), with no significant difference in healthy eating habits (82.4% vs 85.7%, $p = 0.309$). Women had a smaller reduction in mean LDL (0.60 vs 0.89, $p = 0.23$) and TG (0.34 vs 0.44, $p = 0.46$). Less women attended cardiac rehabilitation (58.2% vs 66.4%, $p = 0.045$).

Conclusions: At 12 months following PCI for CAD, 56.6% of patients adhered to healthy lifestyles with no significant difference between genders. Women were significantly more likely to be sedentary, not attend cardiac rehabilitation and smoke less. Women had smaller reductions in LDL and TG levels.

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620

Gender Differences in Long-term Outcomes and Predictors of All-cause Mortality After Percutaneous Coronary Intervention in Australia

A. Conradie[*], D. Eccleston

Genesiscare, Bundaberg, Australia

Introduction: Gender disparities have been consistently reported in the presentation of coronary artery disease, leading to significant outcome differences. We investigated the effect of gender on mortality and whether predictors of mortality were different for men and women, using a multivariable logistic regression model.

Methods: We prospectively collected data on 10,989 PCI procedures from January 2009 to January 2019 from 12 Australian Hospitals, comparing baseline patient and procedural characteristics and 1-year clinical outcome by gender.

Results: The overall 1-year mortality rate was very low for both men and women, with women having a higher risk of death (1.9% vs 1.2%; $P = 0.012$). Predictors of increase mortality in men was significantly different from women. On a multivariate logistic regression model, previous heart failure (OR 2.43, 95%CI 1.14 to 5.1, $P = 0.02$), previous MI (OR 1.96, 95% CI 1.04 to 3.7, $P = 0.036$), and history of peripheral vascular disease (OR 2.46, 95% CI 1.21 to 4.97, $P = 0.012$) were associated with increase in mortality in men. PCI to the left

main (OR 3.69, 95% CI 1.09 to 12.45, $P = 0.035$), and use of BMS vs DES (OR 0.45, 95% CI 0.25 to 0.82; $P = 0.009$) also increase mortality in men. In women no significant predictor was identified.

Conclusion: The difference in predictors of mortality in men and women does not explain the increase rate of death observed in women. Further research is needed to investigate the worse outcome in women.

Kaplan-Myer curve for 1 year

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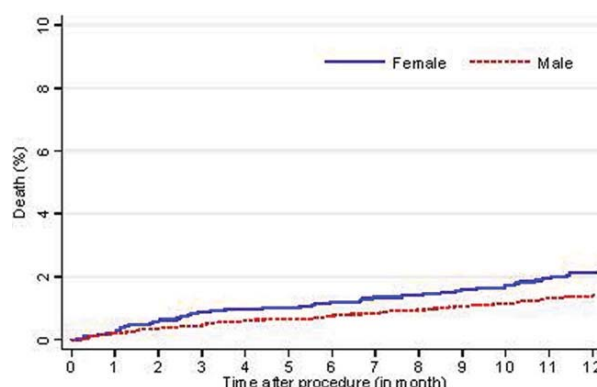
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Gender Differences in Optimal Medical Therapy Following Percutaneous Coronary Intervention for Myocardial Infarction

H. Michael[1,2,*], J. Stehli[3], C. Martin[4], A. Brennan[5], D. Dinh[5], J. Lefkovits[5,6], S. Zaman[1,2]

[1] *Monash Cardiovascular Research Centre, Monash University, Melbourne, Australia*
[2] *Monash Heart, Monash Medical Centre, Melbourne, Australia*
[3] *Cardiology Department, The Alfred Hospital, Melbourne, Australia*
[4] *Monash University, Melbourne, Australia*
[5] *Monash University, Centre of Cardiovascular Research and Education in Therapeutics, Melbourne, Australia*
[6] *Cardiology Department, Royal Melbourne Hospital, Melbourne, Australia*

Background: Prescription of optimal medical therapy (OMT) following myocardial infarction (MI) improves mortality. We evaluated if gender differences in OMT following percutaneous coronary intervention (PCI) for MI existed and their impact on total mortality.

Methods: From 2013-2016, consecutive patients treated with PCI for MI were entered into the Victorian Cardiac Outcomes Registry and followed for 30 days. The primary endpoint was discharge OMT defined as statin + dual antiplatelet therapy (DAPT) in patients with a left ventricular ejection fraction (LVEF) >44% and statin + DAPT + angiotensin-converting enzyme inhibitor + beta blocker in

patients with a LVEF ≤44%. Multivariate logistic regression was used to analyse independent predictors of OMT and 30-day mortality.

Results: 12,901 patients (22.7% female) with ST elevation MI (STEMI, 48.7%) or non-STEMI (NSTEMI) underwent PCI. In patients with LVEF >44%, female gender was independently associated with lower OMT in both STEMI (91.6% vs 95.6%, $p < 0.001$) and NSTEMI (89.6% vs 94.2%, $p < 0.001$) cohorts. Females had lower rates of statin therapy within STEMI (95.2% vs 97.6%, $p < 0.001$) and NSTEMI (92.0% vs 95.8%, $p < 0.001$) cohorts. In patients with LVEF ≤44% there was no difference in rates of OMT between gender. Discharge OMT was independently associated with lower 30-day mortality (OR 0.30, $p = 0.001$) in STEMI but not NSTEMI patients.

Conclusions: Female sex is independently associated with significantly lower rates of OMT in patients with LVEF >44% following MI. This difference was primarily driven by lower rates of statin therapy in women. OMT was independently associated with lower mortality in STEMI patients.

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622

Gender Differences in Percutaneous Coronary Intervention Practice and Outcomes in Australia: Results from a National Multicentre Outcomes Registry

D. Eccleston [1,2,*], A. Conradie [2],
J. Chandrasekhar [2], E. Chowdhury [3],
D. Latchem [2], P. Sage [2], S. Worthley [2]

[1] University Of Melbourne, Parkville, Australia
[2] GenesisCare, Sydney, Australia
[3] Monash University, Melbourne, Australia

Background: Gender differences are reported in presentation and outcomes in coronary artery disease and after percutaneous coronary intervention (PCI) Whether practice and long-term outcomes after PCI in Australia vary by gender is unknown.

Methods: We enrolled 10986 patients undergoing PCI to 14844 lesions in the Genesis HeartCare Outcomes Registry from November 2008-January 2018. Baseline patient/procedural data and 1-year outcomes were analysed with stratification by sex.

Results: Women were older (67.3 ± 10.5 vs 71.6 ± 10.3 years $p < 0.001$), more likely to have hypertension (80.2% vs 71.9% $p < 0.001$), heart failure (5.1% vs 2.9% $p < 0.001$), chronic kidney disease (29.2% vs 20.5% $p < 0.001$) and present with acute coronary syndromes but less likely to have smoked (31.5% vs 51.0% $p < 0.001$) have prior PCI (28.8% vs 33.6% $p < 0.001$), MI (19.5% vs 24.2% $p < 0.001$), multivessel disease (37.4% vs 44.6% $p < 0.001$. Procedural characteristics and outcomes varied by sex (Table)

Characteristic/outcome	Women	Men	p
Radial access	27.8%	31.7%	<0.001
B2/C lesion	46.8%	51.0%	<0.001
DES	73.0%	77.4%	<0.001
Vessel diameter mean (mm)	2.9 ± 0.4	3.0 ± 0.5	<0.001
Stent length mean (mm)	17.9 ± 5.9	18.8 ± 6.2	<0.001
Major bleeding	3.4%	1.7%	<0.001
1 Year - Readmission	8.56%	6.88%	0.01
- Death	1.93%	1.20%	0.08[*]
- MACE	3.09%	2.88%	0.42[*]

[*] multivariate logistic regression (adjusted for baseline variables).

Conclusions: Clinical presentation, PCI practice and outcomes vary between women and men in Australian private hospitals. Risk- adjusted 1 year mortality and MACE are similar for women and men however women are more likely to be readmitted after PCI

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Gender Disparity in Secondary Prevention Medication and Outcomes Following Percutaneous Coronary Intervention for Acute Coronary Syndrome

M. Dagan [1,*], D. Dinh [2], A. Murphy [3],
C. Tan [1], A. Brennan [2], J. Warren [1],
A. Ajani [2,4,6], M. Freeman [5], J. Shaw [1,7],
W. Chan [1,7], C. Reid [2], N. Andrianopoulos [2],
D. Clark [3], S. Duffy [1,7]

[1] Department of Cardiology, Alfred Health, Melbourne, Australia
[2] Centre for Cardiovascular Research and Education in Therapeutics, Department of Epidemiology and Preventive Medicine, Monash University, Melbourne, Australia
[3] Department of Cardiology, Austin Health, Melbourne, Australia
[4] Department of Cardiology, Royal Melbourne Hospital, Melbourne, Australia
[5] Department of Cardiology, Box Hill Hospital, Melbourne, Australia
[6] Department of Medicine, University of Melbourne, Melbourne, Australia
[7] Baker Heart and Diabetes Institute, Melbourne, Australia

Background: Women continue to receive suboptimal secondary prevention medications following acute coronary syndrome (ACS), however, impact on long-term outcomes are not well documented.

Methods: We analysed data on medical management 30-days post percutaneous coronary intervention for ACS in 20,976 consecutive patients in the Melbourne Interventional Group registry (2005-2018). Optimal medical therapy (OMT) was defined as 5 guideline-recommended medications, near-

optimal (NMT) as 4 medications, and sub-optimal (SMT) as ≤3 medications. Long-term mortality was determined by National-Death Index linkage.

Results: 65% of patients were prescribed OMT, 27% NMT and 8% SMT. Mean age 64 ± 12 years; 24% (4,931) female. Women were older (68 ± 12 vs. 62 ± 12 years) and had more comorbidities (higher BMI, hypertension, dyslipidaemia, diabetes and renal failure) than males, all $p \leq 0.001$. Women were less likely to receive OMT (61% vs. 66%) and more likely to receive SMT (10% vs. 8%) compared to men, $p < 0.001$. At 12-months ($n = 17,224$) women were more likely to have recurrent MI (6% vs. 5%, $p = 0.001$), major bleeding (2.3% vs. 0.9%, $p = 0.001$), stroke (1.5% vs. 0.8%, $p < 0.001$) and MACE (13% vs. 11%, $p = 0.026$). At mean 5.3 year follow up, women had higher mortality (20% vs. 13%, $p < 0.001$).

Kaplan-Meier survival estimates
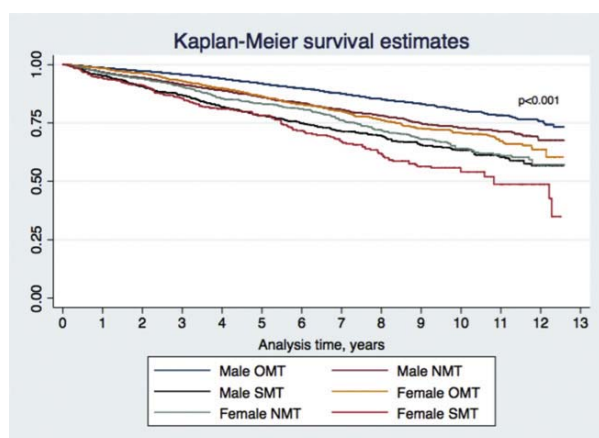
Conclusion: Women are less likely to be prescribed optimal secondary prevention medications following ACS and have poorer 12-month outcomes and long-term survival.

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This abstract has been withdrawn

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Gradient of Outcomes by Treatment Intensity in Patients with Diabetes Mellitus Undergoing Percutaneous Coronary Intervention

S. Biswas [1,2,*], D. Dinh [2], J. Lefkovits [2,3], A. Ajani [2,3], S. Duffy [1,2], A. Brennan [2], W. Chan [1], D. Bluzstein [3], D. Clark [4], C. Hiew [5], E. Oqueli [6], C. Reid [2,7], D. Stub [1,2], D. Eccleston [2,3]

[1] Department of Cardiology, The Alfred Hospital, Melbourne, Australia
[2] Department of Epidemiology and Preventive Medicine, Monash University, Melbourne, Australia
[3] Department of Cardiology, Royal Melbourne Hospital, Melbourne, Australia
[4] Department of Cardiology, Austin Health, Melbourne, Australia
[5] Department of Cardiology, University Hospital Geelong, Geelong, Australia
[6] Department of Cardiology, Ballarat Health Services, Ballarat, Australia
[7] School of Public Health, Curtin University, Perth, Australia

Background: Patients with diabetes mellitus have been shown to have worse outcomes after percutaneous coronary intervention (PCI) than non-diabetics. However, the impact of the intensity of diabetes treatment on outcomes is unclear.

Methods: We prospectively enrolled 4,579 patients with diabetes undergoing PCI in 2005 to 2014, in the multi-centre Melbourne Interventional Group registry. Demographic and procedural characteristics, and 12-month outcomes were compared in patients on insulin (ITDM) to those not on insulin (non-ITDM). Non-ITDM patients were further divided into diet control (diet-DM) and oral hypoglycaemic therapy (OHG-DM) groups. We then assessed the association of treatment intensity with 12-month outcomes adjusted for baseline clinical and lesion characteristics.

Results: In total, the non-ITDM group included 3,468 patients (76%) while the ITDM group included 1,111 patients (24%). ITDM patients were more likely to be male, obese, have peripheral vascular disease and receive drug-eluting stents (all $p < 0.001$). On multivariable analysis, ITDM was an independent predictor of 12-month major adverse cardiovascular and cerebrovascular events (MACCE) (OR 1.26; 95% CI 1.02–1.55; $p = 0.03$). When the non-ITDM group was sub-divided, a progressively higher rate of 12-month mortality and MACCE with increasing treatment intensity, was observed ($p < 0.001$)

	Diet-DM ($n = 786$)	OHG-DM ($n = 2,639$)	ITDM ($n = 1,111$)	P value
12-month mortality	31 (3.9)	188 (7.1)	96 (8.6)	<0.001
12-month MACCE	106 (13.5)	471 (17.9)	242 (21.8)	<0.001

Conclusion: ITDM patients have higher rates of MACCE compared to non-ITDM patients 12 months following PCI.

There is a clear gradient of risk of adverse outcomes with treatment escalation from diet control to OHG to insulin.

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Impact of Gender and Door-to-Balloon Times on Long-Term Mortality in Patients Presenting with ST-Elevation Myocardial Infarction (STEMI)

A. Murphy [1,*], D. Dinh [3], S. Duffy [3,4],
A. Brennan [3], N. Andrianopoulos [3],
M. Freeman [7], C. Reid [3,6], A. Ajani [2,3,6],
O. Farouque [1], L. Martin [1], M. Dagan [4],
D. Blusztein [5], D. Eccleston [5], M. Yudi [1],
D. Clark [1]

[1] *Austin Health, Melbourne, Australia*
[2] *University of Melbourne, Melbourne, Australia*
[3] *Centre of Cardiovascular Research and Education in Therapeutics (CCRE), Monash University, Melbourne, Australia*
[4] *Alfred Hospital, Melbourne, Australia*
[5] *Royal Melbourne Hospital, Melbourne, Australia*
[6] *School of Public Health, Curtin University, Perth, Australia*
[7] *Eastern Health, Melbourne, Australia*

Background: Guidelines mandate urgent revascularisation in patients presenting with STEMI irrespective of gender. There is extensive literature describing gender differences in the clinical presentation and pathophysiology of STEMI that may influence management and outcomes. Accordingly, we sought to compare the door-to-balloon times (DTBT) and the impact of timely reperfusion on clinical outcomes in women compared to men presenting with STEMI undergoing primary percutaneous coronary intervention (PCI).

Methods: 6,179 consecutive patients presenting with STEMI undergoing PCI from the Melbourne Interventional Group (MIG) registry (2005-2017) were analysed. The primary outcome was long-term mortality determined via National Death Index (NDI) linkage.

Results: 1,258 (20.3%) were female and 4,921 (79.7%) were male. Female patients were older (69.4 ± 13 vs 61.5 ± 12 years; $p < 0.001$), had more co-morbidities and had longer symptom-to-balloon times (204 (154,294) vs 181 (139,258) mins; $p < 0.001$) and DTBT (81 (55,102) vs 75 (51,102) mins; $p < 0.001$) while receiving less drug-eluting stents (DES, 38.7% vs 42.7%; $p = 0.01$) and having less radial access for PCI (15.0% vs 21.3%; $p < 0.001$). Unadjusted in-hospital and 30-day mortality rates were higher in women (8.8% vs 6.2%, 9.8% vs 6.9%; $p < 0.001$). However, on Cox-proportional hazard modelling, gender was not an independent predictor of long-term mortality (HR 0.99, 95%CI 0.83-1.18; $p = 0.92$) at a mean follow-up of 4.8 ± 3.5 years.

Kaplan-Meier survival estimates
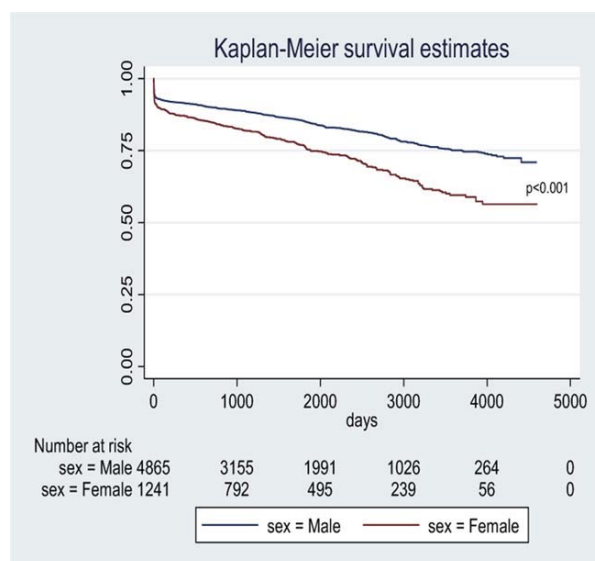
Conclusion: In this large multicentre registry of patients with STEMI, women had longer ischemic times, higher risk profiles and differing interventional approaches compared to men. Addressing these gender inequalities with greater radial access and use of DES, as well as early identification of symptoms, has the potential to further improve outcomes in women with STEMI.

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Impact of Gender on Transcatheter Aortic Valve Implantation Outcomes

J. Koh [1,*], J. Stehli [1], C. Martin [2], M. Dagan [1],
C. Choo [2], C. Crawford [2], M. Dong [2],
N. Htun [1], D. Stub [1], A. Walton [1,3], S. Duffy [1]

[1] *Alfred Hospital, Melbourne, Australia*
[2] *Monash University, Melbourne, Australia*
[3] *Epworth Hospital, Melbourne, Australia*

Background: Prior studies indicate that females undergoing surgical aortic valve replacement (SAVR) have poorer 30-day outcomes compared to males. However, the effect of gender as a prognostic factor for outcomes post transcatheter aortic valve implantation (TAVI) remains unclear.

Methods: Between 2008 and 2017, all patients who underwent TAVI in two experienced centres in Melbourne were prospectively included in a registry. The primary end-point was 5-year mortality. Secondary end-points were Valve Academic Research Consortium (VARC)-2 outcomes at 30-days and 1-year.

Results: Of 588 patients, 295 (50.2%) were female. Females had a higher mean STS-PROM score (5.4 ± 3.3 vs. 4.8 ± 3.7, $p = 0.04$), but were more independent with activities of daily living (67.9% vs. 55.3%, $p = 0.005$) than men. At 30 days, females had a higher incidence of access site complications (8.1% vs. 4.1%, $p = 0.05$), but similar mortality (1.0% vs. 0.3%, $p = 0.31$). Other VARC-2 outcomes including acute myocardial infarction, stroke, major bleeding, acute kidney injury and conduction disturbances requiring permanent

pacemaker implantation were similar (p = NS). There was no significant difference in mortality at 1-year (HR = 0.73, 95%CI 0.40-1.34, p = 0.31) and at 5-years (HR = 0.84, 95%CI 0.60-1.18, p = 0.31). Multivariate analysis demonstrated that gender was not an independent predictor of mortality at 1-year (OR = 1.07, 95%CI 0.43-2.63, p = 0.89) and 5-years (OR = 0.84, 95%CI 0.48-1.44, p = 0.52).

Conclusion: While females have more access site complications, they do not have other adverse outcomes after TAVI. Gender is not a predictor of mortality both in the short- and long-term.

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Impact of Left Ventricular Ejection Fraction on Outcomes Following Transcatheter Aortic Valve Implantation

J. Koh[1,*], J. Stehli[1], C. Martin[2], E. Quine[1], M. Dagan[1], L. Dawson[3], M. Dong[2], C. Crawford[2], N. Htun[1,2], D. Stub[1,2], A. Walton[1,2,4], S. Duffy[1,2]

[1] *Alfred Hospital, Melbourne, Australia*
[2] *Monash University, Melbourne, Australia*
[3] *Royal Melbourne Hospital, Melbourne, Australia*
[4] *Epworth Hospital, Melbourne, Australia*

Background: We aimed to evaluate outcomes after transcatheter aortic valve implantation (TAVI) based on LVEF.

Methods: Between 2008 and 2017, all patients who underwent TAVI in two experienced centres in Melbourne were prospectively included in a registry. Baseline, peri-procedural characteristics and outcomes were compared using Valve Academic Research Consortium (VARC)-2 criteria. Patients were stratified to LVEF <50% and LVEF ≥50%. The primary end-point was 1-year mortality.

Results: Of 535 patients, 89 (16.6%) had a LVEF <50%. Patients with LVEF <50% were younger (83 vs. 85, p = 0.002), more often male (70% vs. 46%, p < 0.001), more often had concomitant CAD (60% vs. 41%, p < 0.001), moderate-severe MR (24% vs. 11%, p = 0.002) and low-gradient severe AS (51% vs. 15%, p < 0.001). Mortality was similar in both groups at 30-days (LVEF <50%: 1.1% vs. LVEF ≥50%: 0.9%, p = 0.99) and at 1-year (LVEF <50%: 10.7% vs. LVEF ≥50%: 7.1% p = 0.29). Multivariate analysis demonstrated that LVEF was not an independent predictor of poorer outcomes at 1-year (LVEF <50%: OR = 1.27, 95%CI 0.51-3.14, p = 0.60). Other VARC-2 outcomes including acute myocardial infarction, stroke, major bleed, access site complications, acute kidney injury and conduction disturbances requiring PPM insertion (p = NS).

Conclusion: Patients with LVEF<50% are a significantly different patient population in terms of baseline characteristics. However, short-term and medium-term outcomes remain similar to patients with a LVEF ≥50%.

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Impact of Limited English Proficiency on Ischaemic Time and Clinical Outcomes in Patients Undergoing Percutaneous Coronary Intervention for ST-elevation Myocardial Infarction

S. Biswas[1,2,*], D. Dinh[2], M. Lucas[2], S. Duffy[1,2], A. Brennan[2], D. Liew[2,3], N. Cox[4,5], C. Neil[4,5], C. Reid[2,6], J. Lefkovits[2,7], D. Stub[1,2,4]

[1] *Department of Cardiology, The Alfred Hospital, Melbourne, Australia*
[2] *School of Public Health and Preventive Medicine, Monash University, Melbourne, Australia*
[3] *Department of General Medicine, The Alfred Hospital, Melbourne, Australia*
[4] *Department of Cardiology, Western Health, Melbourne, Australia*
[5] *Department of Medicine, Melbourne Medical School (Western), The University of Melbourne, Melbourne, Australia*
[6] *School of Public Health, Curtin University, Perth, Australia*
[7] *Department of Cardiology, Royal Melbourne Hospital, Melbourne, Australia*

Background: Australian hospitals increasingly face the challenge of treating culturally and linguistically diverse (CALD) patients with limited English proficiency (LEP). We examined the impact of LEP on reperfusion times and outcomes in patients undergoing percutaneous coronary intervention (PCI) for ST-elevation myocardial infarction (STEMI).

Methods: Patients undergoing PCI for STEMI in 2013-2017, enrolled in the multi-centre Victorian Cardiac Outcomes Registry were included and linked to government administrative datasets to identify patients' primary spoken language. The primary endpoint was 30-day major adverse cardiovascular events (MACE).

Results: 568 (7.4%) of the 7,721 patients had LEP; they were more likely to be older, female, diabetic, and have severe renal impairment (all p < 0.02). Among primary PCI patients (n = 5,385), symptom-to-balloon time was longer for LEP patients (237 [IQR 158-429] vs. 195 [IQR 141-326] minutes, p < 0.001), driven by longer symptom-to-door times (STDT) (150 [IQR 90-276] vs. 114 [IQR 75-215] minutes, p < 0.001). LEP patients had higher 30-day MACE (11.8 vs. 9.1%, p = 0.04), severe left ventricular (LV) dysfunction (11.2% vs. 8.4%, p = 0.003) and heart failure readmissions within 30 days of PCI (5.2% vs. 2.0%, p < 0.001). On multivariate analysis, LEP was not an independent predictor of 30-day MACE (OR 1.27, 95% CI 0.82–1.95), but was an independent predictor of prolonged STDT>120 minutes (OR 1.24, 95% CI 1.02–1.52).

Conclusion: LEP patients undergoing PCI for STEMI present later and are more likely to have severe LV dysfunction and heart failure readmissions, with higher short-term MACE. More effort to provide education in

varied languages on early presentation in STEMI is required.

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This abstract has been withdrawn

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Impact of Pulmonary Hypertension on Outcome Following Transcatheter Aortic Valve Implantation

S. Montalto*, L. Dawson, J. Yao, R. Velusamy, D. Pol, D. Blusztein, J. Wong, L. Grigg, W. Wilson, M. Brooks, R. Gurvitch

Royal Melbourne Hospital, Parkville, Australia

Introduction: Pulmonary hypertension (PHTN) is a well-recognised risk factor in surgical aortic valve replacement and therefore is often a consideration in referral for transcatheter aortic valve implantation (TAVI). There are limited data on the impact of PHTN on outcomes following TAVI.

Method: Data were retrospectively collected on 132 consecutive TAVI procedures at a single centre for patients with available pre-TAVI pulmonary pressures. PHTN was defined as pre-TAVI RVSP ≥ 45 mmHg on echocardiography or mean pulmonary pressure ≥ 25 mmHg at right heart catheterisation (RHC).

Results: PHTN was present in 44% of the cohort; mean age was 83.1 ± 5.5; 45% were male. Baseline characteristics were similar, aside from the PHTN group being more likely to have COPD (20% vs 7%, $p = 0.04$). PHTN patients had a higher pre-TAVI RVSP (54 ± 13.7 mmHg vs 33 ± 6.8 mmHg), and were more likely to have moderate-severe mitral regurgitation (26% vs 2%, $p < 0.001$) or tricuspid regurgitation (29% vs 4%, $p < 0.01$). RHC demonstrated higher mean pulmonary pressure (39.0 ± 8.1 mmHg vs 17.4 ± 8.9, $p < 0.01$) and higher mean capillary wedge pressure (24.2 ± 6.4 mmHg vs 11.1 ± 6.9 mmHg, $p < 0.01$). Post-TAVI, 74% of the PHTN group had improvement in pulmonary pressures, with 63% returning to normal range. There was no significant difference in 30-day mortality (PHTN 2.1% vs non-PHT 1.6%, $p = 0.86$) or long-term survival out to 2 years (log rank 0.91). In multivariate analysis, BMI ≥ 25 was associated with increased risk of persistent PHTN post TAVI ($p = 0.02$).

Conclusion: Pre-TAVI PHTN often improves following TAVI and did not appear to affect outcome in this cohort. BMI may be a risk factor for persistent PHTN post-TAVI.

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Impact of Transcatheter Aortic Valve Implantation on Symptoms and Quality of Life in Australian Patients: Insights from the ACOR TAVI Registry

T. Hooper[1,*], M. Ng[3], G. Thomas[1], J. Bennetts[2], R. Bhindi[4], D. Brieger[5], D. Muller[12], A. Walton[8], A. Camuglia[9], R. Gooley[13], R. Whitbourn[6], G. Yong[14], W. Wilson[11], J. Stewart[7], MacA. Isaac[6], D. Walters[10], A. Sinhal[2]

[1] *SAHMRI, Adelaide, Australia*
[2] *Flinders Medical Centre, Bedford Park, Australia*
[3] *Royal Prince Alfred Hospital, Sydney, Australia*
[4] *North Shore Private Hospital, Sydney, Australia*
[5] *Concord Hospital, Sydney, Australia*
[6] *St. Vincent's Hospital Melbourne, Melbourne, Australia*
[7] *Auckland District Health Board, Auckland, New Zealand*
[8] *Alfred Hospital, Melbourne, Australia*
[9] *Princess Alexandra Hospital, Brisbane, Australia*
[10] *University of Queensland, Brisbane, Australia*
[11] *Royal Melbourne Hospital, Melbourne, Australia*
[12] *St Vincent's Hospital Sydney, Darlinghurst, Australia*
[13] *Monash Health, Clayton, Australia*
[14] *Mount Hospital, Perth, Australia*

Objective: To evaluate the health status outcomes of TAVI patients using two standardised and validated patient-reported outcome measures (PROMs).

Methods: From April to October 2018, TAVI Registry patients were requested via phone, email, mail or direct contact to complete the PROMs at two timepoints: pre-procedure (416 patients) and 30-day follow-up (273 eligible patients). The PROMs include: a generic quality of life questionnaire, the EQ-5D and a disease specific instrument, the Kansas City Cardiomyopathy Questionnaire (KCCQ).

Results: The cohort mean age was 83 years (range 59-87) and 57% male. For both PROMs there was a high completion rate: the pre-procedure timepoint (KCCQ $n = 384$ (92%), EQ5D $n = 390$ (94%)) was lower than at 30-days (KCCQ $n = 262$ (96%) EQ5D $n = 264$ (97%)).

The mean KCCQ-overall score increased from 49.7 ± 22.7 pre-procedure to 76.0 ± 21.2 at 30-days (p value < 0.0001). All KCCQ domains increased when comparing pre-procedure and 30-day follow-up.

The overall mean EQ5D visual analogue scale (score 0-100) increased from 59.8 ± 18.9 to 72.9 ± 17.0 at 30-days (p value < 0.001). A comparison of pre-procedure and 30-day follow-up data using EQ5D showed a significant increase in all five domains.

Conclusion: A dramatic improvement at 30-days is being reported by patients supporting the clinical benefits of the TAVI procedure. This significance was demonstrated

throughout all domain variables and as an overall score in both PROMs. As the TAVI Registry reaches its 1-year time-point, it is expected the outcomes will continue to improve which aligns with the PROMs data reported from other international registries.

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Incidence, Management and Impact of Incidental Coronary Artery Disease on Outcomes Following Transcatheter Aortic Valve Implantation

M. Dagan[1,*], L. Dawson[3], J. Stehli[1], S. Koh[1], E. Quine[1], A. Walton[1,2], D. Stub[1,2], N. Htun[1,2], S. Duffy[1,2]

[1] *Alfred Health, Melbourne, Australia*
[2] *Baker Heart and Diabetes Institute, Melbourne, Australia*
[3] *Royal Melbourne Hospital, Melbourne, Australia*

Background: Coronary artery disease (CAD) and aortic stenosis commonly coexist. However, whether treatment of asymptomatic incidental CAD prior to transcatheter aortic valve implantation (TAVI) improves outcomes remains uncertain.

Methods: We analysed data from 338 patients undergoing TAVI for symptomatic severe aortic stenosis between 2008 to 2018 to assess whether CAD (defined as coronary artery stenosis $\geq$50% in $\geq$1 vessel) management prior to TAVI reduced post procedure myocardial injury (PPMI; defined as troponin-I 15x the upper limit of normal within 24 hours) or affected 30-day and 12-month MACCE or 2-year survival. Those with previous coronary artery bypass grafting were excluded.

Results: Incidental CAD was identified in 41% (140) of patients during work-up for TAVI; mean age 83 $\pm$ 7 years; 51% female. Male gender (66% vs. 37%, $p < 0.01$) and presence of insulin-dependent diabetes (8% vs. 3%, $p = 0.02$) were associated with incidental CAD. Of those with incidental CAD, 36% (51) proceeded to pre-TAVI PCI, while 64% (89) were managed medically. Those managed with PCI had more severe CAD as determined by Gensini score (median 24, IQR 15-36 vs. 15, IQR 10-22, $p < 0.01$). PPMI (61% vs. 67%, $p = 0.47$), 30-day MACCE (2% vs. 6%, $p = 0.26$), 12 month MACCE (16% vs 29%, $p = 0.13$) and two-year mortality (11% vs. 6%, $p = 0.42$), were similar between patients who were medically managed versus PCI.

Conclusion: Male patients with insulin dependent diabetes are more likely to have incidental asymptomatic coronary artery disease found during TAVI work-up. Revascularisation of incidental CAD with PCI was not associated with increased PPMI or adverse clinical outcomes.

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Incidence, Predictors and Clinical Outcomes of Stent Thrombosis Following PCI

R. Batchelor[1,*], D. Dinh[2], A. Brennan[2], J. Lefkovits[2], C. Reid[2,3], S. Duffy[1,2], D. Liew[2], N. Cox[4], D. Stub on behalf of VCOR investigators[1,4]

[1] *Alfred Health, Melbourne, Australia*
[2] *Monash University, Melbourne, Australia*
[3] *Curtin University, Perth, Australia*
[4] *Western Health, Melbourne, Australia*

Background: Stent thrombosis is an uncommon but serious complication of percutaneous coronary intervention (PCI). The reported rate of definite stent thrombosis with new generation drug-eluting stents ranges from 0.5 to 1%. We aimed to examine the incidence and outcomes of stent thrombosis in a real-world setting.

Methods: The Victorian Cardiac Outcomes Registry was established in 2013 as a state-wide clinical quality registry, with all PCI capable centres contributing in 2017. Data were collected on 41,137 consecutive PCI procedures from 2013 to 2017. We described the patient characteristics and clinical outcomes in definite and probable stent thrombosis at 30 days.

Results: Stent thrombosis occurred in 225 patients (0.55%). These patients were more likely to be female (32.0% vs. 23.4%, $p = 0.002$) and have a history of diabetes (28.6% vs. 21.9%, $p = 0.016$). Stent thrombosis was more common in patients with severely reduced left ventricular ejection fraction (14.9% vs. 4.6%, $p < 0.001$) and in patients presenting with ST-elevation myocardial infarction, cardiogenic shock and cardiac arrest for their index PCI (all $p < 0.001$). Dual antiplatelet therapy at 30 days was less frequent in patients with stent thrombosis (84.8% vs. 92.0%, $p < 0.001$), while 30-day mortality was more common: 23.6% versus 2.0% ($p < 0.001$).

Conclusions: Even with contemporary stents and adjunctive medications, ST still occurs following one in 200 PCIs, and is associated with significantly increased mortality at 30 days.

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Incidence, Predictors and Outcomes of Failed Percutaneous Coronary Intervention in Contemporary Australian Practice

S. Biswas [1,2,*], D. Dinh [2], S. Duffy [1,2],
A. Brennan [2], D. Liew [2,3], N. Cox [4],
V. Nadurata [5], C. Reid [2,6], J. Lefkovits [2,7],
D. Stub [1,2,4]

[1] Department of Cardiology, The Alfred Hospital, Melbourne, Australia
[2] School of Public Health and Preventive Medicine, Monash University, Melbourne, Australia
[3] Department of General Medicine, The Alfred Hospital, Melbourne, Australia
[4] Department of Cardiology, Western Health, Melbourne, Australia
[5] Department of Cardiology, Bendigo Health, Bendigo, Australia
[6] School of Public Health, Curtin University, Perth, Australia
[7] Department of Cardiology, Royal Melbourne Hospital, Melbourne, Australia

Background: As techniques and equipment for percutaneous coronary intervention (PCI) have improved, more complex lesions are now being attempted. However, there are limited contemporary data regarding the incidence, predictors and outcomes of failed PCI.

Methods: We prospectively collected data on 34,383 patients undergoing single-lesion PCI in 2013-2017, enrolled in the multi-centre Victorian Cardiac Outcomes Registry, and dichotomised them by whether PCI was deemed successful by the operator on pre-specified criteria. The primary endpoint was 30-day major adverse cardiovascular events (MACE).

Results: 2,080 patients (6.0%) had a failed PCI- they were older (67.5 ± 11.8 vs. 65.5 ± 12.0 years), more likely to have a history of stroke, previous PCI, severe left ventricular dysfunction and chronic kidney disease (all $p < 0.001$). PCI to chronic total occlusion lesions accounted for 30.2% of all failed PCIs (vs. 2.2% of successful PCIs; $p < 0.001$). Failed PCI rates were higher in private compared to public hospitals (7.2% vs. 5.4%; $p < 0.001$). Failed PCI was itself associated with higher 30-day mortality, unplanned revascularisation and MACE ($p < 0.001$). On multivariable analysis, failed PCI was a strong independent predictor of 30-day MACE (OR 3.44, 95% CI 2.75-4.30; $p < 0.001$). In a secondary analysis including multi-lesion PCIs, failed PCI of any one lesion remained strongly independently associated with 30-day MACE (OR 3.23, 95% CI 2.68-3.90; $p < 0.001$).

Conclusion: Our study has characterised demographic and clinical characteristics associated with failed PCI in contemporary practice. Lack of procedural success is strongly associated with adverse patient outcomes. Monitoring rates of failed cases among hospitals and operators is an important quality assurance tool.

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Incidence, Predictors and Outcomes of Myocardial Injury Following Transcatheter Aortic Valve Implantation (TAVI)

M. Dagan [1,*], L. Dawson [3], J. Stehli [1],
S. Koh [1], E. Quine [1], A. Walton [1,2],
D. Stub [1,2], N. Htun [1,2], S. Duffy [1,2]

[1] Alfred Health, Melbourne, Australia
[2] Baker Heart and Diabetes Institute, Melbourne, Australia
[3] Royal Melbourne Hospital, Melbourne, Australia

Background: Myocardial injury following transcatheter aortic valve implantation (TAVI) is common. However, its impact on medium- and long-term outcomes remains controversial.

Methods: We analysed 400 patients undergoing TAVI for severe symptomatic aortic stenosis between 2008 and 2018. Troponin-I values were collected within 24 hours post procedure. Post-procedure myocardial injury (PPMI) was defined as troponin 15x the upper limit of normal based on Valve Academic Research Consortium (VARC)-2 criteria. The primary end-point was 2-year mortality.

Results: Mean age of the cohort was 82 ± 7 years; 46% were female. PPMI occurred in 64% (254) of patients. Multivariable logistic regression analysis demonstrated older generation valves Sapien XT (OR 14.2, 95%CI 2.72-74.5, $p < 0.01$) and CoreValve 'classic' (OR 3.51, 95%CI 1.54-8.00, $p < 0.01$), as well as higher ejection fraction pre-TAVI (OR 1.03, 95%CI 1.01-1.06, $p < 0.01$) were associated with PPMI. Atrial fibrillation (OR 0.60, 95%CI 0.37-1.00, $p = 0.05$) and diabetes mellitus (OR 0.38, 95%CI 0.23-0.62) were protective. Patients who had PPMI had longer hospital stay (5 days IQR 4-7 vs. 4 days IQR 3-6, $p = 0.02$), however PPMI was not associated with complication rates, 30-day or 1-year outcomes. Kaplan-Meier survival analysis up to two years demonstrated lower survival for those who had PPMI (86% vs. 96%, log-rank $p = 0.05$). On multivariable analysis PPMI was an independent predictor of 2-year mortality (OR 4.26, 95%CI 1.26-14.4, $p = 0.02$).

Conclusion: PPMI occurs in the majority of patients undergoing TAVI and is independently associated with longer hospital stay and lower 2-year survival. Higher LVEF, and older generation valves were independent predictors of PPMI.

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Increasing Incidence of Spontaneous Coronary Artery Dissection (SCAD) in Christchurch

C. McAlister [1,*], M. Yi [1], P. Adamson [1,2], J. Blake [1], D. McClean [1], J. Elliott [1,2], D. Smyth [1], A. Puri [1]

[1] Christchurch Public Hospital, Christchurch, New Zealand
[2] University of Otago, Christchurch, New Zealand

Background: Improvements in the understanding of Spontaneous Coronary Artery Dissection (SCAD) have allowed greater recognition of this condition in recent years. However, the true incidence remains unknown. We sought to examine whether the incidence of SCAD in Christchurch has increased over the last five years.

Method: All patients with angiographically confirmed SCAD since January 2014 were included in this study. Numbers of SCAD were compared against the total number of patients with acute coronary syndrome (ACS) who presented to Christchurch Public Hospital and underwent coronary angiogram, identified by the ANZACS-QI database.

Results: A total of 81 patients (89% female, median age 54) were diagnosed with SCAD over 5 years. One-sided p-value derived using Cochrane-Armitage Trend test is <0.0001 for all SCAD, <0.0001 for females and <0.0006 for females <60 years, suggesting a statistically clear upward trend over the 5 years.

SCAD diagnoses per year (and as proportion of ACS)

	2014	2015	2016	2017	2018
All SCAD	4 (0.3%)	14 (1.0%)	10 (0.7%)	22 (1.6%)	31 (2.2%)
Female	4 (1.0%)	12 (2.4%)	10 (2.0%)	19 (4.1%)	27 (5.6%)
Female <60	4 (5.6%)	4 (4.3%)	5 (4.7%)	12 (11.8%)	18 (15.9%)

Conclusion: The incidence of SCAD in Christchurch appears to be increasing. The true incidence of SCAD remains unknown although it may represent more than 2% of all presentations with ACS and significantly more in females. Further research should aim at improving diagnosis and identifying the cause of this fascinating condition.

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Inpatient Coronary Angiography is Associated with Reduced Mortality in Patients aged >85 years with Non-ST-Elevation Myocardial Infarction

P. Kunniardy [*], G. Meehan, A. Murphy, D. Clark, O. Farouque, M. Yudi

Austin Health, Heidelberg, Australia

Introduction: Guidelines recommend early coronary angiography in patients presenting with non-ST-elevation myocardial infarction (NSTEMI), irrespective of age. Whether this strategy is associated with improved survival in patients aged >85 years remains uncertain. In this single centre retrospective study, we assessed whether invasive coronary angiography (CA) during the index admission with NSTEMI was associated with any improvement in long-term survival.

Methods: 956 consecutive patients aged >85 years presenting with NSTEMI between 2010-2018 were included. Patients were stratified depending on whether they underwent invasive CA. The primary outcome was all-cause mortality as determined by review of medical records.

Results: Of the 956 patients included, only 92 (9.7%) patients underwent CA. The mean age was 89 ± 3 years and 43.8% were male. Those undergoing CA were more likely to be younger, male, more likely to be in independent living, without underlying mobility or cognitive issues (all $p < 0.01$). Overall, 444 (46.5%) deaths occurred over a mean follow-up of 1.3 years. Undergoing CA was associated with lower mortality on univariate Cox regression (HR 0.29, 95% CI 0.19-0.45, $p < 0.001$) with early divergence between the groups. After adjusting for age, gender, diabetes, prior MI, AF, living status, cognitive function and mobility, undergoing CA was strongly associated with improved survival (HR 0.35, 95%CI 0.22-0.56, $p < 0.001$).

Conclusion: In this cohort of elderly patients presenting with NSTEMI, invasive management was shown to be an independent predictor of long-term survival. Given the high mortality associated with NSTEMI in this population, consideration should be given to early coronary angiography with a view to revascularisation.

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In-practice Hybrid Heart Team Co-proceduralist TAVR Model is Associated with Low Procedural Complication Rates and Good Patient Outcomes: The Princess Alexandra Hospital Hybrid Heart Team Approach

P. O'sullivan [*], C. Cole, J. Mundy, W. Lo, P. Garrahy, S. Cox, W. Sudhir, A. Chong, S. Cox, K. Korver, A. Camuglia

Princess Alexandra Hospital, Brisbane, Australia

Introduction: The transcatheter aortic valve replacement (TAVR) program was commenced at the institution described in 2016 using a collaborative hybrid team approach. At its core, this entails an interventional cardiologist and cardiac surgeon as scrubbed co-proceduralists for all cases (in addition to other team members). It was hypothesised that this approach would lead to lower than benchmark complication rates and satisfactory patient outcomes.

Outcomes: TAVR was performed on 72 patients, with an average age of 82.3 years, mean STS score of 3.72 (SEM +/- 0.38) and mean Euro II score of 4.12 (SEM +/- 0.24). There were no intra-procedural deaths. Thirty-day and 12 month mortality was 1.4% and 7% respectively. One stroke occurred within 30 days (1.4%). There were no major vascular complications (0%). All cases were assessed for, and planned by, the institutional heart team and all patients were seen by both

a heart surgeon and interventional cardiologist in the multidisciplinary clinic. All procedures were performed by both an interventional cardiologist and cardiothoracic surgeon as co-proceduralists (supported by an imaging cardiologist and cardiac anaesthetic team).

Conclusions: The hybrid heart team co-proceduralist approach as adopted has resulted in low complication rates with good patient outcomes. This likely results from appropriate patient selection and superior peri-procedural care, in particular the ability to assess and pre-empt the potential for major vascular complications with a surgeon and cardiologist working together is key. The results described are consistent with other national and international experience employing a similar model.

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Intravascular Ultrasound (IVUS) Analysis of Intensive Plaque Modification with Rotational Atherectomy with or without Adjunctive Cutting Balloon for Extremely Calcified Coronary Lesions

J. Xu*, A. Hopkins, D. Leung, C. Mussap, J. French, C. Juergens, S. Lo

Liverpool Hospital, Sydney, Australia

Introduction: Intensive plaque modification with rotational atherectomy(RA) $\pm$ cutting balloon(CB) can facilitate successful stent delivery in extremely calcified coronary lesions. However, there is a paucity of studies examining the effects of this on stent expansion.

Methods: We retrospectively analysed consecutive patients undergoing IVUS-guided RA at Liverpool Hospital between Jan 2016-Dec 2018. IVUS was performed post-RA and after stenting. Calcium-index was defined as maximum superficial calcium arc multiplied by calcium length/lesion length. Post-RA reverberations (multiple reflections from calcium) were considered to represent RA-related plaque modification and reverberation-index was maximum reverberation angle multiplied by reverberation length. Stent expansion was minimum stent area (MSA)/average reference lumen area.

Results: Among 76 total RA cases, 15 were IVUS-guided with 20 lesions included for analysis. Mean age 80.3 ± 8.9 years, 93% male. Adjunctive CB was used in 15 lesions (75%). A mean of 1.1 burr/patient was used with the most common burr size being 1.5mm (9 lesions). Mean burr/artery ratio was 0.45 and burr/IVUS-lumen (external-elastic-lamina diameter) ratio was 0.41. Median calcium-index was 96.6 (IQR 52.5-133.7), with 360^0-arc calcium in 11 lesions (55%). Calcium splitting was seen in 13 lesions (65%). Median MSA was 7.5mm^2(IQR 6.5-10.7mm^2). Median stent expansion was 91.5% (IQR 75.3%-95.6%, range 58.2%-98.3%). Median reverberation-index was 445.5 (IQR 256.9-825.6). Calcium-index negatively correlated with stent expansion ($r = -0.62, 95\%CI: -0.86$ to $-0.16, p = 0.01$), and positively correlated with reverberation-index ($r = 0.53, 95\%CI: 0.11$-$0.79, p = 0.02$). Angiographic success achieved in all cases.

Conclusions: Increased coronary calcification is correlated with stent under-expansion despite greater plaque modifica-

tion. IVUS-guidance ensured satisfactory MSA was achieved post-stenting.

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Invasive Assessment of Low Flow Low Gradient Aortic Stenosis

A. Michael [1,*], S. Manoharan [2], R. Nair [3], S. Pasupati [3]

[1] *Royal Adelaide Hospital, Adelaide, Australia*
[2] *University of Auckland, Auckland, New Zealand*
[3] *Waikato Hospital, Hamilton, New Zealand*

Background: Low flow low gradient Aortic stenosis (LF-LG AS) is seen in about 5-10% of patients with severe AS and it is characterised by a discordance between the aortic valve area (AVA) <1 cm^2 and/or index (i) AVA <0.6 cm^2/m^2(consistent with severe AS) and the mean gradient (MG)<40 mmHg, (consistent with non-severe AS). Non-invasive assessment of LF-LG AS can be challenging.

Aim: We hypothesised that invasive assessment of LF-LG AS in the cardiac catheterisation laboratory with dobutamine stress testing can accurately assess AS severity and guide management.

Methods: We conducted a single centre, single operator dependent retrospective study on 18 patients identified to have LF-LG AS by echocardiography. Invasive assessment involved measurement of simultaneous gradients across the aortic valve with measurement of cardiac output (CO) using thermodilution. Clinical outcome following surgical or transcatheter aortic valve replacement (SAVR or TAVR) or medical management for patients with true and pseudo AS was studied.

Results: 11 patients had true severe AS, 5 patients had pseudo AS and 2 had inconclusive finding (See table).

	True AS	Pseudo AS	Inconclusive	P value
Baseline MG	26.91 ± 4.11	24.08 ± 4.77	15.75 ± 1.77	0.054
Post MG	39.64 ± 5.41	29.88 ± 10.19	22.5 ± 0.71	0.006
Baseline iAVA	0.39 ± 0.09	0.52 ± 0.05	0.31 ± 0.10	0.022
Post iAVA	0.43 ± 0.1	0.68 ± 0.1	0.33 ± 0.06	0.0003
Baseline CO	3.66 ± 1.03	4.2 ± 0.78	3.48 ± 0.22	0.513
Post CO	5.07 ± 1.34	5.34 ± 0.95	4.75 ± 1.91	0.852
Max.Dobutamine dose(mcg/kg/min)	22.27 ± 13.3	26 ± 13.42	30 ± 14.14	0.712

6 out of 11 true severe AS patients underwent SAVR or TAVR and all survived beyond 3 years. Of the 5 patients treated conservatively, mortality was 40% in 1 year and 100% in 3 years. 1 patient with pseudo AS underwent SAVR while 4 were medically managed. All patients with pseudo AS survived beyond 1 year.

Conclusion: Invasive assessment of LF-LG AS is an alternative to accurately assess the true severity of AS and guide appropriate management to improve long term outcomes.

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Is STS Score Enough to Predict Appropriate High-risk Surgical Patient for TAVI

A. Sinhal[2,*], T. Hooper[1], M. Ng[3],
L. Griffith[1], A. Deakin[1], R. Bhindi[4],
D. Brieger[5], D. Muller[12], A. Walton[8],
A. Camuglia[9], R. Gooley[13], G. Yong[14],
W. Wilson[11], J. Stewart[7], R. Whitbourn[6],
MacA. Isaac[6], D. Walters[10], J. Bennetts[2]

[1] *SAHMRI, Adelaide, Australia*
[2] *Flinders Medical Centre, Bedford Park, Australia*
[3] *Royal Prince Alfred Hospital, Sydney, Australia*
[4] *North Shore Private Hospital, Sydney, Australia*
[5] *Concord Hospital, Sydney, Australia*
[6] *St. Vincent's Hospital Melbourne, Melbourne, Australia*
[7] *Auckland District Health Board, Auckland, New Zealand*
[8] *Alfred Hospital, Melbourne, Australia*
[9] *Princess Alexandra Hospital, Brisbane, Australia*
[10] *University of Queensland, Brisbane, Australia*
[11] *Royal Melbourne Hospital, Melbourne, Australia*
[12] *St Vincent's Hospital Sydney, Darlinghurst, Australia*
[13] *Monash Health, Clayton, Australia*
[14] *Mount Hospital, Perth, Australia*

Objective: To determine if STS score alone can predict which patients proceed to a TAVI procedure

Method: When evaluating a patient's suitability for a TAVI procedure, Australian multidisciplinary heart teams (MDT) also assess the perioperative risk of surgical mortality (PROM). The STS PROM is calculated based on the patient demographics, history and clinical variables weighted against outcomes for surgical Atrial Valve Replacement (sAVR). However, it does not include many factors deemed important for decision of TAVI vs sAVR. The TAVI Registry commenced mandatory STS scoring in August 2018. Three STS risk levels are included in the cohort of data exported from the TAVI Registry in February 2019.

Results: Out of 677 cases in the TAVI registry with completed STS score, 274 were low risk (STS <4%), 264 "intermediate risk" (STS 4-7%) and 139 "high risk" (STS ≥8%). TAVI was performed as recommended by an MDT, indicating there are other factors which must be considered during risk assessment of patients such as: previous cardiac surgery; porcelain aorta, frailty score, mental state (dementia), mobility, social situation and BMI.

Conclusion: The majority of patients in the TAVI Registry were the "low-risk" for sAVR suggesting deficiency of using STS score alone for TAVI. Many other factors precluding sAVR are not included in the STS risk calculation. Currently the criteria used by the MDT to determine TAVI risk is not uniform and could be viewed as subjective. An opportunity exists to develop a TAVI-specific risk-prediction model incorporating other factors.

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Is there a Mortality Hazard for Women after Percutaneous Coronary Intervention for Acute Coronary Syndrome? Analysis of the GenesisCare Outcomes Registry

J. Chandrasekhar[1,2,*], E. Chowdhury[1],
A. Conradie[2], S. Worthley[2], D. Eccleston[1,2]

[1] *Monash University, Melbourne, Australia*
[2] *GenesisCare, Melbourne, Australia*

Introduction: Sex differences are increasingly recognised in clinical presentation, treatment and outcomes in acute coronary syndromes (ACS). Women are reported to have higher mortality related to percutaneous coronary intervention (PCI) than men. However, the effect of sex on long-term outcomes after PCI in Australia is unknown.

Methods: Patients with ACS undergoing PCI were stratified by sex. We evaluated 1-year mortality and rates of readmissions.

Results: Data were available for 5004 patients (24.2% women) having PCI for ACS from Nov2008 - Jan2018. Women were older (71.7 ± 11.0 vs 66.8 ± 11.2 years $p < 0.001$), with more hypertension (79.1% vs 69.4% $p < 0.001$), vessel < 2.5mm (30.8% vs 21.3% $p < 0.001$), AF (16.4% vs 12.8% $p = 0.018$) or shock (1.4% vs 0.7% $p < 0.019$) but lower rates of smoking (39.6% vs 61.4% $p < 0.001$), multivessel disease (39.5% vs 46.8% $p < 0.001$) or radial PCI. At 1-year women had a trend for higher rates of death and significantly greater rates of readmissions than men (aOR 1.37, 1.11-1.66, $p = 0.003$).

Conclusion: Women undergoing PCI for ACS, demonstrate differing baseline characteristics and higher rates of mortality as well as readmissions at 1 year than men. This indicates a need for improved treatments for women undergoing PCI.

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Late Outcomes of Patients with Chronic Kidney Disease and ST-segment Elevation Myocardial Infarction Undergoing Percutaneous Coronary Intervention

Y. Yang [1,2], S. Burgess [1,*], H. Idris [3],
A. McLean [1,2], T. Nguyen [1,2], K. Kaddapu [1,2],
A. Makris [1,2], C. Mussap [1,2], C. Juergens [1,2],
J. French [1,2]

[1] Liverpool Hospital, Liverpool, Australia
[2] South Western Sydney Clinical School, Sydney, Australia
[3] Omar Almaktar University Cardiology Department, Albeida, Libya

Background and Objective: Patients with chronic kidney disease (CKD) have poorer clinical outcomes following percutaneous coronary intervention (PCI); ST-segment elevation myocardial infarction (STEMI) trials studying PCI-treated patients often exclude patients with CKD. We assessed late event rates with respect to CKD severity to examine the impact of CKD on prognosis.

Methods: Among 2101 screened consecutive STEMI patients treated at our institution from 2003-2014, 2026 had qualifying creatinine levels and were included. Endpoints of death, cardiac death (CD), reinfarction (MI), revascularisation (TVR), contrast induced nephropathy (CIN) were evaluated (mean follow up of 3.7 years, IQR 2.5-5.3).

Results: Of 2026 patients, 1571 had eGFR (in mL/min/73m^2) of $\geq$60, 402 had eGFR 30-59, and 53 had eGFR<30. At final follow-up respective rate for all-cause mortality were 6.6%, 27.6% and 58.5% ($p < 0.001$), cardiac death 2.7%, 15.4% and 39.6% ($p < 0.001$), reinfarction 9.1%, 11.2% and 7.5% ($p = 0.393$), TVR in 8.9%, 7.7% and 9.4% ($p = 0.734$) and CIN in 9.4%, 14.4% and 37.8% ($p < 0.001$). Independent predictors of late mortality were: cardiogenic shock (HR = 3.11, 95% CI: 2.20-4.41, $p < 0.001$), eGFR <60 mL/min/1.73m^2 (HR = 2.81, 95% CI: 2.13-3.72, $p < 0.001$), age$\geq$65 years (HR = 2.19, 95% CI: 1.65-2.90, $p < 0.001$), diabetes (HR = 1.50, 95% CI: 1.11-2.03, $p = 0.008$), ACC/AHA lesion class C (HR = 1.46, 95% CI: 1.13-1.88, $p = 0.004$), multi-vessel disease (HR = 1.46, 95% CI, 1.12-1.89, $p = 0.005$) and anterior infarction (HR 1.35 [95% CI: 1.04-1.74], $p = 0.023$).

Conclusion: Mortality rates are significantly increased in patients with CKD; eGFR is an independent predictor of mortality in STEMI. Outcome differences were not driven by differences in TVR rates with respect to CKD severity.

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Long Term Clinical Outcomes for All-comer Denovo Coronary Artery Lesions Treated with SeQuent Please Paclitaxel-Coated Balloons

N. Nguyen Nguyen[*], A. Faour, S. Lo,
A. Hopkins, C. Juergens, J. French, L. Hee,
C. Mussap

Liverpool Hospital, Liverpool, Australia

Background: The randomised BASKET-SMALL2 trial suggests that paclitaxel coated balloons (PCB) are non-inferior to stents in denovo coronary artery lesions (DNL). We performed an observational study of long-term clinical outcomes for all-comer DNL, treated with Sequent Please PCB (B-Braun).

Methods: We analysed 166 consecutive DNL treated with PCB at Liverpool Hospital (Oct 2011-Sep 2018). Patients were sub-grouped according to diabetes (DM) vs non-DM. Procedural and clinical outcome data were retrieved from electronic databases. Primary outcome was the MACE composite of cardiac death, myocardia infarction (MI), and target lesion revascularisation (TLR).

Results: Mean age was 64 ± 12 years, 87% were male, and 40% had DM. Patients with DM had significantly lower eGFR (33% vs 19%) and worse pre-PCB angiographic stenosis ($89 \pm 9\%$ vs $86 \pm 11\%$; $p < 0.01$). Mean PCB size and length were 2.4 ± 0.4 mm and 20 ± 5 mm, respectively. In 69% target-DNL was complex (type B2-C), yet significant dissection (grade D-F; 19%) and bailout stenting (10%) occurred infrequently. Follow-up angiography was clinically indicated in 30% of patients, with no subgroup difference. The DM subgroup had worse DNL re-stenosis: 30% [10-40] vs 23% [13-30]; and delta-stenosis 10% [0-20] vs 0% [0-20]. Total MACE was 15% at 3.2 [1.6-4.3] years follow-up. The DM subgroup had higher MACE (25% vs 9%, $p = 0.003$), MI (18% vs 6%, $p = 0.008$) and TLR (5% vs 0%, $p = 0.02$).

Conclusions: Treatment of all-comer DNL using moderate-size Sequent Please PCB is associated with low rates of long-term MACE. Patients with DM appear prone to angiographic re-stenosis and higher MACE, driven by MI and TLR.

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Long-term Outcomes and Predictors of Mortality in Low Surgical Risk Patients Undergoing Transcatheter Aortic Valve Implantation

J. Mundisugih [1,*], A. Walton [1], S. Duffy [1], D. Stub [1,2], J. Stehli [1], S. Koh [1], N. Htun [1], R. Johnston [1,3], S. Holland [1,3], D. Kaye [1,2], S. Nanayakkara [1,2]

[1] *Department of Cardiology, Alfred Hospital, Melbourne, Australia*
[2] *Heart Failure Research Group, Baker Heart and Diabetes Research Institute, Melbourne, Australia*
[3] *Faculty of Medicine, Nursing and Health Sciences, Monash University, Melbourne, Australia*

Background: Transcatheter aortic valve implantation (TAVI) is an alternative treatment for severe symptomatic aortic stenosis (AS) in patients at increased surgical risk. However, less is known about long-term outcomes among patients with severe AS who are at low surgical risk.

Methods: All patients who underwent TAVI at two centres between August 2008 and December 2017 were reviewed and excluded if they were lost to follow up. Patients were divided into three cohorts based on the Society of Thoracic Surgery (STS) risk score (<4 = low, 4-8 = intermediate, >8 = high). The primary endpoint was all-cause mortality.
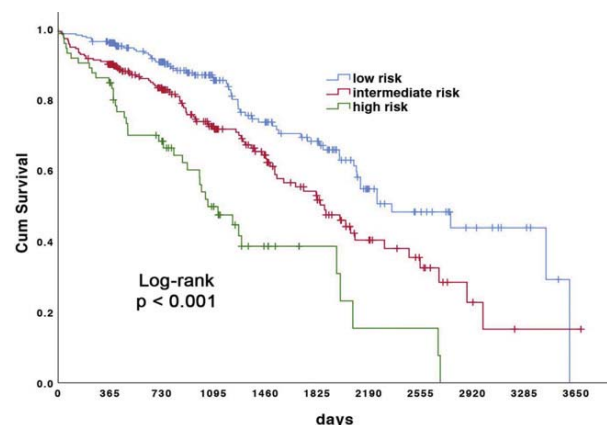
Results: A total of 593 patients were included, with 273 (46%) patients deemed low risk. Mean AV gradient was similar (49mmHg vs. 50mmHg vs. 46mmHg, $p = 0.10$). The median follow-up was 861 days with a maximum follow-up period of 10 years. Low-risk patients had lower 12-month mortality (4% vs. 10% vs. 15%) and 5-year mortality (18% vs. 30% vs. 47%) compared to moderate- and high-risk groups. In low-risk patients, independent predictors of all-cause mortality were prior atrial fibrillation (HR 4.15, 95%CI 1.26-13.66), pre-TAVI left ventricular ejection fraction (HR 0.95, 95%CI 0.91-0.98), and frailty score (HR 2.05, 95%CI 1.07-3.91).

Conclusion: Low-risk patients undergoing TAVI display less than half of the mortality rates of higher-risk patients. Long-term randomised studies are required to determine the safety of TAVI in this cohort of patients compared with surgical aortic valve replacement.

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Long-term Outcomes of Percutaneous Coronary Intervention in Patients with Diabetes Mellitus: Results from a Large Multi-centre Australian Registry

D. Blusztein [1,*], S. Biswas [2], D. Stub [2], A. Ajani [6], A. Brennan [6], S. Duffy [2], W. Chan [2], D. Clark [3], M. Freeman [4], E. Oquieli [5], C. Reid [6], J. Lefkovits [1], M. Yudi [3], L. Dawson [1], A. Murphy [3], D. Eccleston [1,6]

[1] *Royal Melbourne Hospital, Melbourne, Australia*
[2] *Alfred Hospital, Melbourne, Australia*
[3] *Austin Hospital, Melbourne, Australia*
[4] *Box Hill Hospital, Melbourne, Australia*
[5] *Ballarat Health Services, Ballarat, Australia*
[6] *Department of Epidemiology and Preventive Medicine, Monash University, Melbourne, Australia*

Background: Advances in diabetes management, particularly widespread use of SGLT-2 inhibitors, have result in cardiovascular risk reduction but further analysis of percutaneous coronary intervention (PCI) outcomes in diabetics is required.

Method: We prospectively enrolled 20,393 patients in the Melbourne Interventional Group (MIG) Registry from 2005-2014. Patient, procedural characteristics and clinical outcomes were compared by DM status, with target-vessel revascularisation (TVR) and myocardial infarction (MI) used as markers of PCI durability.

Results: Patients with DM were more likely to be female, obese and have renal impairment ($p < 0.001$). DM patients were more likely to receive drug-eluting stents (DES) than bare-metal stents (BMS) ($p < 0.001$). There was no difference between groups in stent length, however those with DM received smaller diameter stents ($p < 0.001$) and more often completed ≥ 12 months of dual antiplatelet therapy ($p < 0.05$). There was no difference in TVR ($p = 0.25$) or MI ($p = 0.1$) at 30 days. However at 12 months, rates of TVR and MI were significantly increased in patients with DM ($p < 0.001$). Sub-group analysis showed highest TVR rates at 12 months in insulin-treated diabetics and those receiving BMS.

	DM ($n = 4984$)	Non-DM ($n = 15409$)	P
30-day TVR (%)	2.1	1.9	**0.25**
30-day MI (%)	1.7	1.4	**0.1**
12-month TVR (%)	6.9	5.4	**<0.001**
12-month MI (%)	5.1	3.1	**<0.001**

Conclusion: Despite advances in drug and device therapy, patients with DM experience higher rates of adverse outcomes including late TVR and MI post PCI, emphasising the importance of optimal drug therapy and DES use in patients with DM.

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Long-term Outcomes With Non-Femoral Access for Transcatheter Aortic Valve Implantation

L. Dawson*, J. Yao, R. Velusamy, S. Montalto, D. Pol, D. Blusztein, J. Wong, L. Grigg, W. Wilson, M. Brooks, R. Gurvitch

Royal Melbourne Hospital, Melbourne, Australia

Background: Femoral access is the preferred route for Transcatheter Aortic Valve Implantation (TAVI) and alternative access routes have become less common with advances in operator experience and femoral delivery systems. Data on real-world long-term outcomes with non-femoral access compared to femoral access are limited.

Methods: Data were retrospectively collected on 297 consecutive transcatheter aortic valve implantation (TAVI) procedures at a single centre from 2011-2018. Patients were divided into those using femoral access and non-femoral access and differences in clinical, procedural, and long term outcome were analysed.

Results: 36 patients used non-femoral access (32 apical, 4 aortic); most before 2016 (44% 2011-2012, 53% 2013-2015, and 3% 2016-2018). Non-femoral access patients were more likely to have peripheral vascular disease (42% vs 7%, $p < 0.001$), concomitant coronary disease (78% vs 35%, $p < 0.001$), and prior coronary bypass surgery (61% vs 26%, $p < 0.001$). Aortic stenosis mean gradient and valve area was similar between groups, however, the non-femoral access group had higher rates of impaired RV function (36% vs 15%, $p = 0.05$). Non-femoral procedures more frequently used an Edwards XT valve (96% vs 37%, $p < 0.001$) and procedural complication rates (22.2% vs 14.2%, $p = 0.21$) and mortality (0% vs 0.8%, $p = 0.60$) were similar. Non-femoral access patients had higher 30-day mortality (9.4% vs 0.9%, $p = 0.001$), while long term outcomes were similar out to 3 years (log rank = 0.49).

Conclusions: Non-femoral access is less frequently used for TAVI. Although long-term mortality is similar, 30-day mortality appears to be higher among non-femoral access patients.

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Long-term Survival and Valve Durability in Patients Undergoing Transcatheter Aortic Valve Implantation

J. Stehli[1,*], S. Koh[1], S. Duffy[1], M. Dagan[1], E. Quine[1], R. Dick[2], N. Htun[1], D. Stub[1], C. Marty[3], A. Walton[1,2]

[1] *Department of Cardiology, Alfred Hospital, Prahran, Australia*
[2] *Cardiovascular Institute, Epworth Healthcare, Richmond, Australia*
[3] *Department of Epidemiology and Preventive Medicine, Monash University, Clayton, Australia*

Background: Long-term outcomes after transcatheter aortic valve implantation (TAVI) remain an important issue. We evaluated valve durability and long-term survival of patients who underwent TAVI since its commencement in Australia.

Methods: Between 2008 and 2017, all patients who underwent TAVI in two Melbournian hospitals were prospectively included in a registry. Outcomes were based on VARC-2 criteria and recently published definition for structural valve degeneration (SVD).

Results: 656 patients with a mean age of 84.2 years (48% females) and a mean STS score of 4.9 underwent TAVI and were followed for up to 10 years. In-hospital and 30-day mortality occurred in 8 (1.2%) and 10 patients (1.6%), respectively. In-hospital complications, according to VARC-2 criteria occurred in 224 patients (34%). The majority of those were permanent pacemaker requirement (23%) and access site complications (6.5%), whereas acute kidney injury (3%), bleeding (2%), cerebrovascular events (2.5%) and death (0.9%) were uncommon. Paravalvular aortic regurgitation ≥moderate was present in 42 (6.4%) patients at discharge. At one year, 73% of patient's echocardiographic follow-up was available. Of those, 28 patients (5.8%) developed SVD, but none of them required reintervention. Following a median follow-up of 1.6 years, 191 patients (29%) had died. In those patients who had follow-up of >5 years, 112 patients (55%) had died following a median of 4.3 years (median survival 5.4 years).

Conclusion: The performance of TAVI in a large Victorian TAVI programme going for over ten years shows excellent short- and long-term outcomes with no clinically significant events of SVD requiring reintervention.

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Management and Outcomes of Spontaneous Coronary Artery Dissection in Christchurch

C. McAlister[1,*], P. Adamson[1,2], J. Blake[1], D. McClean[1], J. Elliott[1,2], D. Smyth[1], A. Puri[1]

[1] *Christchurch Public Hospital, Christchurch, New Zealand*
[2] *University of Otago, Christchurch, New Zealand*

Background: Spontaneous Coronary Artery Dissection (SCAD) is an uncommon presentation of acute coronary syndrome. Awareness of this condition has grown over recent years. The optimal management and prognosis remains unknown.

Method: We reviewed hospital records of all patients with angiographically confirmed SCAD in Christchurch since August 2011.

Results: 103 SCAD patients (86% female, median age 54) presented with NSTEMI (63%), STEMI (29%), cardiac arrest (5%), angina (2%) or stroke (1%). The commonest culprit was the LAD (44%), with left main involved in 1% and multiple vessels in 5%. Initial management was conservative in 83% and percutaneous coronary intervention (PCI) in 17%, with 67% procedural success. 83% of patients were prescribed dual-anti-platelets, including 94% of those with PCI. Beta-blockers were prescribed in 76%. Further in-hospital myocardial infarct (MI) occurred in 5% of patients with unplanned revascularization in 3% (including CABG in 2%). Over median follow-up of 1.8 years, 16% of patients had recurrent MI, including 9% with complications of the index event, and 7% recurrent SCAD in a different vessel (median 2.5 years since index presentation). There was a trend towards increased in-hospital MI, unplanned revascularisation and recurrent MI in those treated with PCI however this was not statistically significant (p-value 0.21, 0.08 and 0.47 respectively). 3 patients died, one by intracranial haemorrhage during index presentation and the others non-cardiac.

Conclusion: The majority of our SCAD cohort were managed conservatively with relatively few major in-hospital adverse events. However, recurrent SCAD is not rare and further research is needed to identify those at highest risk.

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Management of NSTEMI in Elderly Patients: What do We Know About Conservative vs Invasive Management in the Elderly?

P. Kunniardy[*], G. Meehan, A. Murphy, D. Clark, O. Farouque, M. Yudi

Austin Health, Heidelberg, Australia

Background: Studies have found that elderly patients are less likely to undergo evidence-based management and coronary angiography compared to younger patients. Given that older patients are more likely have multiple-comorbidities, they are often underrepresented in trials and studies. Hence, there is a lack of applicability and evidence in this population group.

Methods: Computerised literature searches from MEDLINE and EMBASE were used to identify studies evaluating the impact of management on outcomes of elderly patients (≥75 years) with NSTEMI. Pre-specified outcomes assessed included primary outcome (major adverse cardiovascular events MACE), mortality rate and risk of major bleeding. Intervention and effect on specified outcomes were assessed.

Results: We reviewed 5 randomised controlled trials (RCTs) and 2 observational studies comparing medical therapy (conservative) vs angiography with revascularisation if indicated (invasive) treatment in elderly populations with NSTEMI. 6 out of 7 of the studies showed that invasive treatment had improved primary outcomes. In terms of mortality rate, the 5 RCTs showed no statistical difference between the 2 groups while the 2 observational studies showed reduced mortality rates with patients who had invasive treatment. While the rates of major bleeding were generally low in both groups, 4 of the 7 studies still showed an increase risk in the invasive group.

Conclusion: Invasive treatment of NSTEMI in the elderly has generally been shown to improve primary outcomes of patients. However, this may come at the expense of an increased risk of major bleeding. Hence, further studies are necessary to fully evaluate the risk vs benefits.

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Measurement Variability in TAVI Annulus and Coronary Ostia Analysis

N. Aroney[*], A. Gupta, J. Crowhurst, B. Robinson, K. Poon, C. Raffel, D. Murdoch

The Prince Charles Hospital, Brisbane, Australia

Background: Obtaining accurate annular and coronary height measurements are vital in peri-procedural TAVI decision making and TAVI outcomes. Pre-operative planning software allows operators to analyse cardiac CT data in 3-dimension to ensure accurate assessment. We have noted a degree of operator variability when measuring aortic annular area as well as coronary heights with this software.

Methods: We retrospectively analysed 34 patients at our centre who underwent TAVI in whom measurements were obtained from both a TAVI operator (Group 1) as well as an experienced radiographer (Group 2). Each group had previously analysed over 100 TAVI's. We further analysed whether the valve size decision changed following a second measurement using <430 mm^2, 431 mm^2 - 540 mm^2 and >541 mm^2 as valve sizing cut-offs.

Results: There was no significant difference in the measurement of annulus areas (457 ± 93 VS 439 ± 96, $p = 0.43$), left coronary ostia heights (13.4 ± 3.3 VS 12.8 ± 3.4, $p = 0.8$) or right coronary ostia heights (16.2 ± 3.5 VS 15.9 ± 3.3, $p = 0.7$). However, there were five instances where the valve size decision was changed following a second measurement which crossed one of the cut-offs.

Conclusion: In our retrospective observational study of TAVI measurement variability, we found that there was no significant difference in the measurement variability of annular area or coronary heights between TAVI operators or our experienced radiographers. However, clinical decision making was altered on five occasions with changes in valve sizing due to minor measurement variability.

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Mechanical Circulatory Support for Semi – elective PCI in High-risk Patients with Extracorporeal Membranous Oxygenation (ECMO) Compared to Impella Heart Pump Device

P. Pender*, O. Gibbs, A. Faour, V. Dang, A. Hopkins, D. Leung, C. Mussap, J. French, C. Juergens, S. Lo

Liverpool Hospital, Smithfield, Australia

Background: Impella and Veno-Arterial extracorporeal membranous oxygenation (VA-ECMO) provide consistent augmentation of cardiac output, which can alleviate haemodynamic fluctuations during high-risk PCI. Paucity of data Australian exists.

Methods: We retrospectively analysed (January 2010-January 2019) Liverpool Cardiac Catheterisation and ICU database for consecutive patients receiving Impella or VA-ECMO support for semi-urgent high-risk PCI (non-shock).

Results: 6 patients received VA-ECMO (3 with adjunctive IABP) and 9 IMPELLA for non – operable (heart team) high risk PCI. VA – ECMO group mean age 70.8 ± 14.6 years (44-82). All with severe LV dysfunction and MVD (4 severe LM ischaemia+MVD post-NSTEMI). All had general anaesthesia and ICU admission [LOS $9.5 \pm$ days $(24 -1)$] and surgical decannulation. VA-ECMO dwell time 18.2 ± 8.8 hours (3-24 hours). 6 access site complications [1 minor bleed, 5 major bleed (4 femoral, 1 axillary), 2 limb ischemia (1 amputation).

IMPELLA patients mean age (66.5 +- 14 years (92 −51). Severe LV dysfunction in 77.8% MVD (4 severe LM ischemia + MVD post NSTEMI). Majority non- GA sedation (88%). Impella removed immediately post procedure. 2 cases required ICU [ICU LOS 0.5 +- 1.3 days]. 6 access site complications [(3) minor (2) major bleeds,(1) limb ischemia requiring OT].

Impella was associated with reduced post-PCI and ICU LOS compared to VA – ECMO. Post PCI LOS 7 ± 8.4 days, median 4 days vs VAECMO mean 15 ± 7.7 days, median 13 days (p value = 0.04). All PCI cases were successful with a 0% mortality and complete revascularisation.

Conclusions: VA-ECMO and Impella support for high-risk PCI (complex anatomy/non-operable/poor LV function) achieves excellent results. VA ECMO is resource intensive with high access-site complications, . IMPELLA associated with significantly reduced ICU admissions, and reduced post PCI length of stay.

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Multi-vessel Coronary Artery Disease in STEMI. Prevalence, Management and Impact on Length of Stay

K. Thant*, A. Prashar, M. Giddins, M. Sader, R. Szirt

St George Hospital, Kogarah, Australia

Background: St George Hospital is a tertiary facility located in Southern Sydney offering 24/7 PCI for STEMIs. The prevalence of multi-vessel coronary disease (MVD) in STEMI is significant and the decision to treat non-culprit (NC) arteries during the index procedure, as a staged procedure or to not treat at all is contentious. The aim of this study was to assess the prevalence of MVD during STEMI, interrogate the management and look at the overall length of stay.

Methods: Data was retrospectively collected from consecutive patients presenting with STEMI in 2017 and 2018. Demographic, procedural and outcome data was recorded.

Results: There were 190 STEMI during the study period. 107 (56%) patients had MVD. Of this 22 (20%) had NC PCI during the index procedure, 28 (26%) had NC PCI as an inpatient, 27 (25%) had NC PCI as an outpatient, 17 (16%) had inpatient CABG, 4 (3.5%) were referred for outpatient CABG and 22 (21%) were medically managed. Excluding 2 extreme outliers, the average length of stay for those who had NC PCI during the index procedure was 5.08 days and as an inpatient was 7.5 days.

Conclusion: MVD is common during STEMI. Patients who received NC PCI during the index procedure had an overall shorter length of stay compared to those who had NC PCI as an inpatient.

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Non-adherence to Anti-platelet Therapy Increases Long-term Mortality After Percutaneous Coronary Intervention; 5-year Outcomes from the GenesisCare Cardiovascular Outcomes Registry (GCOR)

D. Eccleston [1,2,*], T. Rafter [2], A. Conradie [2], A. Whelan [2], E. Chowdhury [3], S. Worthley [2]

[1] *University Of Melbourne, Parkville, Australia*
[2] *GenesisCare, Sydney, Australia*
[3] *Monash University, Melbourne, Australia*

Introduction: Secondary prevention therapies including dual anti-platelet therapy (DAPT) are recommended after percutaneous coronary intervention (PCI), However, long-term outcomes of patients who cease anti-platelet medication are unknown.

Methods: Patients discharged on evidence-based medications were stratified into those continuing DAPT or anti-platelet monotherapy (MAPT), or no antiplatelet therapy at 2 years. We assessed the association of DAPT and MAPT adherence with 5-year all-cause mortality adjusted for baseline clinical and lesion characteristics,

Results: Data were available for 7091 patients undergoing PCI to from November 2008 - January 2018, with over 99% follow-up data for patients at 5 years. At discharge 98.9% of patients were prescribed anti-platelet therapy, and 91.2% received DAPT. Adherence at 1 and 2 years with DAPT was 61.7% and 32.8% respectively. Predictors of DAPT adherence at 2 years were age (OR 1.11, $p < 0.001$), diabetes (OR 1.95, $p = 0.007$), and peripheral vascular disease (OR 2.32, $p = 0.003$),

Kaplan-Meier survival estimates
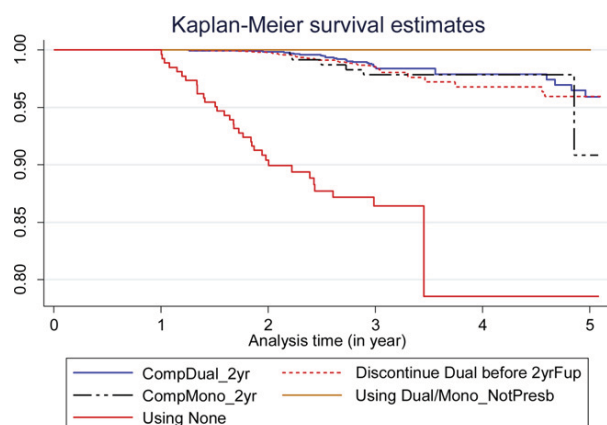
Conclusion: Patients discharged on evidence-based anti-platelet therapy after PCI who continue this for 2 years continue to have greater freedom from all-cause death at 5 years than those who cease anti-platelet medication earlier. Those who cease DAPT therapy at 1 year then continue single antiplatelet therapy have similar rates of mortality to those who continue DAPT.

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Optimal Door-to-balloon Time for Primary Percutaneous Coronary Intervention for ST-elevation Myocardial Infarction

J. Koh[1,*], D. Dinh[2], S. Biswas[1], C. Tan[1], J. Warren[1], A. Brennan[2], J. Lefkovits[2], C. Reid[2,3], D. Stub[1], S. Duffy[1,2]

[1] *Alfred Health, Melbourne, Australia*
[2] *Monash University, Melbourne, Australia*
[3] *Curtin University, Perth, Australia*

Background: Door-to-balloon time (DTBT) for ST-elevation myocardial infarction (STEMI) is a key performance indicator by which hospital primary percutaneous coronary intervention (PPCI) services are assessed. Recently, European Society of Cardiology guidelines decreased their recommended DTBT from ≤90 minutes to ≤60 minutes, though with limited evidence. We aimed to evaluate the optimal DTBT for PPCI for STEMI.

Methods: We included all patients presenting with STEMI undergoing PPCI between 2013 and 2017 enrolled prospectively in the Victorian Coronary Outcomes Registry. Patients transferred from another facility, had prior thrombolysis, or DTBT >3 hours were excluded. Patients were divided into 4 groups based on DTBT (A: ≤60 minutes, B: 61-90 minutes, C:

91-120 minutes, D: 121-180 minutes). The primary endpoint was 30-day mortality.

Results: Of 5,200 patients included, the median DTBT was 64 minutes (IQR: 45-89); 76.2% achieved the current DTBT target of ≤90 minutes and 46.1% achieved a DTBT of ≤60 minutes. Longer DTBT was associated with older age, diabetes, less pre-hospital notification and more cardiogenic shock (all $p < 0.05$). Longer DTBT was associated with higher mortality at 30-days (A: 5.8%, B: 9.0%, C: 10.8%, D: 11.8%, $p < 0.001$). Multivariable analysis confirmed prolonged DTBT to be an independent predictor of higher 30-day mortality, with DTBT 61-90 minutes (OR 1.42, 95% CI: 1.02,1.99, $p = 0.037$) and DTBT 91-120 minutes (OR 1.85, 95% CI:1.24,2.75, $p = 0.003$).

Conclusion: DTBT of ≤60 minutes for PPCI for STEMI is associated with significant reduction in 30-day mortality. Achieving a DTBT ≤60 minutes will require significant improvements in in-hospital and pre-hospital systems of care.

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Outcomes in Femoral Access Patients with Large Abdominal Circumference

P. Nguyen[1,2,3,4,*], A. Makris[2,3], A. Hennessy[1,2,3], S. Jayanti[2,4], A. Wang[2,4], K. Park[2,4], V. Chen[4], C. Juergens[2,4]

[1] *Campbelltown Hospital, Campbelltown, Australia*
[2] *Liverpool Hospital, Liverpool, Australia*
[3] *Western Sydney University, Campbelltown, Australia*
[4] *UNSW, Liverpool, Australia*

Background: One of the predictors of vascular complications in patients undergoing coronary angiography and percutaneous coronary intervention via transfemoral artery access (TFA), is obesity. Fat distribution may have a technical impact on accessing the femoral artery and control of bleeding afterward. We examined the outcomes of patients with abdominal circumference (AC) ≥100 cm in diameter from the Standard Versus Ultrasound-Guided (US) Radial and Femoral Access (SURF) Trial.

Methods: Of the 1388 patients randomised into radial or femoral access and standard or US-guidance in a 2x2 factorial design, 570 patients underwent TFA had AC measured. AC was measured at the level of the iliac crest. We analysed outcomes based on ACUITY (Acute Catheterization and Urgent Intervention Triage strategY) major and minor bleeding, MACE (death, stroke, myocardial infarction or urgent target lesion revascularisation) and vascular complications at 30 days.

Results: 260 patients had AC ≥100 cm, while 310 were <100 cm in diameter. Patients with AC ≥100 cm had a near significantly higher ACUITY major bleeding (2.69% vs. 0.64%, $p = 0.051$); significant ACUITY minor bleeding (36.15% vs. 26.45%, $p = 0.013$) and vascular complications (2.31% vs. 0.32%, $p = 0.032$). There was no significant difference in MACE. When compared with AC<100cm, US guidance did not show any benefit in reducing ACUITY major (1.55% vs. 3.82%, $p = 0.26$), minor (32.56% vs. 39.69%, $p = 0.23$) bleed-

ing or vascular complications (2.27% vs. 0.76%, $p = 0.12$), in patients with AC $\geq$100 cm.

Conclusion: Patients with AC$\geq$100cm in diameter had higher rates of ACUITY major and minor bleeding and vascular complications. Radial access is preferable in this group of patients.

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Outcomes of First 300 Cases of Transcatheter Aortic Valve Implantation at a High-volume Australian Private Hospital

Y. Chacko [1,2,3,*], K. Poon [1,2,3], W. Keegan [3], S. Natani [3], P. Tesar [3], D. Wall [3], F. Harris [3], D. Roper [3], C. Chao [3], M. Hudaverdi [3], I. Smith [3], A. Incani [1,2,3]

[1] *Queensland Heart Institute, St Andrew's War Memorial Hospital, Brisbane, Australia*
[2] *University of Queensland, Brisbane, Australia*
[3] *St Andrew's War Memorial Hospital, Brisbane, Australia*

Transcatheter aortic valve implantation (TAVI) was first performed in Australia in 2008 with steady increase in the number of implanting centres from 7 in 2008 to 46 in 2018 (26 private and 20 public hospitals). There is limited published data on outcomes from Australian centres and no published data from Australian private hospitals. We describe outcomes of the first 300 cases at Australia's first TAVI implanting private hospital.

From July 2015- August 2018, 300 patients with severe, symptomatic aortic stenosis underwent TAVI at our centre. A Heart-team assessed all patients as suitable. All patients underwent computed tomography (CT) assessment of valve sizing and peripheral access. Mean age was 85 years, 58% male, mean STS score 4.0%, 49% had NYHA Class III/IV, 28% previous CABG, 14% peripheral vascular disease and 3.7% renal impairment (Cr >177 μmol/L). At 30 days mortality was 1%, stroke 1.4%, myocardial infarction (MI) 0.3%, major vascular complication 3.1%, no life-threatening or disabling bleeding and new permanent pacemaker (PPM) requirement was 9.2%. Paravalvular leak was none, trace and mild in 27%, 53% and 20% respectively with no $\geq$ moderate paravalvular leak. At 1year, mortality was 6%, stroke 2.6%, MI 0.3%, no life-threatening bleeding and PPM 12.2%. Lower rates of mortality, stroke, MI, major vascular complications and major bleeding were observed compared to the landmark PARTNER 2A trial.

Excellent TAVI clinical outcomes can be achieved in the Australian private hospital setting. Expert Heart Team assessment and CT guided procedural planning are key to these outcomes.

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Outcomes of Transcatheter Aortic Valve Implantation in Nonagenarians

J. Stehli [1,*], S. Koh [1], S. Duffy [1], C. Marty [3], C. Crawford [1], M. Dong [1], M. Dagan [1], N. Htun [1], D. Stub [1], R. Dick [2], A. Walton [1,2]

[1] *Department of Cardiology, Alfred Hospital, Prahran, Australia*
[2] *Cardiovascular Institute, Epworth Healthcare, Richmond, Australia*
[3] *Department of Epidemiology and Preventive Medicine, Monash University, Clayton, Australia*

Background: Limited data exist regarding transcatheter aortic valve implantation (TAVI) in nonagenarians. This study evaluates the short- and mid-term outcomes of nonagenarians following TAVI.

Methods: Between 2008 and 2017, all patients with severe aortic stenosis who underwent TAVI in two centres in Australia were prospectively included in a registry and followed-up for 5 years. Outcomes were based on VARC-2 criteria. Additionally, the patient's reliance on daily living support at 1 year was evaluated. Logistic regression was used to analyse binary data.

Results: Of the 588 patients, 71 (13%) were $\geq$90-year-old (mean age 92.2 $\pm$ 2 versus 83.2 $\pm$ 6 years in <90-year-old patients), with a median STS-PROM score of 5.7 (versus 3.9 in <90-year-old patients, OR 1.07, 95% CI 1.01-1.13, $p = 0.02$) and a median clinical frailty of 4 (versus 4 <90-year-old patients, OR 0.88, $p = 0.44$). Mortality was 0% in $\geq$90-year-old patients at 30 days (versus 1.4% in <90-year-old patients; $p = 0.82$) and 12% at 1 year (versus 7.4%, in <90-year-old patients; HR 1.64, $p = 0.20$). There were no significant differences in periprocedural complications and mortality at 5 years between the two groups. At 1 year, nonagenarians were significantly more likely to live in an aged-care facility compared to <90-year-old patients (25% versus 16%, OR 5.99, 95% CI 2.62-13.67, $p < 0.001$).

Conclusions: In conclusion, carefully selected nonagenarians have excellent short- and mid-term outcomes post-TAVI and should therefore not be refused based on age alone. Nevertheless, the significantly higher rate of transfer to an aged-care facility highlights the importance of a more refined frailty assessment prior to TAVI.

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Outcomes of Tricuspid Valve in Valve Implantation Via Trans-jugular and Transfemoral Approach

D. Pol*, R. Gurvitch, D. Blusztein, L. Dawson, W. Wilson

Royal Melbourne Hospital, Newborough, Australia

Introduction: Transcatheter "Valve-in-valve" (VIV) implantation for degenerated surgical bioprostheses has

been described as a viable therapeutic option. We highlight our experience treating failed surgical bioprostheses in the tricuspid position utilising the Edwards SAPIEN 3 valve which poses unique clinical and technical challenges.

Objective: Demonstrate the feasibility and effectiveness of tricuspid VIV implantation.

Methods: Four patients underwent VIV implantation. Underlying diagnoses were: Ebstein anomaly $n = 2$, Carcinoid syndrome $n = 1$ and previously replaced native valve for infective endocarditis $n = 1$. Previous valve type and size was: Biocor (St Jude Medical), $n = 2$ (27 mm, 33 mm), Perimount $n = 1$ (29 mm) and Medtronic Intact $n = 1$ (33 mm). Valve dysfunction was regurgitation in 3 and stenosis in 1. Procedural access was via the femoral vein in 3 and jugular vein in 1. Edwards Sapien S3 valves (29 mm $n = 3$ and 26 mm $n = 1$) were deployed and all procedures were successful and uncomplicated.

Results: None or trivial residual tricuspid regurgitation was present in all cases and median post procedural tricuspid valve mean gradient was 4mmHg (range 2-5). Median follow-up was 13.5 months (range 2-17) and median gradient was 6mmHg. One patient has developed progressive severe stenosis (MG 14mmHg) despite anticoagulation.

Conclusion: All four patients underwent successful tricuspid VIV implantation for severely degenerated (regurgitant or stenotic) tricuspid surgical bioprostheses. Both the transjugular and femoral approach may be used successfully, with unique clinical advantages for each depending on the surgical valve orientation. Tricuspid VIV implantation is clinically feasible with excellent acute haemodynamic outcomes and safety.

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Patients with Aortic Stenosis Exhibit Early Improved Endothelial Function Following Aortic Valve Replacement

A. Comella [1,*], M. Michail [2], A. Ihydayhid [2], M. Baldi [3], J. Cameron [1,2,3], A. Brown [1,2]

[1] *Monash Univeristy, Clayton, Australia*
[2] *MonashHeart, Clayton, Australia*
[3] *Monash Cardiovascular Research Centre, Clayton, Australia*

Background: Patients with severe aortic stenosis (AS) have impaired coronary flow reserve (CFR), resulting in myocardial ischaemia in absence of obstructive coronary disease. Endothelial dysfunction (ED) contributes towards impaired CFR in patients with AS, although it remains unknown whether endothelial function recovers following valve replacement. It is also unclear whether any hypothesised improvement immediately as consequence of arterial haemodynamics or more long-term.

Methods: Patients with severe AS undergoing transcatheter and surgical valve replacement had assessment of endothelial-independent and -dependent flow mediated dilation (FMD) via ultrasound and EndoPAT2000. Measurements were performed prior to, 24 hrs and 28 days after valve replacement. Intraobserver FMD reproducibility was excellent (intraclass correlation coefficient 0.96).

Results: To date, 8 out of 40 patients have been recruited into the trial (75% male). Seven (87.5%) patients underwent transcatheter valve replacement. FMD was successfully performed in all patients pre- and immediately post-procedure, while EndoPAT measurements were possible in 75% of patients. FMD significantly increased from 5.8% (pre-) to 11.6% post-procedure ($p = 0.01$). Although a similar trend was observed for EndoPAT measures (pre- 2.00 vs. post- 2.36), this did not reach statistical significance ($p > 0.05$). FMD follow-up data at 28 days was available for 2 patients and demonstrated that the improvement was sustained (8.5%). We anticipate complete data will be available by time of presentation.

Conclusion: Our preliminary data shows that endothelial function in patients with AS improves quickly after valve replacement, likely as a result of improved arterial haemodynamics. This improvement may result in restoration of CFR and alleviate myocardial ischaemia.

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Percutaneous Coronary Intervention Outcomes Following Out-of-Hospital Cardiac Arrest For Patients With and Without ST-Elevation Myocardial Infarction

L. Dawson [1,*], D. Dinh [2], S. Duffy [2,3], A. Brennan [2], D. Clark [4], C. Reid [2], D. Blusztein [1], D. Stub [2,3], N. Andrianopoulos [2], M. Freeman [5,6], E. O'Queli [7], A. Hutchison [2], A. Ajani [1,2]

[1] *Royal Melbourne Hospital, Parkville, Australia*
[2] *Department of Epidemiology and Preventive Medicine, Monash University, Melbourne, Australia*
[3] *Alfred Health, Melbourne, Australia*
[4] *Austin Health, Melbourne, Australia*
[5] *University Hospital, Geelong, Australia*
[6] *Eastern Health, Melbourne, Australia*
[7] *Ballarat Hospital, Ballarat, Australia*

Background: Outcomes after out-of-hospital cardiac arrest (OHCA) remain poor, and percutaneous coronary intervention (PCI) may have prognostic benefit in patients with a culprit coronary lesion. We aimed to describe outcomes among patients undergoing PCI following OHCA and the effect of ST-elevation myocardial infarction on outcome.

Methods: Data were prospectively collected on 1,047 consecutive PCI procedures following OHCA at six Victorian public hospitals from 2005 to 2017. Patients were divided into those with STEMI (OHCA-S) and those without (OHCA-NS). Outcomes were compared against patients with STEMI only without OHCA ($n = 9,694$).

Results: OHCA-S patients were younger and the treated lesion was more commonly occluded at time of PCI (63% vs 22%, $p < 0.001$). GP-IIb/IIIa antagonists, thrombus aspiration and intra-aortic balloon pump insertion were more frequently used for OHCA-S ($p < 0.01$). Cardiogenic shock (CS) was present in 47% of OHCA-S and 29% of OHCA-

NS ($p < 0.001$). 30-day mortality was 34% for the OHCA-S and 18% for the OHCA-NS group. However, OHCA-S and OHCA-NS had similar long-term outcomes to the STEMI only group if they survived to 30-days. Multivariable predictors for 30-day mortality after PCI for OHCA were diabetes, impaired renal or LV function, and CS.

	OHCA w STEMI	OHCA w/out STEMI	
	$n = 840$	$n = 207$	p-value
30-Day Mortality, n (%)	282 (33.6)	37 (17.9)	<0.001
12-Month Mortality, n (%)	292 (34.8)	38 (18.4)	<0.001
NDI-Linked Mortality, n(%)	344 (41.3)	53 (25.6)	<0.001
NDI Follow-up (days), mean ± SD	1,082 ± 1198	1,221 ± 1103	0.12

Conclusions: PCI following OHCA has a high 30-day mortality, with worse outcomes among patients with STEMI. Beyond 30-days, long-term outcomes are similar to uncomplicated STEMI cohorts.

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Percutaneous Treatment of Mitral Regurgitation with MitraClip – A Western Australian Experience

P. Ng *, E. Yamen, W. Yeow

Sir Charles Gairdner Hospital, Nedlands, Australia

Objectives: Severe symptomatic mitral regurgitation (MR) is associated with significant morbidity and mortality without treatment. Percutaneous edge-to-edge repair of severe MR with MitraClip has emerged as an alternative to surgical treatment for high risk or inoperable patients. This study aimed to describe our experience of MitraClip implantation in Western Australia over the past seven years.

Methods: Data of patients who underwent MitraClip implantation at Sir Charles Gairdner Hospital between January 2011 and December 2017 were retrospectively collected and analysed.

Results: Ninety-five high-risk consecutive patients with severe MR (grade 3+ or more) underwent MitraClip implantation (mean age 77.5 ± 10.1 years). Mean Society of Thoracic Surgeons (STS) mortality score was 7.98% (33.7% of patients had STS score ≥8%) and 96.8% of patients were in New York Heart Association (NYHA) class III or IV. Pre-procedural mean left ventricular ejection fraction was 45.1% ± 17.2%. Device implantation was successful in ninety-four patients (98.9%). There were no acute deaths or myocardial infarctions. One patient (1.1%) suffered a post-procedural stroke without permanent neurological deficits. Median post-procedural length of stay was 2 days, with 82 (86.3%) patients being discharged home. Actuarial survival was 100%, 97.9% and 88.4%

at 30 days, 90 days and 1 year respectively. At 12 months, 81.1% of survivors were NYHA class II or less.

Conclusions: At our centre, MitraClip implantation was carried out with high procedural success and low complication rates. There was successful post-procedural reduction of MR severity and sustained improvements in NYHA class at 12 months.

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Pericardiocentesis for Pericardial Effusion – a Single Centre Experience

J. Assad *, P. Pender, A. Faour, D. Leung, R. Rajaratnam, C. Mussap, C. Juergens, S. Lo

Liverpool Hospital, Sydney, Australia

Background: Diagnostic and therapeutic drainage of pericardial effusions can be performed percutaneously or surgically.

Methods: A retrospective audit was performed for consecutive patients who underwent pericardiocentesis at Liverpool hospital from February 2018-January 2019 using the hospital electronic medical record.

Results: 34 patients required drainage of pericardial effusions. Mean age was 60.8 ± 19.4 years (55% male). 25/34 (74%) were performed percutaneously by Cardiology with Cardiology AT performing the majority of cases (17/25). All were echocardiographic-assisted. 47% were performed after-hours. Mean effusion-maximal diameter was 2.77 cm ± 1.02 cm. 85% had echocardiographic features of tamponade and 71% had clinical features of tamponade. 13 (37%)were malignant, 9 (25%) iatrogenic (44% post-cardiothoracic surgery) and 4 (11%) were inflammatory. 11% took aspirin,17% DAPT and 26% were anticoagulated. Most common approach was subcostal (68%). Mean total drainage output was 770.8 ± 460 ml, average dwell time 54.7 h ± 31.4 h. 4/25 had fluid re-accumulation managed with surgical pericardial window. Complications occurred in 2/25 cases [1 RV needle perforation successfully surgical repaired, 1 death from cardiac arrest from pacing wire perforation]. 9/34 (26%) had initial surgical management and were more likely to be loculated and posterior or post-surgical with suspected clot tamponade. There was 1 failed drainage and 1 death in the surgical group. Surgical management was associated with an increased ICU-stay (mean 2.7 ± 4.5 days) compared to non-surgical (0 days).

Conclusion: Percutaneous pericardiocentesis is a successful approach to draining pericardial effusions. Complications are rare and commonly successfully surgically managed.

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Predicted Impact of Recent Patent Foramen Ovale Closure Trials on Management of Cryptogenic Stroke

P. Trevella*, L. Sanders, D. Jin, J. Gutman, MacA. Isaac, S. Palmer

St Vincent's Hospital Melbourne, Melbourne, Australia

Background: The indication for percutaneous closure of patent foramen ovale (PFO) has recently changed, following evidence that closure is superior to medical treatment alone in preventing recurrent stroke in cryptogenic stroke patients aged ≤60 years. We aimed to determine the impact of updated criteria on the management of stroke or transient ischaemic attack (TIA) at our institution.

Methods: We performed a retrospective record review using ICD-10-AM codes for patients presenting with stroke/TIA between 2015 and 2018. Patients >60 years old or presenting with primary haemorrhagic stroke were excluded. Demographic, clinical, brain imaging and echocardiographic data were collected. Transthoracic and transoesophageal echocardiograms (TOE) were independently reviewed by a cardiologist and stroke aetiology classified by a stroke neurologist. Suitability for closure was evaluated against recent clinical trial inclusion criteria.

Results: There were 241 presentations of stroke/TIA ≤60 years (58% male, mean age 49 ± 9). TOE was performed in 46/241 (19.1%), PFO was identified in 16/46 (34.8%). Stroke was classified as embolic stroke of undetermined source (ESUS) in 10/16 (62.5%) and 8/10 (80%) met inclusion criteria for closure (large shunt size (>30 microbubbles passing to left atrium within three cardiac cycles) ($n = 5$) and/or atrial septal aneurysm ($n = 7$)). PFO closure was performed in 3/8 (37.5%)

Conclusions: Recent trial results indicate that an increased proportion of patients with cryptogenic stroke may benefit from PFO closure. Within the limitation of small numbers, we predict at least a doubling in the number of patients for PFO closure consideration at our centre.

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Predictors of Clinical Outcomes Following Transcatheter Aortic Valve Implantation

J. Koh[1,*], J. Stehli[1], C. Martin[2], E. Quine[1], M. Dagan[1], L. Dawson[3], N. Htun[1,2], D. Stub[1,2], A. Walton[1,2,4], S. Duffy[1,2]

[1] *Alfred Hospital, Melbourne, Australia*
[2] *Monash University, Melbourne, Australia*
[3] *Royal Melbourne Hospital, Melbourne, Australia*
[4] *Epworth Hospital, Melbourne, Australia*

Background: Despite good predictive scores for surgical aortic valve replacement (SAVR), they were not designed for transcatheter aortic valve implantation (TAVI). We sought to determine factors predictive of worse outcomes post-TAVI.

Methods: Between 2008 and 2017, all patients who underwent TAVI in two experienced centres in Melbourne were prospectively included in a registry and followed-up for one year. Outcomes were based on the Valve Academic Research Consortium (VARC)-2. The primary end-point was one-year mortality.

Results: A total of 588 patients (mean age 84 ± 6 years, mean STS-PROM 5.1 ± 3.5, 295 (50%) women) were included. The primary end-point occurred in 43 (7.3%) patients (baseline mean STS-PROM 6.3 ± 3.8 for patients who died vs. 4.9 ± 3.5 for survivors, $p = 0.01$). On univariate analysis, baseline characteristics that predicted mortality included larger valve size (29-34mm, HR = 2.44, 95%CI 1.13-5.28, $p = 0.02$), atrial fibrillation (AF, HR = 2.35, 95%CI 1.26-4.36, $p = 0.007$), moderate-severe mitral regurgitation (MR, HR = 2.34, 95%CI 1.18-4.65, $p = 0.02$) and chronic obstructive pulmonary disease (COPD, HR = 2.08, 95%CI 1.03-4.20, $p = 0.04$). Post-procedure ICU admission (HR = 4.81, 95%CI 2.23-10.38, $p < 0.001$), acute kidney injury (HR = 4.32, 95%CI 1.54-12.11, $p = 0.005$) and moderate-severe MR (HR = 2.34, 95%CI 1.18-4.65, $p = 0.02$) predicted worse outcomes. Multivariate analysis confirmed moderate-severe MR (HR = 4.84, 95%CI 2.15-10.9, p>0.001), AF (HR = 2.46, 95%CI 1.19-5.09, $p = 0.015$), and COPD (HR = 2.37, 95%CI 1.04-5.37, $p = 0.039$) as predictors of one-year mortality.

Conclusion: While STS-PROM is a reasonable surrogate, a novel predictive score specific for TAVI incorporating clinical and echocardiographic factors should be considered for optimal patient selection.

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Predictors of Invasive Management in Patients Aged >85 Years with Non-ST-Elevation Myocardial Infarction (NSTEMI)

A. Murphy*, A. Koshy, G. Meehan, P. Kunniardy, J. Ramchand, O. Farouque, D. Clark, M. Yudi

Austin Health, Melbourne, Australia

Introduction: The management of NSTEMI in the elderly is subject to significant physician bias as there is a paucity of evidence to guide invasive versus conservative management. In this single centre, retrospective study, we aimed to assess the clinical characteristics that predict the invasive management of patients aged >85 years presenting with NSTEMI.

Methods: 956 consecutive patients aged >85 years presenting with NSTEMI to a tertiary hospital between 2010-2018 were included. The proportion of patients undergoing coronary angiography (CA) was established from medical record review.

Results: Of the 956 patients included only 92 (9.7%) underwent CA. Those undergoing CA were more likely to be younger, male, and to be in independent living, without underlying mobility or cognitive issues (all $p < 0.01$). They were significantly less likely to have invasive management if they had a history of heart failure ($p < 0.001$) or atrial fibrillation ($p = 0.02$). On logistic regression adjusting for age, gender

and cardiovascular risk factors, the absence of cognitive impairment (OR 4.2 95%CI 1.56-11.3, $p = 0.004$), independent living status (OR 3.6 95%, CI 1.4-9.2, $p = 0.006$), and independent mobility (OR 2.6, 95%CI 1.5-4.6; $p = 0.001$) were the strongest predictors of patients undergoing CA.

Conclusion: In this cohort of elderly patients presenting with NSTEMI, the absence of frailty, as determined by cognitive status, independent living status and mobility were the strongest predictors of invasive management. Consideration should be given to comprehensive geriatric assessment using credible frailty scales to select patients for invasive management of NSTEMI.

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Predictors of Radiation Exposure During ST Elevation Myocardial Infarction (STEMI)

U. Allahwala [1,2,*], N. Mughal [1],
H. Rasmussen [1,2], P. Hansen [1], G. Figtree [1,2],
G. Nelson [1], M. Ward [1], J. Weaver [3],
R. Bhindi [1,2]

[1] Department of Cardiology, Royal North Shore Hospital, Sydney, Australia
[2] The University of Sydney, Sydney, Australia
[3] Department of Cardiology, Royal Prince Alfred Hospital, Sydney, Australia

Aims: Coronary angiography accounts for a disproportionately high amount of medical radiation in the adult population. We sought to determine the predictors of increased radiation exposure during ST elevation myocardial infarction (STEMI).

Methods & Results: Between January 2011 and December 2018 a total of 2,151 patients presented to our centre for primary percutaneous coronary intervention (pPCI) or rescue PCI. Fluoroscopy time and air Kerma dosage were recorded. Mean age was 65.6 ± 13.7 yrs with 21.5% females. The mean body mass index (BMI) was 27.39 ± 4.65 kg/m^2. The median fluoroscopy time was 11.3 minutes (IQR: 8.2-16.7 minutes), whilst the median air Kerma was 810 mGy (IQR: 506.0-1274.3mGy).

Older age was associated with a greater fluoroscopy time ($p < 0.0001$), but not air Kerma ($p = 0.70$), whilst female sex was associated with lower fluoroscopy time (12.8 mins vs 14.5 mins, $p < 0.0001$) and lower air Kerma (854.8mGy vs 1106.9mGy, $p < 0.0001$). A higher BMI was associated with a higher air Kerma ($p < 0.0001$) but not fluoroscopy time ($p = 0.17$). pPCI performed during day-time hours (8:00am – 8:00pm) was associated with higher fluoroscopy time (19.3 mins vs 14.1 mins, $p < 0.0005$) and air Kerma (1238.4 mGy vs 1006.7 mGy, $p < 0.0005$). In multivariate analysis, time of day remained independently predictive of fluoroscopy time ($p < 0.05$) and air Kerma ($p < 0.0005$).

Conclusions: During pPCI for patients presenting with a STEMI, age, sex, BMI and timing of the procedure impact the fluoroscopy time and radiation dosage. An appreciation of these factors and may identify patients whereby strategies to reduce radiation dosage should be implemented.

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Pre-hospital Notification of Patients with ST-elevation Myocardial Infarction is Associated with a Reduced Door-to-reperfusion Time

J. Gray [1,*], L. Dare [2], M. Burley [2],
S. Brown [3,4,5], T. Hudson [2], T. Murray [2],
N. Anderson [3], S. Sanderson [2],
P. MacIntyre [2], J.A. Black [2,6], E. Eberhart [2]

[1] University Of Tasmania, Hobart, Australia
[2] Department of Cardiology, Royal Hobart Hospital, Hobart, Australia
[3] Ambulance Tasmania, Hobart, Australia
[4] Department of Emergency Medicine, Royal Hobart Hospital, Hobart, Australia
[5] University of Western Australia, Perth, Australia
[6] Menzies Research Institute, Hobart, Australia

Background: A reduced time to reperfusion is associated with decreased mortality in cases of ST elevation myocardial infarction (STEMI). This study evaluates the effect on door-to-reperfusion time (DTRT) of a recently implemented pre-notification and emergency department bypass protocol for STEMI patients presenting via ambulance to the Royal Hobart Hospital (RHH).

Method: We conducted a prospective review of reperfusion times for STEMI patients presenting via ambulance to the RHH prior to, and following, the implementation of an ambulance initiated activation protocol of the cardiac catheterisation team. From July 2017 until January 2019 there were 189 STEMI cases that underwent percutaneous intervention. Of the 189, 140 cases met the criteria for the study. The cohort was divided in to three groups: (1) STEMI cases with no pre-notification, (2) STEMI cases with pre-notification to the emergency department only, (3) STEMI cases who were transported by ambulance with pre-notification and activation of the cardiac catheterisation team.

Results: DTRT times were lower in cases where the cardiac catheterisation team was pre-notified, compared to cases where the emergency department was pre-notified, and also lower than in cases with no pre-notification (median DTRT of 35.5 vs 63 vs 79 minutes respectively, $p < .0001$).

Conclusion: Notifying the cardiac catheterisation team prior to ambulance arrival had a significant effect on lowering the DTRT compared with no pre-notification and pre-notification of the emergency department only.

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Pre-procedural E/e' Predicts Left Ventricular RemodellLV filling pressure on LV remodeing in Patients Undergoing Transcatheter Aortic Valve Implantation

J. Mundisugih[1,*], A. Walton[1], Duffy[1], D. Stub[1,2], R. Johnston[1,3], S. Holland[1,3], D. Kaye[1,2], S. Nanayakkara[1,2]

[1] Department of Cardiology, Alfred Hospital, Melbourne, Australia
[2] Heart Failure Research Group, Baker Heart and Diabetes Research Institute, Melbourne, Australia
[3] Faculty of Medicine, Nursing and Health Sciences, Monash University, Melbourne, Australia

Background: Transcatheter aortic valve implantation (TAVI) is an alternative treatment for severe symptomatic aortic stenosis (AS) in patients at increased surgical risk. AS induces structural alterations to the left ventricle (LV) that lead to elevated filling pressure. We sought to assess the impact of baseline LV filling pressure on LV remodelling following TAVI.

Methods: We reviewed patients undergoing TAVI at a single centre between January 2008 and December 2016. Patients were divided into two cohorts based on echocardiographic estimation of baseline LV filling pressure assessed by the mean E/e' ratio. The primary endpoint was the change in LV diastology from pre-TAVI to 12 months following the procedure.
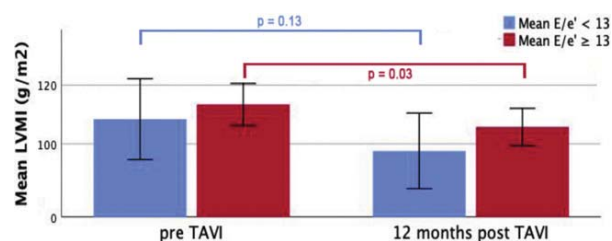
Results: The study includes 98 patients, 81 patients with a mean E/e' $\geq$13 and 17 patients with mean E/e' <13. Mean LV ejection fraction was $63 \pm 7\%$. Mean aortic valve gradient was similar (51 mmHg vs 48 mmHg, $p = 0.46$). The high mean E/e' group had significant improvement in LV mass index (LVMI, $p = 0.03$) with no significant reduction in mean E/e' ratio ($p = 0.09$). In contrast, there was a significantly worsening of mean E/e' ratio ($p = 0.004$) with no significant change in LVMI ($p = 0.13$) in the low E/e' group. There was no significant change in left atrial volume index and right ventricular systolic pressure in either group.

Conclusion: A high pre-operative mean E/e' ratio (>13) predicts favourable remodelling at 12 months in patients with severe symptomatic AS undergoing TAVI.

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Prevalence and Awareness of Pregnancy-related Vascular Complications in Women Undergoing Percutaneous Coronary Intervention (PCI) for Coronary Artery Disease

A. Aslam[1,7,*], S. Perera[1], M. Watts[5], J. Stehli[5], D. Kaye[5,6], J. Cameron[2,3,4], S. Zaman[2,3,4]

[1] Monash University, Melbourne, Australia
[2] MonashHeart, Melbourne, Australia
[3] Monash Medical Centre, Melbourne, Australia
[4] Monash Cardiovascular Research Centre, Monash Heart, Melbourne, Australia
[5] Alfred Hospital, Melbourne, Australia
[6] Baker Heart and Diabetes Institute, Melbourne, Australia
[7] University of Toronto, Toronto, Canada

Background: Women who experience complications of pregnancy including pre-eclampsia, hypertension and diabetes are at increased risk of coronary artery disease (CAD). Yet patients and their medical providers have low awareness of the significance of 'non-traditional' cardiovascular risk factors. We aimed to determine the prevalence and awareness of pregnancy-related vascular complications in women with known CAD.

Methods: Women aged 18-75 years who underwent PCI at three hospitals were prospectively followed for 12-months. Telephone interview was used to determine past pregnancy-related complications. Clinical records were retrospectively reviewed for documentation of pregnancy-related complications at the time of PCI admission or previous admissions.

Results: A total of 725 women aged 18-75 (mean age 61.5 ± 6.8 years) underwent PCI for CAD across the three centres. A total of 75 women completed the 12-month pregnancy history interview. Obstetric maternal-vascular complications had occurred in 25.3% (19/75) of women with past pregnancies, consisting of pre-eclampsia 31.5% (6/19), gestational diabetes 36.8% (7/19) and hypertension 73.6% (14/19). Women with gestational complications compared to those without had similar BMI (mean $30.3 \pm 9.9 \, kg/m^2$ versus $29.9 \pm 8.0 \, kg/m^2$, $p = 0.860$), rate of baseline diabetes (42.1% vs. 26.7%, $p = 0.211$), and hypertension (73.6% vs. 60.7%, $p = 0.309$). Of the women with pregnancy complications, none of the patients (0/19) had obstetric history documented during the PCI or any previous admissions.

Conclusion: Women treated with PCI for CAD have a >25% prevalence of previous pregnancy-related vascular complications. Despite vascular complications of pregnancy predicting future CAD, medical providers are not obtaining a history of these 'non-traditional' cardiovascular risk factors.

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Prevalence, Outcomes and Cost Implications of Patients Undergoing Same Day Discharge After Elective Percutaneous Coronary Intervention (PCI)

S. Liew [1,*], D. Dinh [2], D. Liew [2],
A. Brennan [2], S. Si [2], S. Duffy [1,2,4],
J. Lefkovits [3], D. Stub [1,2,3,5]

[1] Department of Cardiovascular Medicine, The Alfred Hospital, Melbourne, Australia
[2] School of Public Health and Preventive Medicine, Monash University, Melbourne, Australia
[3] Department of Cardiology, Royal Melbourne Hospital, Melbourne, Australia
[4] Baker IDI Heart and Diabetes Institute, Melbourne, Australia
[5] Department of Cardiology, Western Health, Melbourne, Australia

The rates of elective percutaneous intervention have increased significantly in Australia with half of procedures performed in stable coronary artery disease. Despite international growth in the use of same day PCI, there remains little data on the impact of same day PCI in the Australian setting. This study sought to determine the prevalence, clinical outcomes and cost implications of same day discharge (SDD) amongst Australian patients undergoing elective (PCI).

Methods: Retrospective observational cohort study of patients who underwent elective PCI in Victoria between January 2014 to December 2017. Data from this study was obtained from the Victorian Cardiac Outcomes Registry (VCOR). The primary outcome measured was the incidence of 30-day major cardiac events (MACE) and secondary outcomes included in-hospital complications and 30-day readmissions, between patients who were discharged on the same day post PCI and those observed as inpatients overnight (ON). Propensity score matching for patient age, gender, presence of at least stage 3 chronic kidney disease and complex lesions were used to compare both groups.

Results: We studied 18,106 patients, with a mean age of 68 ± 11 years and 13938 (77%) were male. The rate of SDD was 591 (3.3%) and 17,515 (96.7%) patients stayed in hospital overnight. Propensity matching highlighted SDD to be non-inferior to overnight no significant difference in 30-day MACE (0.5%, 95% CI: 0.34, 1.35) but SDD was associated with reduced average length of stay by 2.06 days (95% CI: 1.94, 2.19).

Conclusions: SDD is safe and feasible with no increase short-term adverse outcomes or rehospitalisation.

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Procedural Success Rates from the Standard Versus Ultrasound-Guided Radial and Femoral Access (SURF) trial

P. Nguyen [1,2,3,4,*], A. Makris [2,3],
A. Hennessy [1,2,3], S. Jayanti [2,4], A. Wang [2,4],
K. Park [2,4], V. Chen [4], T. Nguyen [2,4], S. Lo [2,4],
W. Xuan [4,5], M. Leung [2,4], T. Badie [1,2],
J. Xu [1,2,4], K. Kadappu [1,2,3,4],
H. Kachwalla [1,2,3], O. Gibbs [2,4], A. Faour [2,4],
A. Kee [2], R. Rajaratnam [1,2,3,4], D. Leung [2,4],
J. French [2,3,4], C. Juergens [2,4]

[1] Campbelltown Hospital, Campbelltown, Australia
[2] Liverpool Hospital, Campbelltown, Australia
[3] Western Sydney University, Campbelltown, Australia
[4] UNSW, Liverpool, Australia
[5] Ingham Institute, Liverpool, Australia

Background: Ultrasound (US) guidance has been shown to improve vascular access. We examined access time, attempts, venipuncture, difficult and first-pass successes as secondary outcomes from the SURF trial.

Methods: A prospective, randomised [transradial (TRA) vs. transfemoral (TFA) access and standard (SD) vs. US guidance], 2×2 factorial trial of 1388 patients undergoing coronary angiography and percutaneous coronary intervention. Access time was recorded from needle first touched the skin until sheath was successfully inserted and attempts were defined as a forward motion of the needle separated by any withdrawal. Difficult accesses were those that required 5 or more attempts. All were recorded by an independent observer.

Results: There were 700 and 688 patients in the TRA and TFA groups, respectively. Similarly, 700 and 688 patients were randomised into SD and US guidance groups, respectively. All groups had similar baseline characteristics. US guidance showed significant reduction in mean access time (93.1 vs. 111 seconds, $p = 0.0096$), mean access attempts (1.47 vs. 1.9, $p < 0.0001$), venipuncture (28 vs. 64, $p < 0.0001$), difficult accesses (31 vs. 64, $p = 0.0007$) and improved first-pass successes (503 vs. 417, $p < 0.0001$). Whereas, TFA had lower mean access time ($p < 0.0001$), mean access attempts ($p = 0.02$) and difficult accesses ($p < 0.0001$) but higher rate of venipuncture (64 vs. 28, $p < 0.0001$). No significant difference in first-pass successes ($p = 0.3$).

Conclusion: US guidance significantly reduced access time, attempts, venipuncture, difficult accesses and improved first-pass successes in arterial cannulation. This suggests that it could be used on a routine basis for both TRA and TFA.

Prognostic Impact of Proximal versus Distal Dominant Right Coronary Artery (RCA) Myocardial Infarction

G. Femia [1,2,*], J. Assas [2], L. Sharma [2],
H. Idris [2], O. Gibbs [2], A. Hopkins [2],
R. Rajaratnam [2], C. Juergens [2], C. Mussap [2],
J. French [2], S. Lo [2]

[1] University of Sydney, Sydney, Australia
[2] Department of Cardiology, Liverpool Hospital, Liverpool, Australia

Background: ST elevation myocardial infarctions involving proximal dominant right coronary arteries (RCA) have worse outcomes compared to distal lesions. Associated right ventricular(RV) myocardial infarction and cardiogenic shock (CS) may explain the higher mortality. There are implications for clinical care.

Methods: The procedural database at Liverpool Hospital was retrospectively evaluated for dominant RCA ST elevation myocardial infarctions treated with PCI between January 1st 2006 and December 31st 2016. We compared pre-procedure haemodyanmics, cardiogenic shock, the need for balloon counterpulsation and temporary ventricular pacing and mortality. We classified the culprit lesion as proximal if it was proximal to the origin of the acute marginal arteries.

Results: During the study period, 773 patients had a dominant RCA STEMI; 493 had a proximal lesion and 280 had a distal lesion. Overall, patients with a proximal lesion were more likely to present with cardiogenic shock and require balloon counterpulsation and temporary pacing. In-hospital, 1-year and 2-year cardiac death was significantly higher for proximal culprit lesions ($p = 0.004, 0.039, 0.035$, respectively). In-hospital death was driven by patients with cardiogenic shock despite maximal therapy to the culprit lesion (5.1% vs. 1.1%; p, 0.004).

Conclusion: Proximal RCA myocardial infarctions were associated with an increased risk of cardiogenic shock and cardiac death despite urgent resuscitation and revascularisation. Despite modern resuscitation techniques including balloon counterpulsation and temporary pacing, in-hospital death was significantly higher in those with cardiogenic shock.

Radial vs Femoral - A Paradigm Shift to Improve PCI Outcomes in Acute Coronary Syndromes

C. McCallum [1,*], N. Ariyarathna [1], Q. Yang [1],
V. Moosavi [1], B. Nkoane-Kelaeng [1],
R. Ocsan [2], A. Farshid [1]

[1] Department of Cardiology, The Canberra Hospital, Canberra, Australia
[2] Australian National University, Canberra, Australia

Background: There is increasing evidence to support the use of trans-radial access (TRA) in place of trans-femoral access (TFA) for percutaneous coronary intervention (PCI) in patients with an acute coronary syndrome (ACS).

Methods: We performed a large retrospective study of all patients treated with PCI for ACS between 2011 and 2017. TRA was compared with TFA for rates of death, bleeding, major adverse cardiovascular events (MACE) and differences in contrast volume.

Results: 3624 patients with ACS were treated with PCI; 2391 via TFA, 1233 via TRA. The mean age of TFA was 65.5 ± 12.5 years compared with 63.2 ± 12.1 years in TRA group ($p < 0.0001$). 79.9% of TRA were male compared with 75.4% of TFA ($p = 0.0019$). We noted a paradigm shift in our practice: in 2011 TRA was used in 1.84% of PCI for ACS increasing steadily to 58.2% in 2017. TRA used less contrast volume (133.5mls vs 144.2mls; $p < 0.0001$). On univariate analysis TRA was associated with a significantly reduced risk of death at 1 year (3.0% vs 6.3%; $p < 0.0001$), MACE at 1 year (5.4% vs 12.1%; $p < 0.0001$) and bleeding (0.4% vs 1.8%; $p = 0.0002$). On multivariate analysis including all baseline variables, STEMI, shock and cardiac arrest, TRA was an independent predictor of lower MACE at 1 year (RR 0.55, 95% CI 0.40-0.75; $p < 0.0001$).

Conclusions: In conjunction with an expanding evidence base in favour of TRA for PCI, we have noted a dramatic paradigm shift in our practice. TRA was an independent predictor of lower MACE and was associated with lower bleeding in our centre.

Radiation Burden of Patient Obesity During Percutaneous Coronary Intervention

J. Crowhurst [1,2,*], M. Savage [1,2],
D. Murdoch [1], C. Raffel [1,2]

[1] The Prince Charles Hospital, Chermside West, Australia
[2] University of Queensland, St Lucia, Australia

Introduction: Radiation dose to patients and staff during percutaneous coronary intervention (PCI) is relatively high and increased radiation exposure is associated with adverse health outcomes. This study sought to investigate the impact

of patient body mass index (BMI) on radiation dose to the patient and primary operator during PCI procedures.

Methods: In a single tertiary institute, operators wore real time digital dosimeters (RTDD) to measure radiation dose during 1662 PCI procedures over a 30-month period. The radiation dose absorbed by the RTDD was recorded at the end of each procedure. BMI was recorded and categorised as per the World Health Organization (WHO) classification and radiation dose to the patient was recorded as kerma area product (KAP). Radiation doses were grouped by BMI classification.

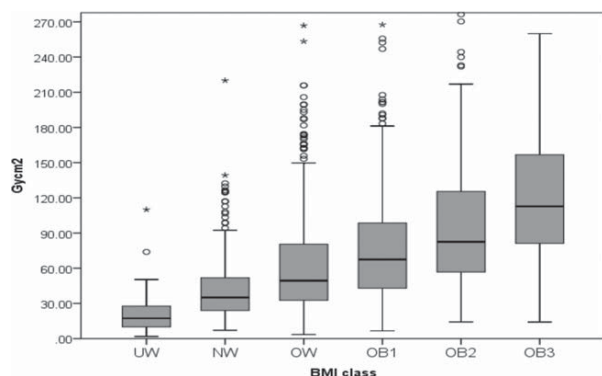**Results:** Boxplots in Figures 1 and 2 demonstrate how KAP
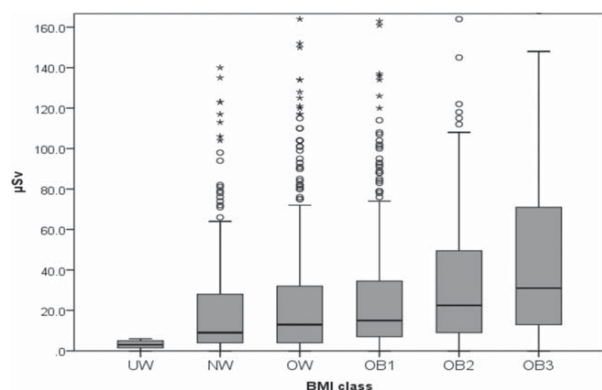

Figure 1.

Figure 2.

(Gycm^2) and RTDD (μSv) significantly increase ($p < 0.001$ and $p < 0.001$ respectively) as BMI increases.

Conclusions: Both KAP and RTDD increase with an increase in BMI. Both KAP and RTDD are more than three times higher when performing PCI procedures on obesity class III patients when compared normal weight patients. Greater radiation awareness is advised when treating obese patients.

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Safety and Efficacy of Pressure Regulated Deployment of Balloon-expandable Transcatheter Aortic Valve Implantation (TAVI)

A. Snir [1,*], S. Wong [4], L. Khor [3],
C. Naoum [2,3], M. Wilson [3], M. Ng [1,3]

[1] *Royal Prince Alfred Hospital, Sydney, Australia*
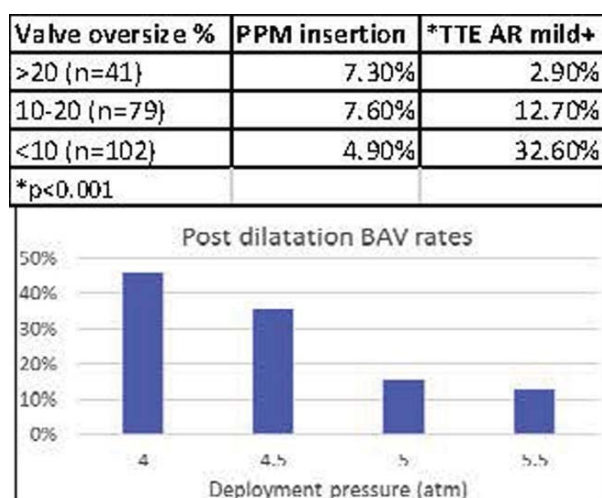[2] *Concord Hospital, Sydney, Australia*
[3] *Macquarie University Hospital, Sydney, Australia*
[4] *Gold Coast University Hospital, Southport, Australia*

Introduction: Currently no optimal strategy exists for deployment of balloon-expandable transcatheter aortic valves. Prosthesis oversizing is associated with the devastating complication of aortic annular rupture as well as increased post-procedural atrioventricular conduction disease. Conversely, valve undersizing is associated with greater paravalvular regurgitation and poor long-term outcomes. We propose a novel pressure regulated deployment strategy that enables optimal apposition between prosthesis and annulus while also carefully preventing significant annular overstretching and injury.

Methods: 251 consecutive patients underwent TAVI procedure with balloon-expandable valves across two Australian centres. Prosthesis sizing was determined using device manufacturer and previously published charts. In all patients the valve prosthesis was deployed using a pressure regulated expansion strategy. Following initial deployment, an additional intraprocedural post-dilatation with Balloon Aortic Valvuloplasty was occasionally performed to reduce paravalvular leak. 41 patients underwent prosthesis implantation that would have otherwise resulted in >20% oversizing by traditional volume expansion. For this group the deployment pressure was limited to 5.5 atm.

Results: No cases of aortic annular rupture occurred and overall rates of PPM insertion and development of new LBBB were 6.3% and 12.2%, respectively. There was no significant association between the degree of valve oversizing and sustained postprocedural conduction disease. However, there was a strongly significant inverse relationship between valve oversizing and resulting paravalvular leak. Higher deployment pressures resulted in fewer post-dilatation BAV.

Valve oversize %	PPM insertion	*TTE AR mild+
>20 (n=41)	7.30%	2.90%
10-20 (n=79)	7.60%	12.70%
<10 (n=102)	4.90%	32.60%
*p<0.001		

Post dilatation BAV rates

Conclusion: Pressure regulated deployment of transcatheter aortic balloon-expandable valves is a safe and efficacious strategy.

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Safety and Feasibility of Distal Transradial Artery Access for Coronary Interventions: First Multicentre Australian Experience

D. Nayyar[1,*], A. Faour[1], C. Wong[3],
O. Gibbs[1], J. Xu[1], T. Badie[1,2], A. Yong[3],
D. Leung[1], C. Juergens[1], S. Lo[1]

[1] *Liverpool Hospital, Liverpool, Australia*
[2] *Campbelltown Hospital, Campbelltown, Australia*
[3] *Concord Hospital, Concord, Australia*

Introduction: Coronary angiography and percutaneous coronary intervention (PCI) via the anatomical snuffbox approach has been reported in overseas centres. We present the first multicentre Australian experience on the safety and feasibility of this approach.

Methods: We performed a retrospective observational study of 50 patients at Liverpool, Campbelltown and Concord Hospitals who underwent distal transradial artery access between 4th September 2018 and 8th March 2019.

Results: The cohort included 37 males (74%), mean age 66.7 ± 13.3 years. Left distal radial artery was cannulated in 32 patients (64%) and right distal radial artery in 18 patients (36%). Ultrasound guidance was used for the puncture in 43 patients (86%). Mean time taken to achieve arterial access was 4.6 ± 3.5 minutes and median attempts was 1 (range 1-4). There were 35 diagnostic coronary angiograms (70%) and 15 PCIs (30%). Mean fluoroscopy screening time was 16.1 ± 13.5 minutes and mean radiation dose area product 614 ± 488 dGy/cm^2. Fractional flow reserve was performed in 5 patients (10%), intravascular ultrasound in 3 (6%), optical coherence tomography in 1 (2%) and 8 patients (16%) had a bypass graft study to evaluate the left internal mammary artery graft. Procedural failure requiring conversion to alternative vascular access occurred in 2 patients (4%). There were 2 hand haematomas (4%) which were managed conservatively. There were no cases of sensory loss or compartment syndrome. Post-procedural bedside ultrasound performed in 8 patients indicated no cases of radial artery occlusion.

Conclusions: Distal transradial artery access is feasible for coronary angiography and PCI, with low rates of vascular complications.

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Safety and Long-Term Clinical Outcomes of Fractional Flow Reserve (FFR): An 8-year Study in a Real-world Setting

L. Toner[*], T. Scully, J. Yeoh, M. Yudi,
O. Farouque, D. Clarke

Austin Health Department of Cardiology, Melbourne, Australia

Background: FFR has become the standard invasive technique for physiological assessment of coronary disease to guide percutaneous coronary intervention (PCI). The ORBITA recently raised concerns regarding wire related complications. Therefore, we audited acute complications and long-term clinical outcomes of FFR-guided revascularisation at a tertiary Australian hospital.

Method: 243 patients (mean age 65 years, 76% male) undergoing FFR-guided revascularisation of 329 vessels from 2008-2015 were analysed. Patients with previous coronary artery bypass graft (CABG) or in-stent restenosis were excluded. FFR was performed at the discretion of the operator using IV adenosine at 140-180 mcg/kg/min. Baseline clinical and procedural data was collected including inpatient complications. Long term follow-up of major adverse cardiac events (MACE) comprising death, acute myocardial infarctions (AMI), target vessel revascularisation (TVR) was determined.

Results: There were 164 vessels with FFR ≤ 0.8 of which 138 (84%) were revascularised (82 PCI, 56 CABG) and 165 vessels with FFR > 0.8 of which 11 (6.7%) were revascularised (2 PCI, 9 CABG). Procedural complications comprised five vascular access site haematomas (2.0%) including one femoral artery pseudoaneurysm, two transient atrial arrhythmias and no wire related complications. Long term clinical outcomes (mean 4.6 ± 1.6 years) are shown.

FFR ≤ 0.8	FFR > 0.8
6 deaths (3 cardiac, 3 non-cardiac)	12 deaths (5 cardiac, 7 non-cardiac)
0 AMI, 0 TVR	5 AMI, 11 TVR
MACE rate = 0.8 per 100 vessels/year	MACE rate = 3.2 per 100 vessels/year

Conclusion: In this large real-world analysis, FFR-guided revascularisation was remarkably safe with low rates of long-term revascularisation and MACE.

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Sex Differences in Guideline Directed Medication Usage and Adherence to Medications After PCI: From the GenesisCare Outcomes Registry

J. Chandrasekhar[1,*], E. Chowdhury[1], A. Conradie[2], S. Worthley[2], D. Eccleston[1]

[1] Monash University, Melbourne, Australia
[2] Genesis Care, Melbourne, Australia

Introduction: Compliance to medications is crucial to outcomes after percutaneous coronary intervention (PCI). We sought to review sex differences in the use of guideline directed medications at discharge and during 1-year follow up after PCI from the multicenter prospective GenesisCare Outcomes Registry (GCOR) dataset.

Methods: From the GCOR multicenter Australian dataset we assessed discharge medications and compliance to medications over 1-year follow up in men and women.

Results. Out of 10,959 patients including 2500 (22.8%) women and 8456 (77.2%) men, women received less ASA (96.8% vs. 97.8%, $p < 0.01$). Despite undergoing PCI more often for ACS, women were less likely to receive ticagrelor (16.7% vs. 20.3%) or prasugrel (3.4% vs. 7.2%), $p < 0.01$ for both. Women received statins less often (91.3% vs. 94.2%, $p < 0.01$) and showed a trend for less ACEI/ARB use (67.3% vs. 69.2%, $p = 0.067$) without differences in use of beta blockers (58.7% vs. 58.1%) at discharge. At 1-year women received lower rates of nearly all guideline directed medications than men (Table).

1-year adherence	Women	Men	p-value
ASA	1669 (88.9%)	5876 (91.5%)	<0.001
P2Y12 inhibitor	1251 (64.0%)	4409 (66.6%)	0.034
Statin	1668 (88.9%)	5976 (93.3%)	<0.001
ACEI/ARB	1239 (63.4%)	4439 (67.1%)	0.003
Beta blockers	957 (51.3%)	3056 (47.9%)	0.009

Conclusion: Women comprise nearly a quarter of patients undergoing PCI but received significantly lower rates of ASA and potent P2Y12 inhibitors at discharge. At 1-year women received lower rates of nearly all guideline directed medications, which warrants further study on the role of under-prescription vs. poor adherence.

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Sex Differences in Medication Use After PCI in ITDM versus non-ITDM Patients: From the GenesisCare Outcomes Registry

J. Chandrasekhar[1,*], E. Chowdhury[1], S. Worthley[2], D. Eccleston[1]

[1] Monash University, Melbourne, Australia
[2] Genesis Care, Melbourne, Australia

Introduction: Whether guideline directed medication use and adherence varies by insulin treated diabetes mellitus (ITDM) compared to non-ITDM in women and men has not been previously reported.

Methods: From the GenesisCare Outcomes Registry we assessed discharge medications and compliance to medications over 1-year follow up in men and women by ITDM or non-ITDM status.

Results. A total of 624 women and 2031 men with diabetes mellitus underwent PCI during the study period, with 99% follow-up at 1-year. Women with ITDM vs. non-ITDM received similar rates ASA, ticagrelor, statins and beta-blockers, higher rates of clopidogrel or prasugrel and lower rates of ACEI/ARB. Men with ITDM vs. non-ITDM received lower rates of ASA and statins, similar rates of P2Y$_{12}$ inhibitors and higher rates of ACEI/ARB. At 1-year ITDM men continued to receive lower rates of statins but received beta-blockers more often than non-ITDM counterparts. Although there were no differences in guideline directed medication use by ITDM status at 1-year in women, rates were lower than in men (Table).

12 months	Women			Men		
	Non-ITDM	ITDM	p-value	Non-ITDM	ITDM	p-value
Aspirin	89.0%	89.3%	0.92	90.6%	89.1%	0.40
P2Y12 inhibitor	68.2%	65.8%	0.60	69.6%	71.6%	0.43
Statin	89.1%	87.1%	0.53	94.1%	90.5%	0.013
Beta blocker	56.3%	52.4%	0.44	53.2%	59.5%	0.031
ACE/ARB	72.2%	68.3%	0.37	72.8%	74.3%	0.58

Conclusion: In this analysis from the GCOR dataset we noted important sex differences in discharge medications by ITDM status. At 1-year significant differences in guideline directed treatments were noted by ITDM status in men but not women, however both ITDM and non-ITDM women received lower rates of several medications compared to men.

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Sex-related Differences in Adverse Outcomes Following Percutaneous Coronary Intervention with Rotational Atherectomy

E. Kalman[1,*], R. Lim Yak[1], S. Burgess[2,3], S. Lo[4], S. Zaman[1,5,6,7]

[1] *Monash Health, Melbourne, Australia*
[2] *Nepean Hospital, Sydney, Australia*
[3] *University of NSW, Sydney, Australia*
[4] *Liverpool Hospital, Sydney, Australia*
[5] *Monash Heart, Melbourne, Australia*
[6] *Monash Cardiovascular Research Centre, Melbourne, Australia*
[7] *Monash University, Melbourne, Australia*

Background: We aimed to describe sex-related differences in adverse outcomes of percutaneous coronary intervention (PCI) with rotational atherectomy (RA) in patients with coronary artery disease.

Methods: Consecutive patients undergoing PCI from a tertiary teaching hospital were recruited into a registry with procedural, in-hospital and 30-day outcomes prospectively collected. Further in-depth procedural RA data was retrospectively obtained. The primary endpoint was occurrence of a RA-related complication defined as coronary artery dissection, slow or no reflow, perforation or cardiac tamponade. Secondary endpoints included each component of the primary endpoint as well as intra-procedural, hypotension and need for inotropic pharmacological support, PCI success rates, mortality and major cardiac/cerebrovascular events (MACCE).

Results: Between 2010-2018, 123 patients (32% female) underwent RA, mean age 72 ± 10 years. Female patients were significantly older ($p < 0.001$). Angiographic PCI success was obtained in 87% of women versus 86% of men ($p = 0.83$). The primary endpoint occurred in 79% of women versus 21% of men ($p < 0.001$). Women had higher rates of coronary artery dissection (21% versus 2%, $p < 0.001$), with no statistical difference in slow/no, perforation or cardiac tamponade. No sex difference was seen in intra-procedural hypotension and use of inotropic pharmacological support. Overall 30-day mortality and MACCE was 1.6% and 4%, respectively, with no significant difference between genders.

Conclusion: Female patients undergoing PCI with RA were more likely to experience RA-related complications, particularly coronary artery dissection. However overall rates of PCI success were high and 30-day MACCE acceptably low in both genders.

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This abstract has been withdrawn

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Six-year Registry Data for Patients with Left Ventricular Dysfunction and Severe Mitral Regurgitation Undergoing Transcatheter Repair with the MitraClip™ System at St Vincent's Hospital, Sydney

N. Song[1,2,*], S. Hungerford[1,2,3], N. Bart[1,2], C. Hayward[1,2,3], D. Muller[1,2,3]

[1] *St Vincent's Hospital, Sydney, Darlinghurst, Australia*
[2] *University of New South Wales, Sydney, Australia*
[3] *Victor Chang Cardiac Research Institute, Sydney, Australia*

Background: We present the 6-year registry data for all patients with left ventricular (LV) dysfunction (ejection fraction [EF] <55%) and severe mitral regurgitation (MR) undergoing MitraClip™ repair at our institution.

Objectives: To examine the efficacy and safety of MitraClip™ repair at our institution.

Methods: This is a single-centre, retrospective, observational cohort study of patients' who underwent MitraClip™ repair between November 2011 and November 2017. All demographic data was manually extracted from the electronic medical records. Pre and post-operative transthoracic echocardiograms were analysed by two blinded independent investigators using Epsilon Imaging® for LVEF, LV end-diastolic and end-systolic volumes (LVEDV and LVESV) and MR.

Results: 48 patients (age 79 ± 9 years; 32 men) with grade 3–4 MR underwent MitraClip™. The pre-operative Euroscore II was 8.0 ± 6.1 ($n = 45$). MR aetiology was primary in 48% and secondary/mixed in 52% of patients. 1+ MR or less was achieved in 77% of patients and 3+ MR remained in 2 patients. There was no significant reduction in LVEDV, LVESV or improvement in LVEF. There was an average of 1.67 of clips per patient. There were no acute deaths, one stroke and no myocardial infarctions. One patient had acute leaflet rupture, another required pericardiocentesis for tamponade. The length of stay was 3.8 ± 3.7 days. Successful device implantation free of cardiovascular mortality, stroke, and device malfunction at 30 days was 92%.

Conclusions: MitraClip™ repair at our institution is an effective and safe therapy for selected patients with LV dysfunction and symptomatic MR not suitable for conventional mitral valve surgery.

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Standard Versus Ultrasound-Guided Radial and Femoral Access (SURF) - A Randomised Controlled Trial

P. Nguyen [1,2,3,4,*], A. Makris [2,3],
A. Hennessy [1,2,3], S. Jayanti [2,4], A. Wang [2,4],
K. Park [2,4], V. Chen [4], T. Nguyen [2,4], S. Lo [2,4],
W. Xuan [4,5], M. Leung [2,4], T. Badie [1,2],
J. Xu [1,2,4], K. Kadappu [1,2,3],
H. Kachwalla [1,2,3], O. Gibbs [2,4], A. Faour [2,4],
A. Kee [2], R. Rajaratnam [1,2,3,4], D. Leung [2,4],
J. French [2,3,4], C. Juergens [2,4]

[1] *Campbelltown Hospital, Therry Road, Australia*
[2] *Liverpool Hospital, Liverpool, Australia*
[3] *Western Sydney University, Campbelltown, Australia*
[4] *UNSW, Liverpool, Australia*
[5] *Ingham Institute, Liverpool, Australia*

Background: This study compared outcomes in unselected patients undergoing cardiac catheterisation via transradial (TRA) and transfemoral access (TFA) and also standard (SD) versus ultrasound (US) guidance.

Methods: A prospective, randomised (radial vs. femoral and standard vs. US guidance), 2x2 factorial trial of patients undergoing coronary angiography and percutaneous coronary intervention. Primary outcome was a composite of ACUITY (Acute Catheterization and Urgent Intervention Triage strategY) major bleeding, MACE (death, stroke, myocardial infarction or urgent target lesion revascularisation) and vascular complications at 30 days.

Results: Of the 1388 patients randomised, 700 and 688 were into the TRA and TFA groups, respectively. Similarly, 700 and 688 patients were randomised into SD and US guidance groups, respectively. All groups had similar baseline characteristics. All groups had similar baseline characteristics. TRA significantly reduced the primary outcome (hazard ratio [HR] 0.37, 95% CI 0.17-0.81; $p = 0.013$), mostly driven by ACUITY major bleeding (HR 0.343, 95% CI 0.123-0.959; $p = 0.041$). Subgroup analysis showed TRA had the greatest benefit in females ($p = 0.046$), diabetics ($p = 0.027$) and patients $\geq 25\,kg/m^2$ ($p = 0.072$) when compared to TFA. SD versus US guidance did not differ in primary outcome ($p = 0.76$). US guidance did not show significant benefit in all subgroup analysis, even in females ($p = 0.82$) or patients $\geq 25\,kg/m^2$ ($p = 0.33$).

Conclusion: TRA significantly reduced composite outcome, especially in diabetic, females and those with BMI $\geq 25\,kg/m^2$, when compared with TFA. When compared with standard, US guidance did not show any significant difference in primary outcome.

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Successful Use of Low Fluoroscopy Workflow to Reduce Patient and Operator Exposure During Atrial Fibrillation Ablation

M. Swale [1,2,*], C. Stevens [1,2], N. Hill [2],
D. Eccleston [1], D. O'Donnell [1]

[1] *Genesiscare, Melbourne, Australia*
[2] *Mulgrave Private Hospital, Mulgrave, Australia*

Background: Ablation procedures for atrial fibrillation (AF) are frequently utilised for symptomatic, drug-refractory patients with multiple procedures sometimes required. However, radiation exposure to patients, operators and staff is potentially detrimental.

Methods: We compared 56 cases by a single operator with >100 cases experience using intracardiac echo (ICE) for AF ablation (28 each normal fluoroscopy (NF) and low fluoroscopy (LF) arms). LF cases used ICE and cardiac mapping for introduction of catheters and trans-septal puncture with fluoroscopy per operator preference. All cases used minimal fluoroscopy once trans-septal access was achieved.

Results: Baseline characteristics were similar between groups (table 1). Mean fluoroscopy time in the LF arm was significantly reduced (LF 3.6 min vs NF 10 min, $p < 0.001$). Median fluoroscopy time in the LF arm was lower at 2.27 min, with two outliers of 13 and 19 minutes caused by (1) difficulties with trans-septal requiring repeated punctures and (2) persistent eustachian valve respectively. A single case had an ICD present with fluoroscopy of 4.5 min. Total procedure times were similar (LF 127 vs NF 141 min, $p = 0.12$). Procedural success was unaffected by LF protocol. Fluoroscopy with experience showed a trend to reduction ($r = -0.45$)

Workflow	NF	LF	P value
Age	62	62.1	0.83
BMI	29	30	0.78
%Paroxysmal	71	75	0.67

Fluoroscopy by LF case
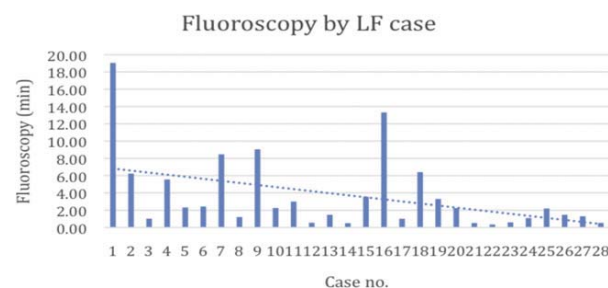
Conclusions: A dedicated low fluoroscopy workflow can significantly reduce radiation exposure for patients and staff, without impacting total procedural time or success, with potential impacts on exposure risks.

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Sugar Sickness in Aboriginal & Torres Strait Islander (A&TSI) Cardiology Patients

H. Yong [1,*], R. Parr [2], W. Wang [1],
S. Mitchell [1], V. Bryce [1], S. Grugan [1],
A. Turner [1], S. Renouf [1]

[1] *Better Cardiac Care, Princess Alexandra
Hospital, Woollongabba, Australia*
[2] *Cairns Hospital, North Cairns, Australia*

Background: A&TSI patients are known to have 4 times higher risks of having diabetes. Diabetes patients are also known to be 2 to 4 times more likely to develop cardiovascular disease. This audit aims to retrospectively analyse whether pre-diabetes and diabetes are identified, managed and communicated to general practitioner (GP) in A&TSI cardiology patients at a tertiary hospital.

Method: A total of 198 A&TSI cardiology patients were admitted in 2017, identified via the Better Cardiac Care team database. Patients' random blood glucose level (BGL), HbA1c were analysed. Parameters utilised are consistent with current guidelines. Patients with HbA1c $\geq$ 6.5% are likely Type 2 diabetes mellitus (T2DM). Patients with HbA1c $\geq$7.5% are considered suboptimal and requires further interventions. Patients with BGL >7.8 mmol/L are likely pre-diabetes patients.

Result: 64% of all A&TSI cardiology patients had HbA1c screen. Of those patients who did not have known diabetes, 10 patients (5%) were identified to likely have new T2DM whereas 28 patients (14%) were identified to likely have pre-diabetes patients. Of those patients with pre-existing diabetes, 42 patients (21%) were found to have suboptimal control. It was found that a majority had intensified medical therapy as intervention and referral to GP for further review is also a common management pathway.

Conclusion: A robust diabetes screen, review and GP handover process needs to be established to improve diabetes prevention and risk factor management of A&TSI cardiology patients.

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Surgical Versus Percutaneous Management of Concomitant Aortic Stenosis and Coronary Artery Disease: A Single Centre Retrospective Study

J. Carroll [1,*], K. Jones [1], S. Eather [1],
H. Kempton [1], K. Kearney [1], K. Bensted [2],
N. Bart [1], D. Baron [1], D. Muller [1], D. Roy [1]

[1] *St Vincent's Hospital, Darlinghurst, Australia*
[2] *St George Hospital, Kogarah, Australia*

Background: Patients with severe aortic stenosis (AS) and concurrent coronary artery disease have typically been managed with surgical aortic valve replacement (SAVR) and coronary artery bypass surgery (CABG). With the increasing use of transcatheter aortic valve implantation (TAVI), patients can have percutaneously coronary intervention (PCI) at or around the time of TAVI. Given the recent change in practice, there is a paucity of literature on feasibility and outcomes of the percutaneous approach.

Aim: To determine if TAVI and PCI has comparable outcomes to SAVR and concomitant CABGs.

Method: At a single institution, we retrospectively compared all patients who underwent PCI within one month of TAVI between 2013 and 2019 with an age-and sex matched cohort of patients who underwent surgical aortic valve replacement and concomitant CABG. Outcomes measured include complications and mortality.

Results: A total of 26 matched patients were included. Average age in the interventional group was 82.69 ± 5.51 and EURO score of 3.77 ± 1.95. The average age in the surgical group was 81.85 ± 3.67 and EURO score of 3.86 ± 2.25. At follow-up 5 of the 13 SAVR + CABG patients were deceased, all 13 TAVI + PCI patients were alive. 11/15 SAVR + CABG group experienced complications versus 2/15 in the interventional group.

Conclusions: In this single centre study, TAVI and PCI was associated with reduced mortality and fewer complications in comparison to SAVR and CABGs in high risk patients.

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Ten-year Trends in Transcatheter Aortic Valve Implantation

J. Koh [1,*], J. Stehli [1], C. Martin [2], M. Dagan [1],
L. Dawson [3], S. Liew [1], N. Htun [1,2],
D. Stub [1,2], A. Walton [1,2,4], S. Duffy [1,2]

[1] *Alfred Hospital, Melbourne, Australia*
[2] *Monash University, Melbourne, Australia*
[3] *Royal Melbourne Hospital, Melbourne,
Australia*
[4] *Epworth Hospital, Melbourne, Australia*

Background: One of the first transcatheter aortic valve implantations (TAVI) in Australia was performed in Victoria in 2008. Since then, this program has performed over 800 TAVIs. We aimed to determine temporal changes in patient and procedural characteristics and clinical outcomes over ten years.

Methods: Between 2008 and 2017, all patients who underwent TAVI in two experienced centres in Melbourne were followed-up for 1 year. Outcomes were analysed based on the Valve Academic Research Consortium (VARC)-2 criteria.

Results: The number of TAVIs performed significantly increased each year from 11 in 2008 to 136 in 2017 ($p < 0.01$). Initially, most patients had an STS-PROM score of $\geq$4 (2008: 63.7%), compared with contemporary patients who have an STS-PROM score <4 (2017: 59.3%) ($p < 0.01$). Contemporary patients are treated earlier in the disease process with a mean pressure gradient (mmHg) of 51.0 ± 14.9 in 2008 to 46.3 ± 14.6 in 2017 ($p < 0.01$). Coinciding with an increasing use of third generation devices, there has been a decline in conduction abnormalities requiring permanent pacemaker implantation (PPM, 2008: 55.6% to 2017: 22.8%, $p < 0.001$). Progressively, more patients are discharged $\leq$5 days (2017: 66.2% vs. 2008:

9.1%, $p < 0.01$). Periprocedural and 1-year mortality remain low and unchanged ($p = 0.24$ and $p = 0.22$, respectively), as were other VARC-2 outcomes ($p = $ NS).

Conclusion: There has been a significant change in the patient population undergoing TAVI, with patients at lower risk and undergoing TAVI earlier in the disease process. PPM implantation and length of stay have declined significantly. Other VARC-2 outcomes remained unchanged at a low rate.

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The Association Between Type II Myocardial Infarction and Increased In-Hospital Mortality in Patients aged >85 years with Non-ST-Elevation Myocardial Infarction

A. Murphy*, A. Koshy, P. Kunniardy, G. Meehan, J. Ramchand, O. Farouque, D. Clark, M. Yudi

Austin Health, Melbourne, Australia

Introduction: Current guidelines are oriented toward the treatment of Type I Myocardial Infarction (MI) with no established recommendations regarding management of Type II MI. Type II MI is common in clinical practice, especially in the elderly. In-hospital outcomes in the very elderly with Type II MI are unknown.

Methods: A single-centre retrospective analysis of 956 consecutive patients aged >85 years presenting with NSTEMI between 2010-2018 was undertaken. Patients were stratified by Type I vs Type II MI as defined by the 4th Universal Definition of MI. The primary outcome was all-cause in-hospital mortality.

Results: Of the 956 patients included, 477 (50%) suffered a Type II MI. The initial presentation of those with Type II MI was delirium (34%), sepsis (18%), post-non-cardiac surgery (8.5%) and bleeding/anaemia (7%). Those with Type II MI were much less likely to undergo invasive coronary angiography (2.5 vs 17.0%, $p < 0.001$) and less likely to be prescribed aspirin (77 vs 84%, $p < 0.007$). In-hospital mortality was significantly higher in those with Type II MI (21.1 vs 13.5%, $p = 0.002$). Cox-proportional hazard modelling showed Type II MI was independently associated with in-hospital mortality after adjustment for conventional cardiac risk factors and medical therapy (OR 1.56, 95% CI 1.1-2.2; $p = 0.01$) but not after adjusting for patients that underwent coronary angiography (OR 0.97, 95% CI 0.97-2.0; $p = 0.07$).

Conclusion: Type II MI are common in elderly patients and confers a high risk of in-hospital mortality. At present, there is a lack of evidence to risk stratify and guide treatment in this population. Future studies should address whether an invasive strategy reduces the risk of mortality in this high-risk cohort.

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The CRE8 Polymer-free Amphilimus-eluting Coronary Stent. Real World Data from a Tertiary Hospital

F. Zaky[1,*], M. Rooney[1], M. Ghodsian[2], P. Shetty[1]

[1] *Wollongong Hospital, Wollongong, Australia*
[2] *The University of Wollonong, Wollongong, Australia*

The CRE8 coronary stent is a novel polymer-free stent design which delivers Amphilimus (sirolimus/fatty acid) via a reservoir design. Has been shown to be non-inferior to current generation stents and may reduce restenosis in diabetic patients. We aim to review the real-world safety and efficacy data from a tertiary referral centre providing cardiology services for approximately 350,000 residents.

A retrospective analysis of a total of 111 patients receiving 147 CRE8 stents deployed between 2017 and 2018 was conducted. Target lesion failure (TLF), a composite outcome of unplanned intervention, target vessel related myocardial infarction and cardiac death), was measured and patient specific endpoints of MACE (composite of all-cause death, myocardial infarction and stroke) and major bleeding were also measured. Outcomes were recorded until the time of writing.

Of the 111 patients (mean age 67.5 ± 12.1 and 72.8% proportion male), 72.1%, 69.4% and 28.8% had hypertension, hyperlipidaemia and diabetes respectively and 55.9% were smokers. Indication for PCI were STEMI (43%), NSTEMI (39%), positive stress test (17%) and unstable angina (12%). Aspirin/clopidogrel was initiated in 89.3% of patients post-PCI with prasugrel and ticagrelor replacing clopidogrel in 8.0% and 2.7% cases respectively. 52% of stents were inserted via radial access. The average stent diameter and length was 3.14 ± 1.68 mm and 20.23 ± 5.96 mm, respectively.

Analysis revealed an incidence of 3.0% TLF with 4.5% MACE and 3.0% major bleeding consistent with previous pre-marketing randomised controlled trials [1], providing real-world data supporting the safety and efficacy of this novel stent design.

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The Effect of Sex on 1-year All-cause Mortality After Percutaneous Coronary Intervention in Patients with Insulin-treated vs. Non-insulin Treated Diabetes Mellitus: Outcomes from a Large National Multi-centre Registry

J. Chandrasekhar [1,2,*], E. Chowdhury [1], A. Conradie [2], S. Worthley [2], D. Eccleston [1,2]

[1] *Monash University, Melbourne, Australia*
[2] *Genesis Care, Melbourne, Australia*

Introduction: Diabetes mellitus has a significant adverse effect on outcomes after percutaneous coronary intervention (PCI). Whether sex affects all-cause mortality in patients with insulin treated diabetes mellitus (ITDM) vs. non-ITDM is unknown.

Methods: From the multicenter GenesisCare Outcomes Registry (GCOR) we assessed the effect of ITDM vs. non-ITDM status on 1-year mortality after PCI from 2009-2017 in men and women. Outcomes were adjusted for baseline characteristics using multivariable regression methods with interaction testing for sex and ITDM.

Results. Data were available for 624 women and 2031 men with diabetes mellitus undergoing PCI with 99% follow-up at 1 year. Women were more likely than men to have ITDM (33.3% vs. 26.8%, $p < 0.01$). ITDM women were younger with higher BMI and greater prevalence of renal impairment but less prior stroke, and had more radial PCI, drug eluting stents and smaller stent diameter than non-ITDM women. ITDM men had more hypertension, dyslipidaemia, prior MI or revascularisation, PAD and renal impairment and underwent more multivessel PCI, less de-novo and greater bypass vessel PCI than non-ITDM men. At 1-year, all-cause mortality was higher in ITDM vs NITDM women and men, however risk-adjusted mortality was significantly higher in ITDM vs non-ITDM women but not men with no interaction by sex ($p = 0.83$). (Table)

1 year Mortality	ITDM	NITDM	p	Adjusted OR ITDM v NITDM	P
Women	4.2%	2.0%	0.15	8.70 (1.39-54.4)	0.02
Men	3.5%	1.4%	0.009	1.50 (0.59-3.79)	0.40

Conclusion: In this multicenter GCOR analysis, ITDM was more frequent in women than men. Baseline comorbidities were more common for both women and men with ITDM than NITDM. However all-cause mortality for those with ITDM vs. non-ITDM was 5-fold higher for women than men, although there was no interaction by sex.

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The Effect of Sex on Unplanned Readmission Following Percutaneous Coronary Intervention in Australia: Results from a National Multicentre Outcomes Registry

A. Conradie *, D. Eccleston

Genesiscare, Bundaberg, Australia

Introduction: Gender differences are increasingly recognised in clinical presentation, treatment and outcomes in coronary artery disease. Women are reported to have higher complication rates after percutaneous coronary intervention (PCI) than men. However, the effect of sex on long-term readmission after PCI in Australia is unknown.

Methods: From the GCOR multicenter Australian dataset we assessed the association of sex with outcomes including unplanned cardiac readmission at 1 year, adjusted for baseline clinical and lesion characteristics.
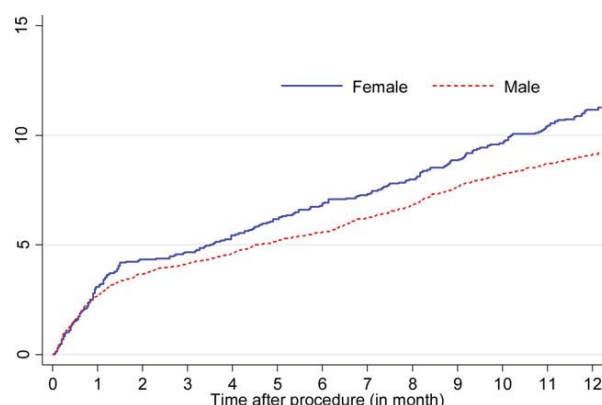
Results. Data were available for 10,959 patients undergoing PCI from November 2008 - January 2018. Women comprised 2500 (22.8%) and despite presenting more often for ACS received less ASA (96.8% vs. 97.8%, $p < 0.01$), ticagrelor (16.7% vs. 20.3%) or prasugrel (3.4% vs. 7.2%) than men ($p < 0.01$ for both). At 1-year women had higher rates of risk-adjusted unplanned readmissions than men (OR 1.26 95% CI 1.02-1.58 $p = 0.04$) Predictors of unplanned readmission in women were a history of previous CABG (OR 3.32, 95% CI 1.62 to 6.78, $P = 0.001$) and treatment of in-stent restenosis (OR 2.18, 95% CI 0.93 to 5.16, $P = 0.071$).(Figure).

Conclusion: Despite several high-risk baseline characteristics, women received significantly lower rates of anti-platelet therapy at discharge and of all guideline-directed medications at 1 year. Risk-adjusted rates of unplanned cardiac admission were higher in women than men, which warrants further study on the role of treatment and prevention post-PCI in women.

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The J-CTO Score Remains Predictive of Procedural Success for Chronic Total Occlusion Percutaneous Coronary Intervention (CTO PCI) in a Contemporary Australian Cohort

U. Allahwala [1,*], A. Bland [1], K. Kott [1,2], M. Ward [1], R. Bhindi [1,2]

[1] Royal North Shore Hospital, Sydney, Australia
[2] The University of Sydney, Sydney, Australia

Aims: The J-CTO score is an easily calculated clinical tool which can predict the success of CTO PCI. However, it is unknown whether this score remains relevant in the context of the modern techniques used in contemporary CTO PCI.

Methods & Results: We reviewed patients undergoing CTO PCI at our centre from April 2010 to February 2019. A total of 301 patients were included. The mean age was 69.3 years (±10.3) with 16.6% females and a mean BMI of $28.5 \, \mathrm{kg/m}^2$ (±5.6). 28.6% of patients had a previous coronary artery bypass graft, with 7% of CTOs being within a stented vessel.

The right coronary artery (RCA) was the commonest target vessel, accounting for 53.8% of cases, followed by the left circumflex artery (25.2%) and left anterior descending artery (19.3%). The remainder comprised of vein grafts or a protected left main stem (1.7%).

The mean J-CTO score was 1.9, with a median score of 2. The overall procedural success rate was 72.1%. A higher J-CTO score was associated with greater utilisation of the retrograde approach ($p < 0.01$) although not dissection re-entry approach ($p = 0.18$). A higher J-CTO score was associated with a lower rate of procedural success ($p < 0.0001$). In multi-variate analysis, after correcting for age, gender and BMI, the J-CTO score remained predictive of procedural success ($p < 0.0001$).

Conclusions: The J-CTO score remains a valuable tool to predict procedural success in patients undergoing contemporary CTO PCI. Routine calculation of the J-CTO score remains useful to identify challenging cases which may require additional planning or proctoring.

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The Ultimaster Bioresobable Polymer Sirolimus-eluting Coronary Stent. Real World Data from the Largest Australian Single-site Database

F. Zaky [1,*], V. Vijayarajan [1], R. Cohen [1], I. Zaki [1], K. Haeney [1], M. Ghodsian [2], M. Morad [1], A. Lee [1]

[1] Wollongong Hospital, Wollongong, Australia
[2] University of Wollongong, Wollongong, Australia

The Ultimaster stent is bioresorbable polymer sirolimus-eluting stent currently being investigated for abbreviated duration dual antiplatelet therapy in high risk bleeding patients [1]. We aim to review the real-world safety and performance data from Wollongong Hospital, the highest utiliser of Ultimaster stents in Australia.

A retrospective analysis of 317 patients receiving a total of 536 stents from August 2017 to January 2019 was performed. Target lesion failure (TLF), a outcome of unsuccessful intervention, target vessel related myocardial infarction and cardiac death), was measured and patient specific endpoints of MACE (composite of all-cause death, myocardial infarction and stroke) and major bleeding were also measured. Outcomes were recorded until the time of writing.

Of the 317 patients (mean age 67.6 ± 11.4 years and 70% male) 65.9%, 56.8% and 30.0% had hypertension, hyperlipidaemia and diabetes respectively and 59.9% were smokers. 89.3% of patients were initiated on aspirin/clopidogrel post-PCI with ticagrelor and prasugrel replacing clopidogrel in 4.7% and 5.4% respectively. 76% of stents were inserted via radial access. Average stent diameter and length was $2.95 \pm 0.48 \mathrm{mm}$ and $21.89 \pm 8.55 \mathrm{mm}$, respectively.

Analysis revealed an incidence of 4.4% TLF and 8.2% MACE while the incidence of major bleeding was 3.4%. This is the first real-world study in Australia on the Ultimaster stent and results are comparable with pre-marketing randomised controlled trials [2] proving translation of safety and efficacy into clinical application.

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Transcatheter Aortic Valve Implantation and Concurrent Mitral Regurgitation, an Australian Perspective

V. Sankhla *, D. Murdoch, M. Savage, K. Poon, C. Raffles, D. Walters

Queensland Health, Brisbane, Australia

Severe aortic stenosis (AR) and mitral regurgitation (MR) often exists concurrently. In observational studies, simultaneous multivalvular replacement has been associated with high morbidity and mortality. Decision-making and management can be difficult in patients with multiple comorbidities that deem surgical management unfeasible.

We analysed 569 patients with severe AS undergoing TAVI at The Prince Charles Hospital between 2008 and 2017 and identified those with significant MR ($\geq 3/4$). Of 569 patients

undergoing TAVI 28(4.92%) had significant MR. Median MR grade improved between baseline and 30 days in the significant MR group (2.0 to 1.0, $p < 0.000$ and was unchanged in the ≤mild MR group (1.21 to 1.19; $p = 0.539$). 18 out of 26 (69%) had improvement in MR to ≤mild. 2 out of 28 (7.1%) patients in the significant MR group and 17 out of 541 (3.14%) of the ≤mild MR group were deceased at 30-days ($p = 0.251$).

This study demonstrates improvement in MR in patients undergoing TAVI alone and is concordant with international experience. Patients assessed for TAVI with concurrent mitral regurgitation may benefit from TAVI alone. Further study is required to evaluate long-term outcomes and to identify which patients are likely to require mitral valve intervention.

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Transcatheter Aortic Valve Implantation in Australia: Insights from the ACOR TAVI Registry

A. Sinhal[2,*], T. Hooper[1], J. Bennetts[2], L. Griffith[1], A. Deakin[1], R. Bhindi[4], D. Brieger[5], D. Muller[12], A. Walton[8], A. Camuglia[9], R. Gooley[13], R. Whitbourn[6], G. Yong[14], J. Stewart[7], W. Wilson[11], A. MacIsaac[6], D. Walters[10], M. Ng[3]

[1] *SAHMRI, Adelaide, Australia*
[2] *Flinders Medical Centre, Bedford Park, Australia*
[3] *Royal Prince Alfred Hospital, Sydney, Australia*
[4] *North Shore Private Hospital, Sydney, Australia*
[5] *Concord Hospital, Sydney, Australia*
[6] *St. Vincent's Hospital Melbourne, Melbourne, Australia*
[7] *Auckland District Health Board, Auckland, New Zealand*
[8] *Alfred Hospital, Melbourne, Australia*
[9] *Princess Alexandra Hospital, Brisbane, Australia*
[10] *University of Brisbane, Brisbane, Australia*
[11] *Royal Melbourne Hospital, Melbourne, Australia*
[12] *St Vincent's Hospital Sydney, Darlinghurst, Australia*
[13] *Monash Health, Clayton, Australia*
[14] *Mount Hospital, Perth, Australia*

Objective: To examine Australian TAVI practice and early clinical outcomes with data from the TAVI Registry.

Method: Australian TAVI Registry data were exported in February 2019 with incomplete cases subsequently excluded from the dataset. The following data variables were included in the review: age, gender, mortality, STS score, hospital type, length of stay (total LOS and post Procedure LOS) and adverse events. Results are aggregated for all contributing hospitals.

Results: The TAVI Registry contains 865 in-hospital cases, 778 were eligible for follow-up at 30-days. The number of complete cases at these timepoints are: in-hospital 717 (83%) and 30-day follow-up 553 (71%). The cohort mean age was 83 years (range 45.8 - 97.3) and 60% were male. The majority (81%) of procedures were performed in the private sector. The median STS score was 4.47% with a mean STS score of 5.87% (range 1.0 - 39.4%). The 30-day mortality was 1.54% ($n = 12$). Of these, 7 patients (0.8%) died in-hospital. This mortality is consistent with the 1-2%% reported by other international registries. Median total length of stay (LOS) admission to discharge was 4 days. At 30-days an adverse event occurred in 199 patients (25%, 209 events), which includes 186 in-hospital events.

Conclusion: The clinical characteristics of Australian TAVI patients are consistent with international practice. Early clinical outcomes are also consistent with international benchmarks.

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Transcatheter Aortic Valve Implantation in the Very Large Annulus – Beyond the "Recommended Retail"

D. Blusztein[*], W. Wilson, M. Brooks, D. Pol, L. Dawson, S. Montalto, R. Gurvitch

Royal Melbourne Hospital, Melbourne, Australia

Introduction: Transcatheter aortic valve implantation (TAVI) for symptomatic aortic stenosis is recommended in patients of intermediate or high surgical risk where technically feasible. The 29mm Edwards SAPIEN 3 (S3) valve is the largest balloon-expandable valve and is recommended for aortic annulus areas up to 683mm². Significant undersizing may lead to significant paravalvular leak, embolisation and poor durability.

Case Report: A 69-year-old male was diagnosed with severe symptomatic aortic stenosis (mean gradient 46 mmHg, dimensionless index 0.2) after presenting with acute pulmonary oedema. His past history included previous coronary bypass grafting and metastatic lung adenocarcinoma with >2-year prognosis. His bypass grafts were patent. TAVI CT revealed a huge annulus area of 812 mm² with suitable coronary and iliofemoral anatomy for TAVI. TAVI was undertaken with a 29mm Edwards SAPIEN 3 valve. Given the nominal dimensions of the valve are 660 mm², 6 extra ml of fluid were utilised to overstretch the valve. An excellent acute haemodynamic result was achieved with only trivial-mild aortic regurgitation post-procedure. At one month, the patient had NYHA class I symptoms and echocardiography demonstrated a well-functioning bioprosthesis with a mean gradient of 15 mmHg and trivial-mild paravalvular leak.

Conclusion: This case demonstrates successful use of a SAPIEN 3 valve by marked overfilling to accommodate a very large annulus, the largest recorded in Australia to date. This case displays the feasibility of TAVI in those very large annuli with marked overstretching of the nominal valve dimensions resulting in acceptable haemodynamic outcomes and minimal leak. More analysis of long-term durability is required.

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Transcatheter Aortic Valve-in-Valve Implantation For Failed Surgical Bioprosthetic Valves. A Minimalist Approach Without Contrast Aortography or Echocardiographic Guidance

N. Htun [1,*], A. Attinger-Toller [2,3,4],
D. Murdoch [4], G. Perlman [4], A. Alenezi [4],
J. Sathananthan [4], P. Blanke [4], J. Leipsic [4],
C. Thompson [4], J. Ye [4], A. Cheung [4],
D. Wood [4], J. Webb [4]

[1] *Alfred Hospital, Melbourne, Australia*
[2] *Peninsula Health, Frankston, Australia*
[3] *Monash University, Melbourne, Australia*
[4] *St Paul's Hospital, Vancouver, Canada*

Objectives: To demonstrate safety, feasibility and short-term clinical outcomes after transcatheter aortic valve-in-valve (ViV) implantation under local anaesthesia without contrast aortography or echocardiographic guidance.

Background: Transcatheter ViV implantation is an emerging treatment modality for patients with degenerative surgical bioprostheses. Given the radiopaque properties of the surgical aortic valve (SAV) frame, ViV procedures can often be performed with fluoroscopic guidance alone.

Methods: ViV implantation was performed in 37 patients with SAV failure under local anaesthesia without contrast aortography. Clinical and echocardiographic data were obtained at baseline, discharge, and 30 days.

Results: Mean age was 74 ± 10 years and STS predicted risk of mortality was $5.6 \pm 2.4\%$. Mean transaortic gradient decreased from 39.4 ± 15.5 mmHg to 13 ± 6.3 mmHg at discharge ($p < 0.001$), and 20 ± 7.5 mmHg at 30 days ($p < 0.001$ compared to baseline), aortic valve area increased from 0.9 ± 0.3 cm^2 to 1.2 ± 0.4 cm^2 at 30 days ($p = 0.007$). No patient had more than mild aortic regurgitation. Hospital discharge occurred at a median of 2.6 ± 4.4 days. At 30-day follow-up there were no deaths, myocardial infarctions, strokes, repeat hospital admissions for heart failure, or renal failure. 1 patient (2.7%) required a new pacemaker. 93% of patients were in New York Heart Association functional class I or II.

Conclusions: Transcatheter aortic ViV implantation for selected patients with degenerative surgical bioprostheses under local anaesthesia without aortography or echocardiographic guidance is feasible and safe.

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Trends in Pre-hospital Notification (PHN) in ST Segment Elevation Myocardial Infarction (STEMI) and Clinical Outcomes – Longitudinal Study

M. Savage [1,2,*], D. Murdoch [1,2],
J. Crowhurst [1,2], C. Raffel [1,2]

[1] *The Prince Charles Hospital, Brisbane, Australia*
[2] *University of Queensland, Brisbane, Australia*

Introduction: Globally, there has been a significant reduction in door to balloon (DTB) times over time with varying reported impact on clinical outcomes in STEMI patients. Pre-hospital notification (PHN) and initiation of treatment by ambulance officers in the field has previously been shown to improve DTB times yet there is limited data in the Australian context with regard to clinical outcomes.

Method: Analysis of 1211 consecutive STEMI patients over a 10-year period between 2008 – 2017 from prospectively collected data from the Prince Charles Hospital STEMI database was performed. Comparison of performance markers including DTB times and clinical endpoints of 30-day mortality and 1-year mortality were examined.

Results: The proportion of STEMI patients receiving PHN and initiation of treatment of STEMI has increased from 19.6% in 2008 to 66.9% in 2017; $p < 0.0001$. Median DTB time was significantly improved with PHN (35mins vs 71mins; $p < 0.0001$). Achievement of DTB<60mins and DTB<90mins targets were also both significantly improved with PHN (DTB<60mins 90.9% vs 33.7%; $p < 0.0001$ and DTB<90mins 99.3% vs 73.7%; $p < 0.0001$). Both 30 day and 1-year mortality were significantly improved with PHN (2.05% vs 5.42%; $p = 0.0024$ and 2.4% vs 7.50%; $p < 0.0001$ respectively).

Conclusion: Pre-hospital notification and initiation of treatment of STEMI by ambulance officers in the field significantly improves both STEMI performance markers and 30-day and 1-year mortality. Further examination of factors surrounding PHN utilization is warranted.

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Ultrasonic Assessment of Subclinical Radial Artery Stenosis After Transradial Angiography

P. Nguyen [1,2,3,4,*], A. Makris [2,3],
A. Hennessy [1,2,3], K. Park [2,4], V. Chen [4],
S. Jayanti [2,4], C. Juergens [2,4]

[1] *Campbelltown Hospital, Campbelltown, Australia*
[2] *Liverpool Hospital, Liverpool, Australia*
[3] *Western Sydney University, Campbelltown, Australia*
[4] *UNSW, Liverpool, Australia*

Background: This pilot study aims to investigate for subclinical endothelial injury following transradial coronary

angiography (CA) and percutaneous coronary intervention (PCI)

Methods: Sixty consecutive patients were recruited from the Standard versus Ultrasound-guided Radial and Femoral Access (SURF) trial. Thirty transradial access (TRA) were compared with 30 control transfemoral patients. 2D color Doppler, 13-6 MHz transducer was performed at: distal radial, mid radial and brachial artery. Ultrasound was done pre-procedure, 1-week post-procedure and at 6 months for positive results. A separate investigator blinded to de-identified patients performed measurements using ImageJ program. Each site was measured 3 times and average taken. Findings classified into 4 types: (A) no stenosis (B) segmental stenosis [<10 mm length and >10% stenosis] (C) diffuse stenosis [>50mm length, >15% stenosis and intimal thickening >0.4 mm] (D) no flow.

Results: Both groups were similar in characteristics, including mean radial artery diameter (0.19 cm TRA vs. 0.18 cm control). All used 6F sheath. In TRA group, 83.3% had CA and 16.7% had PCI. There was no symptom or clinical evidence of vascular complications post-procedure. All radial pulses were palpable at follow up. Two patients (6.7%) developed type B stenosis at puncture site and persisted at 6 months. No common risk predictor identified.

Conclusion: Asymptomatic, subclinical stenosis at radial access site may occur at higher rates than expected. This may have implications on future arterial use or its conduit. Larger study is required to identify features that predict risk of stenosis.

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Ultrasound Guided Technique for Percutaneous Transfemoral Transcatheter Aortic Valve Implantation

L. Khan[*], D. Murdoch, M. Savage, C. Raffel, K. Poon

Heart And Lung Institute, The Prince Charles Hospital, Brisbane, Australia

Aim/objective: The aim of this study was to determine the outcomes of ultrasound-guided technique for patients undergoing percutaneous transfemoral transcatheter aortic valve implantation (TF-TAVI) to prevent vascular complications.

Method: We report a single centre analysis of 154 patients of a prospectively collected cohort between who underwent transfemoral TAVI using the balloon-expandable Edwards SAPIEN 3 transcatheter heart valve. Patients were divided into two groups (non ultrasound-guided puncture group who underwent TAVI $n = 86$ compared to those patients who underwent ultrasound-guided puncture $n = 68$.)

The incidence of major vascular complications as defined by The Valve Academic Research Consortium - 2 Criteria (VARC2 criteria) and bleeding complications as defined by the Bleeding Academic Research Consortium (BARC) were used as outcome measures.

Results: The incidence of major access site related complications were low and were numerically reduced with ultrasound guided puncture (4.65% vs 0.0%; $p = 0.135$.) BARC

Bleeding criteria greater or equal to 3 was similar between groups (2.33% vs 1.47%; $p = $ NS).

Conclusion: This study demonstrates a numerical trend to improved outcomes following the use of ultrasound-guided percutaneous transfemoral puncture for TAVI. This technique has been shown to prevent vascular complications as defined by VARC2 criteria.

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Ultrasound-Guided Femoral Access in Patients with Large Thigh Circumference: Analysis from the Standard Versus Ultrasound-Guided Radial and Femoral Access (SURF) Trial

S. Jayanti[2,4], P. Nguyen[1,2,3,4,*], A. Makris[2,3], A. Hennessy[1,2,3], A. Wang[2,4], K. Park[2,4], V. Chen[4], T. Nguyen[2,4], C. Juergens[2,4]

[1] *Campbelltown Hospital, Therry Road, Australia*
[2] *Liverpool Hospital, Liverpool, Australia*
[3] *Western Sydney University, Campbelltown, Australia*
[4] *UNSW, Liverpool, Australia*

Background: Palpation and fluoroscopy are currently the 'standard' for transfemoral artery access (TFA). However, it can be challenging in patients with large thigh circumferences. Previous small-scale studies have suggested that the use of ultrasound (US)-guidance in patients with thigh circumference greater than 60 cm may reduce puncture attempts required for successful catheterisation. The aim of this analysis was to assess the effect of US-guided femoral access in patients with thigh circumference $\geq$ 60 cm.

Methods: As part of the SURF trial, we randomised 1388 patients undergoing coronary angiography into radial or femoral access and standard or US-guidance in a 2×2 factorial design. Of these, 592 patients underwent TFA with a recorded thigh circumference measurement. Thigh circumference was measured at the level of the medial inguinal crease due to difficulty of measuring at the femoral puncture site. Sonosite S-Cath Ultrasound machine was used with a 6cm depth and a 6-13MHz Linear Array Transducer.

Results: 423 patients had thigh circumference <60 cm while 169 patients were $\geq$ 60 cm. In patients with thigh circumference $\geq$ 60 cm, US significantly reduced venipuncture (3.05% vs. 20.1%, $p = 0.001$) and access attempts (1.23 ± 0.53 vs. 2.02 ± 1.42, $p < 0.001$) and, improved first-pass success (82.1% vs 48.8%, $p < 0.001$). There was no significant difference in vascular complications or bleeding events.

Conclusion: US was shown to significantly improve access outcomes in patients with larger thigh circumferences. This suggests that it would be useful on a routine basis for TFA.

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Updated Society for Thoracic Surgeons Calculator Downgrades Surgical Risk Scores for Patients Undergoing Transcatheter Aortic Valve Replacement (TAVR): Implications for TAVR and Patient re-stratification

W. Peverill*, A. Camuglia

Princess Alexandra Hospital, Brisbane, Australia

Introduction: The Society for Thoracic Surgeons score (STS score) was updated in November 2018 with major changes to the scoring algorithm (from version 2.73 to 2.81). It is hypothesised that this has led to the downgrading of surgical risk projections for patients being assessed for transcatheter aortic valve replacement (TAVR).

Methods: A cohort of TAVR recipients over the past 3 years at a single institution were examined. Their variables were collated and compared between scoring systems. Both scores were re-calculated by the same investigator to limit potential inconsistency in calculations. The scores were calculated using stand-alone single procedure aortic valve replacement only as the basis for the calculation.

Results: 65 consecutive patients were identified with an average age was 82.4 years. Twenty-one per cent of patients had had a previous cardiothoracic surgical operation. The mean STS scores for predicted mortality were 3.6% (SEM +/- 0.20) for the original score (version 2.73) and 3.1% (SEM +/- 0.23) for the updated scoring system (version 2.81; $p = 0.093$). 8 patients (13%) would have been reclassified from intermediate to low risk or high risk to intermediate risk (downgraded) using cut-offs of 4% and 8% for low/intermediate and intermediate/high risk respectively.

Conclusions: This analysis suggests that the updated STS score calculator (version 2.81) downgrades surgical risks compared with the previous iteration of the calculator. This may have important implications for patient care as current guidelines, previous clinical trials and treatment algorithms rely on scores derived from the previous versions to STS scoring calculator.

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Use of Mechanical Cardiac Support (MCS) for ST-elevated Myocardial Infarction with Cardiogenic Shock(STEMI-CS) in a Non-transplant Centre

P. Pender*, A. Faour, O. Gibbs, V. Dang, A. Hopkins, D. Leung, C. Mussap, J. French, C. Juergens, S. Lo

Liverpool Hospital, Smithfield, Australia

Background: Intra–aortic balloon pump(IABP) counterpulsation remains the most widely used MCS despite class III recommendation for STEMI-CS. Peripheral VA-ECMO is an emerging treatment for refractory CS despite a IIb recommendation.

Methods: Retrospective analysis of Cardiac Catheterisation and ICU databases at Liverpool Hospital(January 2010-Janurary 2019) for STEMI-CS patients receiving IABP including those with subsequent VA-ECMO support.

Results: 211 patients received IABP(mean-age 65 ± 12.9 years(21-91);78% male;64% dual anti-platelet preloading;74% GPIIb/IIIa use. Majority used 7.5F 40cc Sensation IABP(54.3%). Mean dwell-time $53\,\text{hrs} \pm 40.5$(0.8–245 hrs); length-of-stay(LOS) $12\,\text{days} \pm 13$(0.3- 82 days). Overall mortality 88(43.3%) of which 160 had primary PCI and 69 died(44%) and 51 no-PCI of which 19 died(39.6%).40 had Left main >70% stenosis with 63% total mortality of which 15/25 underwent primary PCI and 4/15 no-PCI. IABP related complications occurred in 20 cases[leg ischaemia(9),major bleeding(3), minor bleeding(6),sepsis(1),mortality(1)].

20 cases VA-ECMO(5 pre-PCI,11 post-PCI,4 post-CABG). 8 with adjunctive IABP in-situ. Mean decision-to-cannulation time $2.4\,\text{hours} \pm 1.3\,\text{hrs}$(range 0.5-4 hrs);dwell-time 5.8 ± 4.5 days(range 0.2-14); LOS 25.5 ± 32days(range: 0.5-129).16 Access related complications in 14 patients [(11)major bleeding;(1)minor bleed(4)limb ischaemia]; (2)major intestinal bleed related to intravenous heparin, death(14)73.6%].

Conclusions: IABP is frequently used in STEMI-CS due to availability, familiarity and cost. Increased use of VA-ECMO is seen without significant prognostic impact. LM STEMI-CS pertains worse prognosis despite primary PCI. MCS patient selection remains challenging, co-ordinated MCS service pathways may expedite care and potentially improve prognosis

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Validation of Physiological Principles of Non-Invasive Fractional Flow Reserve

A. Ihdayhid [1,*], M. Michail [1], M. Leung [1],
U. Thakur [1], G. Barron [1], S. Seneviratne [1],
B. Ko [1], J. Cameron [1], H. Samady [2],
A. Brown [1]

[1] *MonashHeart, Monash Health, Clayton, Australia*
[2] *Andreas Gruentzig Cardiovascular Center, Emory University School of Medicine, Atlanta, USA*

Background: CT-coronary-angiography (CTCA) simulation of fractional flow reserve (FFR) is computationally derived from the basis of allometric and morphometric scaling. These assumptions describe the relationship of baseline coronary flow and microvascular resistance with quantitative measures such as left-ventricular (LV) mass and coronary luminal dimensions. The validity of these assumptions in humans remains unknown with historic data only available from animal models.

Methods: Twenty patients (age 64.5 ± 7.9, 60% male) with non-obstructive disease underwent proximal-LAD intravascular-ultrasound (IVUS) and Combowire assessment at rest and hyperaemia. Coronary volumetric flow (Q, cm^3/sec) was derived from average baseline peak-velocity (cm/sec) x IVUS luminal cross-sectional-area (cm^2). Baseline microvascular resistance ($mmHg/cm^2$) was calculated: distal coronary pressure (mmHg) - right atrial pressure (mmHg) divided by Q. Patients underwent same-day CTCA to provide quantitative measures including LV mass (g) and coronary luminal volume (mm^3).

Results: Mean FFR was 0.93 ± 0.05 and median coronary flow reserve velocity was 2.6 [IQR 2.1-3.1]. Baseline Q and BMVR were $2.17 \pm 1.03 cm^3$/sec and 45.6 ± 21.2 $mmHg/cm^2$, respectively. Average LV-mass was 147.6 ± 32.0g and coronary luminal volume $1038.6 \pm 485.2 mm^3$. LV mass exhibited the strongest and most significant correlation with coronary flow ($r = 0.87$, $p < 0.001$). The scaling coefficient describing the relationship between coronary flow and LV-mass was 1.91, which differs significantly from experimental data. CT-defined coronary luminal volume also exhibited strong and significant negative correlation with BMVR ($r = -0.79$, $p < 0.001$).

Conclusion: Although these results support the basis for estimation of coronary flow and microvascular resistance from non-invasive indices, use of revised human-specific scaling coefficients may improve the diagnostic performance of FFR calculated from CTCA.

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Valve-in-valve Transcatheter Aortic Valve Implantation for Failing Aortic Valve Prostheses: An Australian Interventional Experience

K. Jones [1,*], J. Carroll [1], H. Kempton [1],
S. Eather [1], K. Kearney [1], K. Bensted [2],
N. Bart [1], D. Baron [1], D. Muller [1], D. Roy [1]

[1] *St. Vincent's Hospital, Darlinghurst, Australia*
[2] *St George Hospital, Kograh, Australia*

Background: Surgical bioprosthetic aortic valves are increasingly utilised for younger patients, given long-term implications of mechanical valves and anticoagulation. As these valves are less durable, there is increasing need for a longer-term strategy in the event of valve failure. Re-entry sternotomy can be high risk, with transcatheter aortic valves (TAVI) becoming an excellent alternative.

Aim: This study aims to retrospectively analyse outcomes of valve-in-valve TAVI replacements in a single Australian centre.

Methods: All patients who underwent valve-in-valve TAVI replacement between February 2015 and January 2019 were included, valve characteristics, patient demographics, clinical data and outcomes were all analysed.

Results: A total of 20 patients were included in the valve-in-valve cohort. Nineteen had previous surgical bioprostheses, and one paravalvular leak during initial TAVI. Indications included AS (2), AR (13) and AS/AR (2). The average age of patients was 76.1 (± 11.5), with a mean Euroscore of 6.3 ± 5.1. Average pre-operative mean gradient was 27.8 mmHg ± 18.3 mmHg. Average post-operative mean gradient was 12.3 mmHg ± 5.1 mmHg. There have been no deaths in this cohort. One patient developed heart block and required pacemaker insertion, one required surgical closure of femoral access site and one patient had re-do surgical replacement due to valve malposition.

Conclusions: Valve-in-valve TAVI can be successfully performed, with an acceptable morbidity profile and excellent outcomes, in a TAVI centre for patients who otherwise may have to undergo a high risk re-do sternotomy.

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What is the Optimal Drug-Eluting Stent for Percutaneous Coronary Intervention in Patients with Insulin-Treated vs. Non-Insulin Treated Diabetes?

D. Blusztein [1,*], S. Biswas [2], J. Lefkovits [1], A. Ajani [6], A. Brennan [6], D. Stub [2], S. Duffy [2], W. Chan [2], D. Clark [3], M. Freeman [4], E. Oqueli [5], C. Reid [6], M. Yudi [3], A. Hutchison [7], L. Dawson [1], A. Murphy [3], D. Eccleston [1,6]

[1] *Royal Melbourne Hospital, Melbourne, Australia*
[2] *Alfred Hospital, Melbourne, Australia*
[3] *Austin Hospital, Melbourne, Australia*
[4] *Box Hill Hospital, Melbourne, Australia*
[5] *Ballarat Health Services, Ballarat, Australia*
[6] *Department of Epidemiology and Preventive Medicine, Monash University, Melbourne, Australia*
[7] *Monash Health, Melbourne, Australia*

Background: Patients with diabetes mellitus (DM) have increased adverse events post percutaneous coronary intervention (PCI), somewhat attenuated by use of drug-eluting stents (DES). DES choice is controversial, with studies showing increased late mortality with sirolimus-eluting stents (SES) compared to paclitaxel-eluting (PES) or bare-metal stents (BMS) and higher major adverse cardiac and cerebrovascular event (MACCE) rates with second generation everolimus (EES) vs. PES.

Methods: We enrolled 4,579 diabetic patients undergoing PCI from 2005-2014 in the Melbourne Interventional Group registry. Characteristics and 12-month outcomes were compared between insulin-treated (ITDM) and non-ITDM patients and by stent type.

Results: Diabetics receiving DES were more likely to be insulin-requiring ($p < 0.05$) or undergoing PCI for restenosis ($p < 0.001$). ST-elevation myocardial infarction (STEMI) patients more often received BMS ($p < 0.003$ for SES and PES); even after propensity matching in STEMI, a significant hazard for MACCE in ITDM vs. non-ITDM patients (OR 1.48, 1.19-1.84) remained. Stents were longer and vessel size smaller in DES vs. BMS ($p < 0.0001$). However, 12-month MACCE were higher in BMS vs. SES or PES ($p = 0.004$ and $p = 0.046$) and did not differ between DES types.

12 month Outcomes		Non-ITDM ($n = 3468$)	ITDM ($n = 1111$)	P value
1st generation DES	**Death**	5.1	6.0	0.66
	MACCE	12.6	13.3	0.82
2nd generation DES	**Death**	3.7	7.2	<0.001
	MACCE	10.5	16.6	<0.001

Conclusion: In ITDM, all DES resulted in lower 12 month MACCE than BMS. Overall, outcomes depend more on the presence and intensity of DM treatment than stent type, particularly for EES vs. PES or second-generation vs. first generation DES.

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