CSANZ New Zealand Annual Scientific Meeting

Energy Events Centre,
Rotorua | 23-25 May 2025

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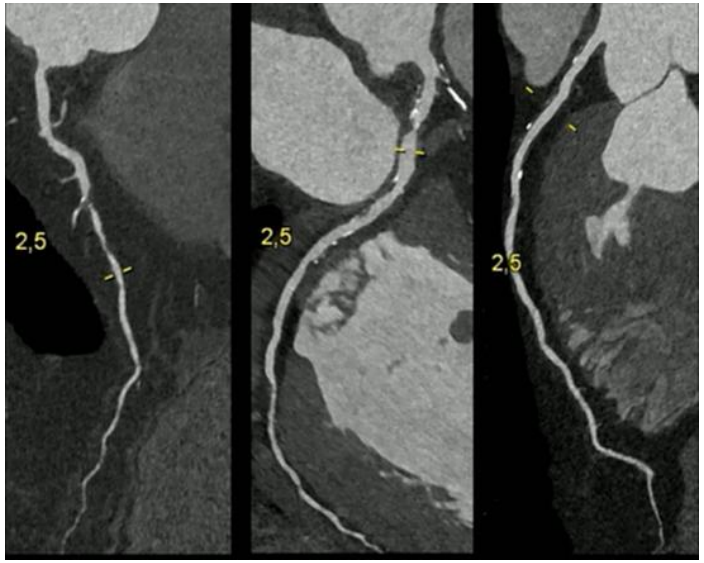
CT coronary angiography for the General Cardiologist

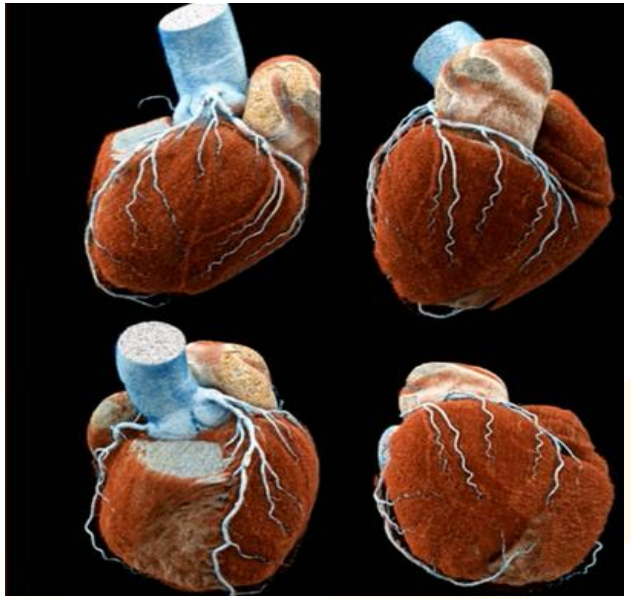
Niels van Pelt

Cardiologist

Auckland City Hospital

May 2025



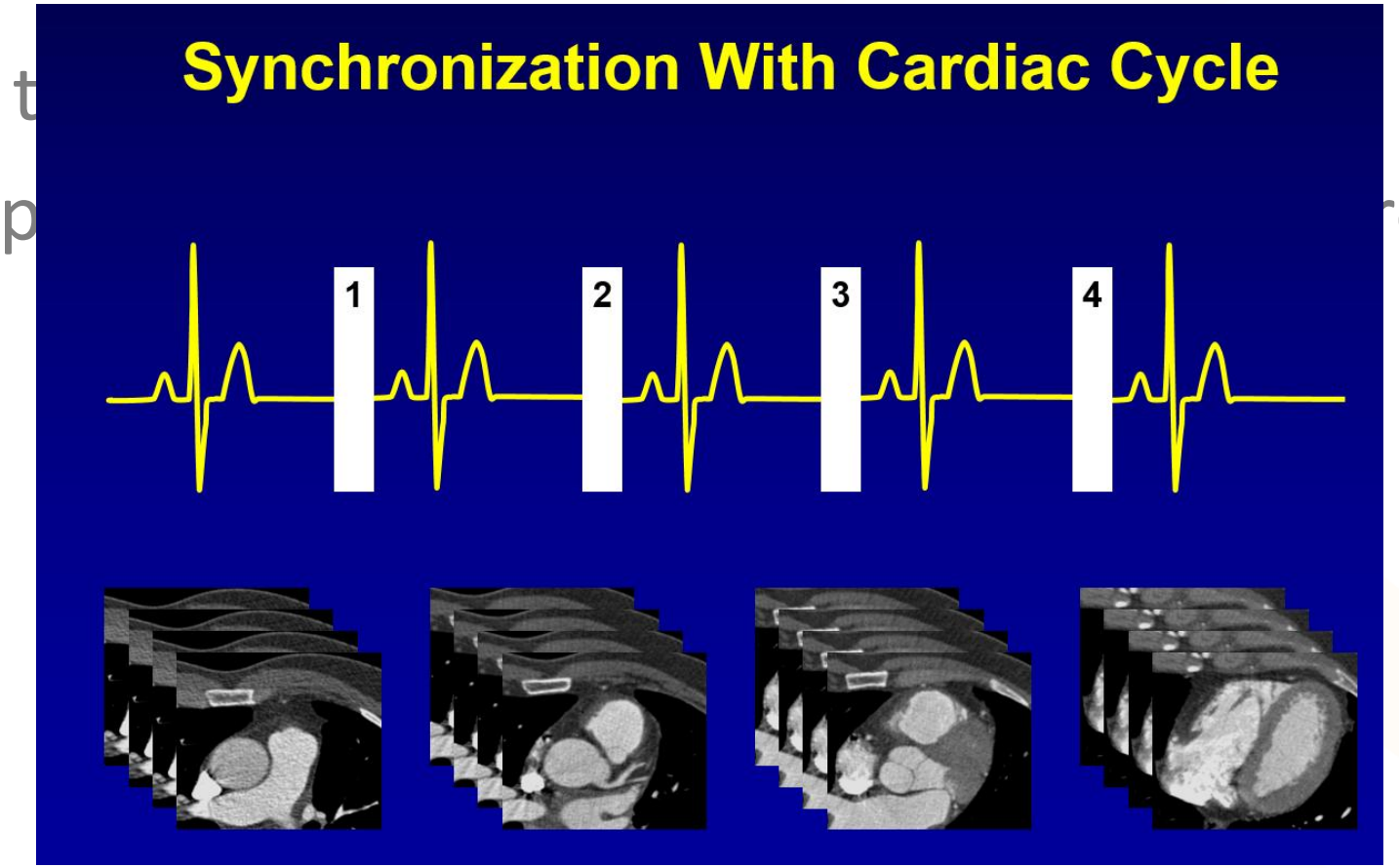


Disclosures

- Received fees for co directing Level A CTCA courses with Siemens Healthineers
- No other disclosures

- In the beginning … the role for CTCA needed to be justified

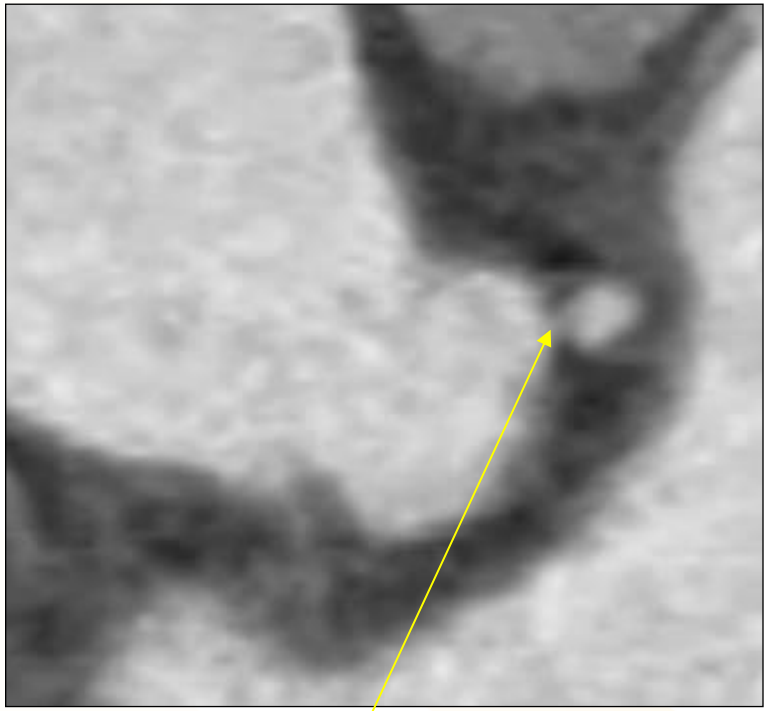
- CTCA t
- Examp reviewed



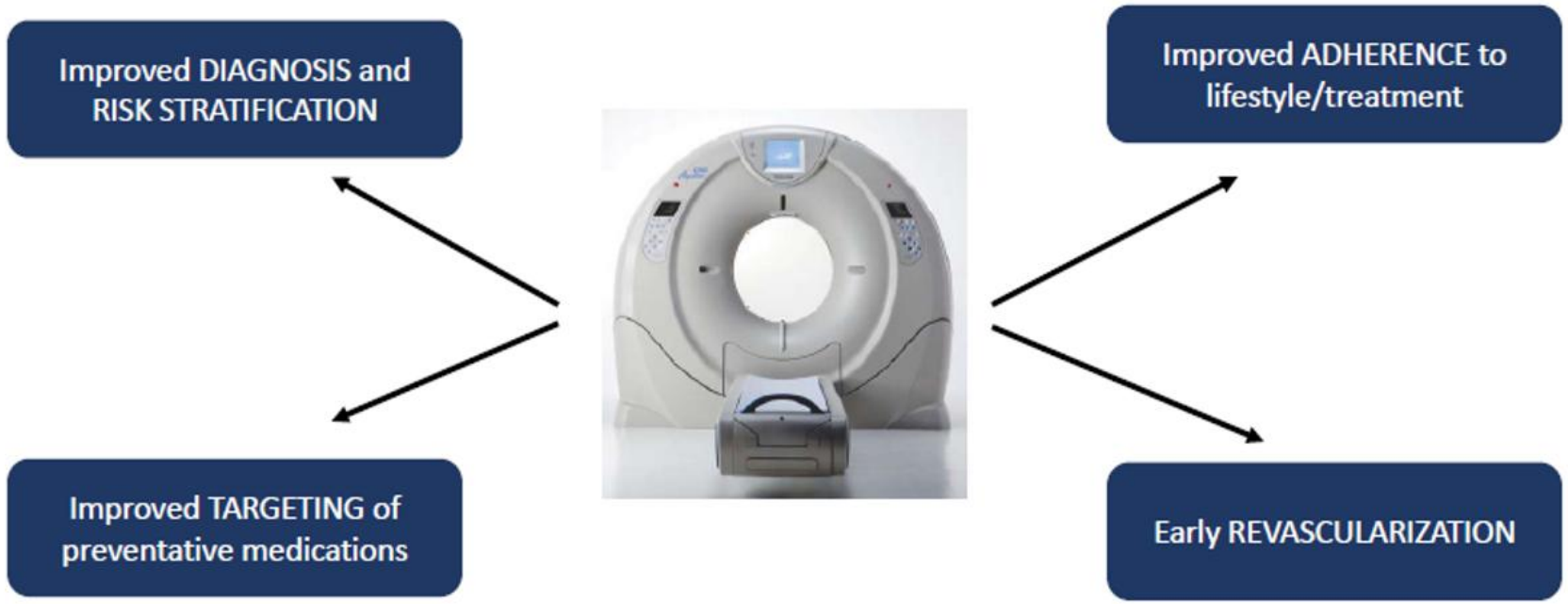
Patient with ongoing angina type symptoms- normal invasive coronary angiogram (ICA the gold standard?)

64 slice CT-CA: severe LMS lesion not shown on ICA

This case was from 2007!



Severe left main stem disease



Adamson, et al. JCCT. 2019

- CTCA has become well established and is a first line investigation in chest pain syndromes
- Cardiac CT has become one of the fastest growing imaging modalities

Aunt Minnie RSNA podcast 2nd most popular article in 2024- Radiologists are reading more cardiac CT exams

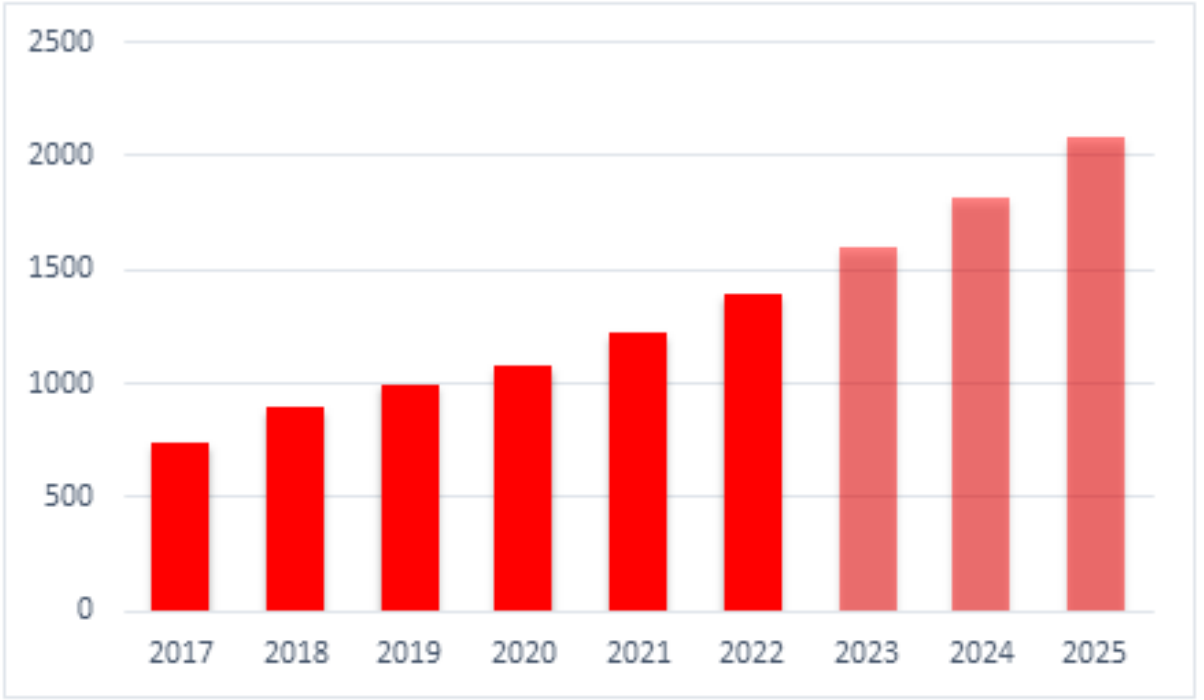


Fig 1: Growth in cardiac CT scans at ACH since 2017, extrapolated until 2025.

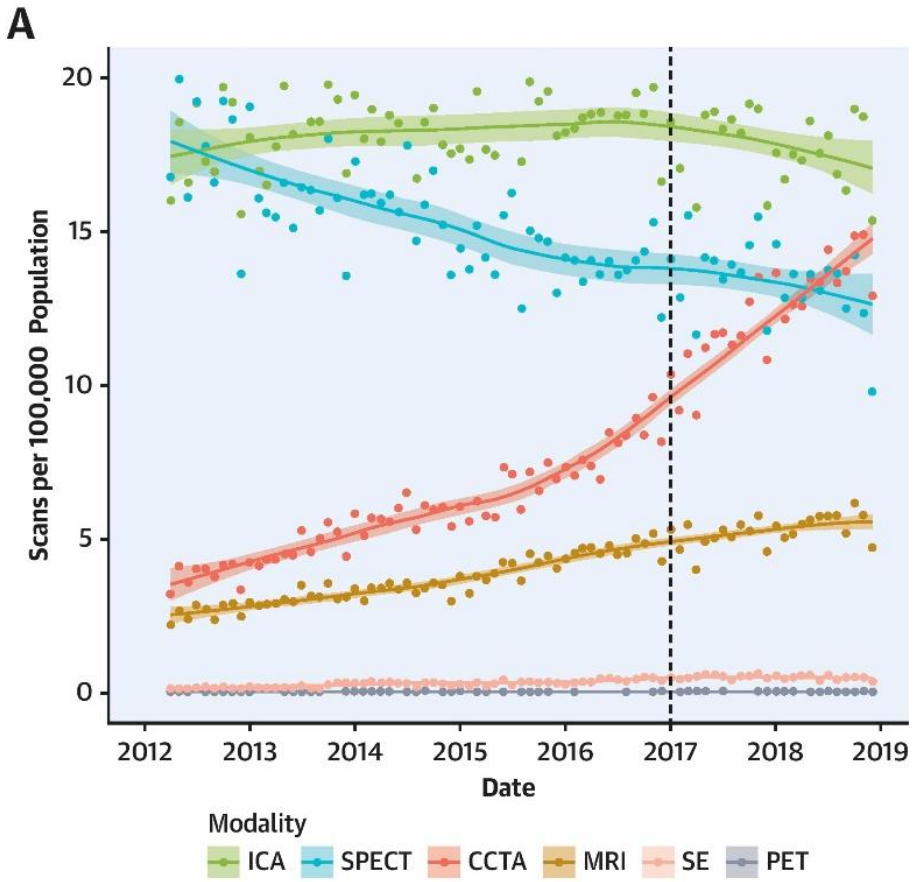
Increasing access to CT coronary angiography at ACH

(Dr A Kueh)

- MoH predicted in 2022 that that number of CT scanners in NZ would need to double in 5 years

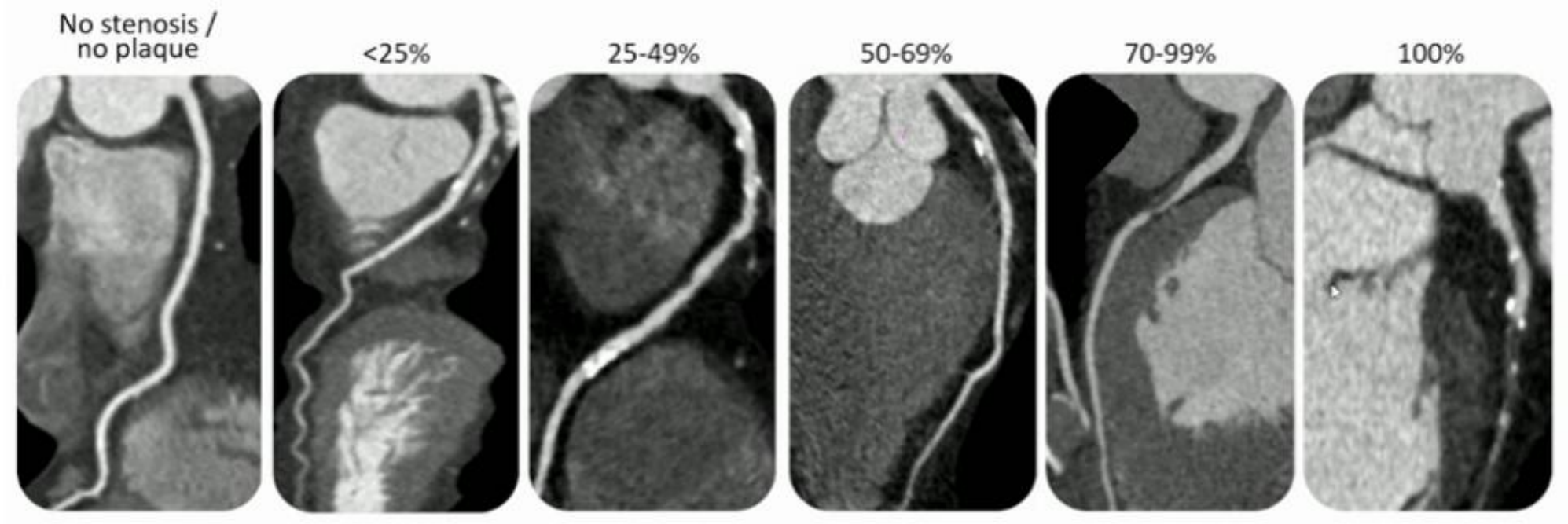
1. Radiology and Te Whatu Ora – Health New Zealand in 2022. Why we should all care. Doyle AJ NZMJ 2022; 135 (1564)

CENTRAL ILLUSTRATION: England-Wide Examinations Performed per Month per 100,000 Population for the Investigation of Coronary Artery Disease From 2012 to 2018

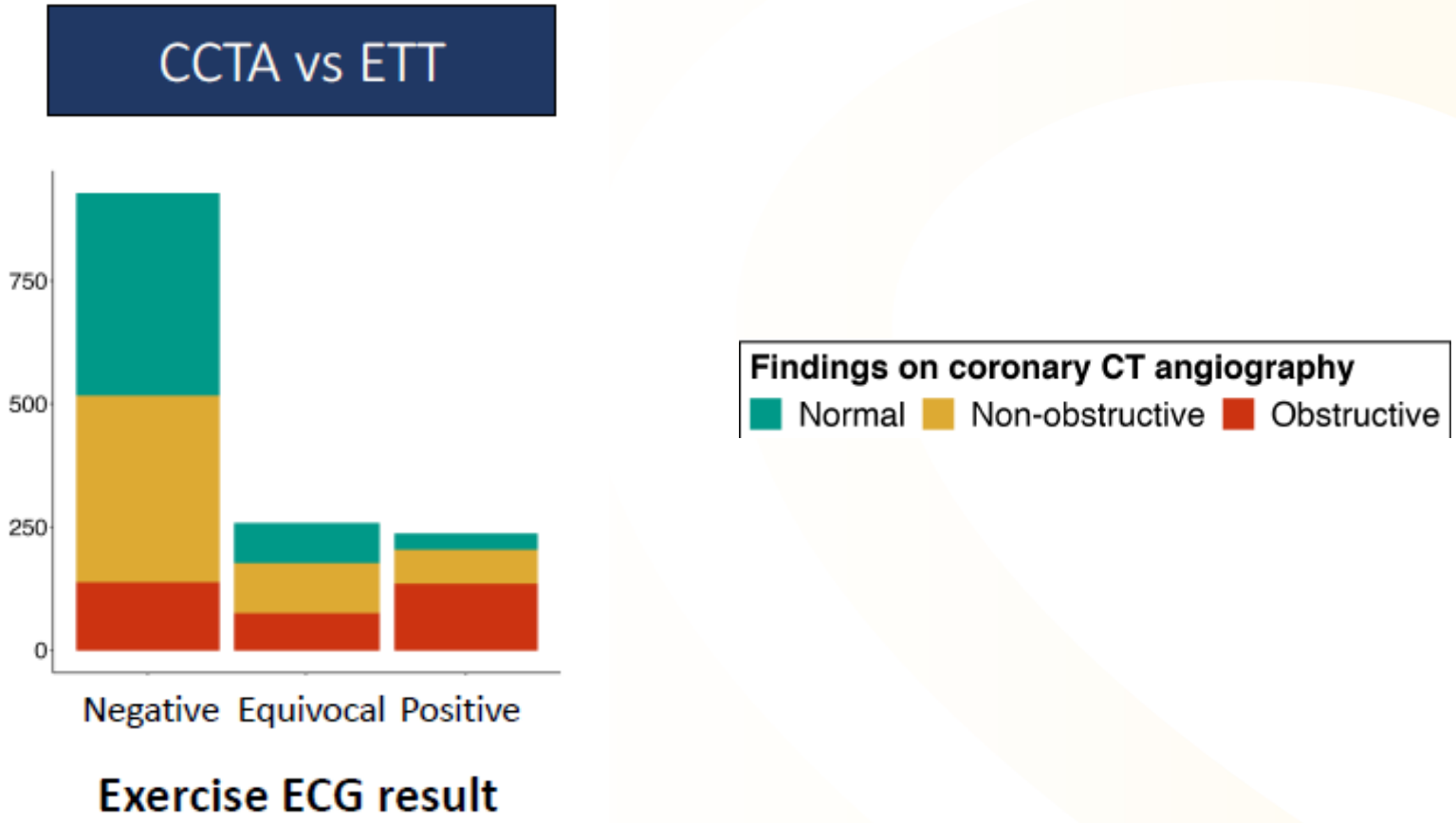


- CTCA has increased more than other modality
- Despite cardiac imaging increasing approx 6%/pa the costs stayed neutral (more expensive ICA, SPECT decreasing and cheaper CTCA increasing)

J Am Coll Cardiol Img. 2023 May, 16(5): 659-671



- CTCA has become more accessible and accepted
- Technology has evolved
  - Better images, lower radiation exposure
- It allows us to rule out coronary plaque OR define extent and type of coronary plaque



More than 1/3 patients investigated for chest pain syndromes with normal ETT had non obstructive CAD and ~15% have obstructive CAD

Pretest likelihood of CAD	Low	→	No testing necessary	→	Option for CAC for ASCVD risk stratification	
	Intermediate-high	→	Younger patient (<65 y of age)	**OR**	Less obstructive CAD suspected	→ CCTA favored
	Intermediate-high	→	Older patient (≥65 y of age)	**OR**	More obstructive CAD suspected	→ Stress testing favored

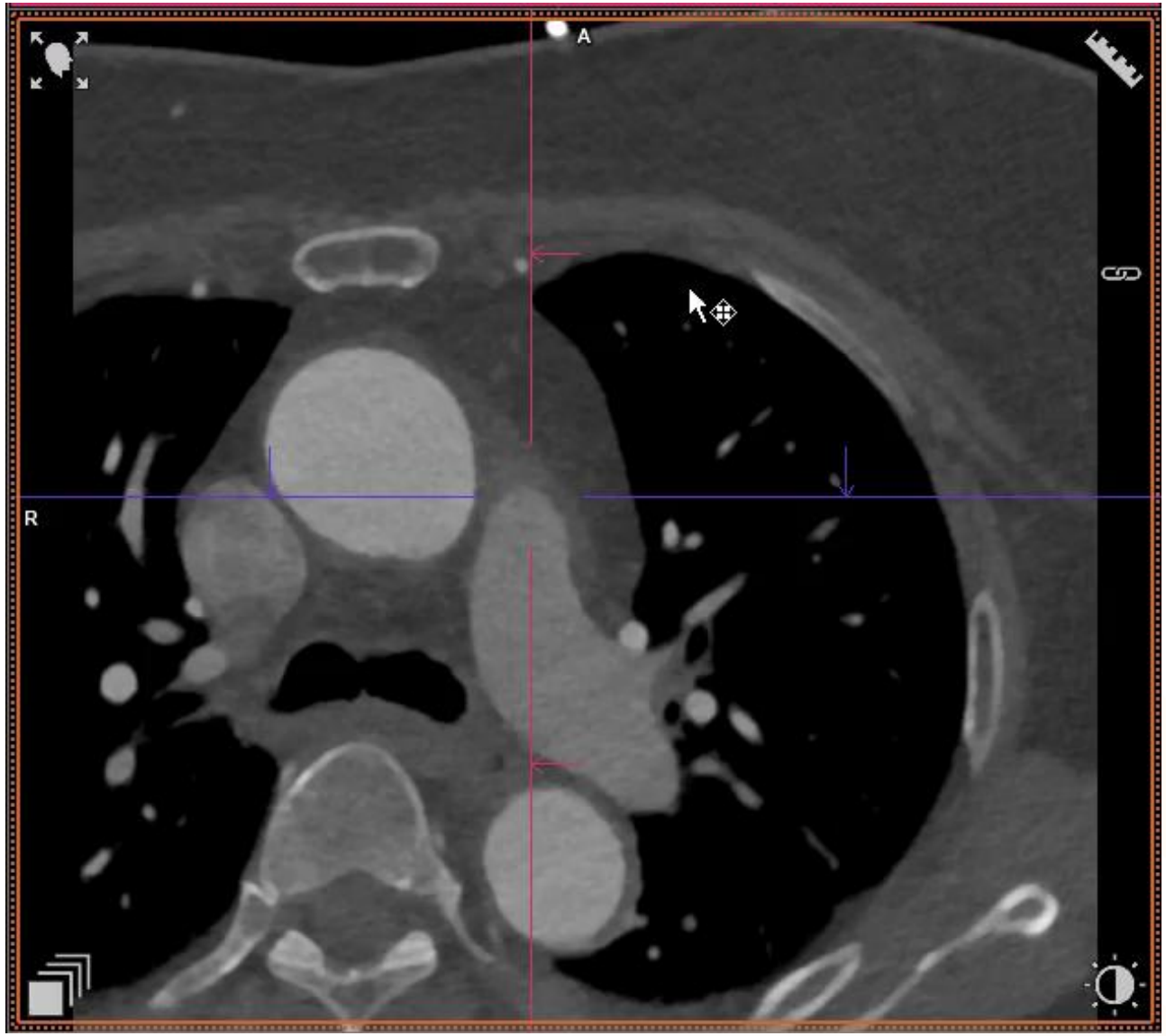
Practice guidelines

2021 AHA/ACC/ASE/CHEST/SAEM/SCCT/SCMR Guideline for the Evaluation and Diagnosis of Chest Pain

A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

Journal of Cardiovascular Computer Tomography. 2022; 16: 54-122

- 63 yr old woman with increasing exertional SOB
- Back ground of medically treated atrial tachycardia and HT
- ETT was stopped due to back discomfort at a moderate work load with significant SOB, no significant ECG changes
- Recent echo mildly dilated LA, otherwise normal
- CTCA requested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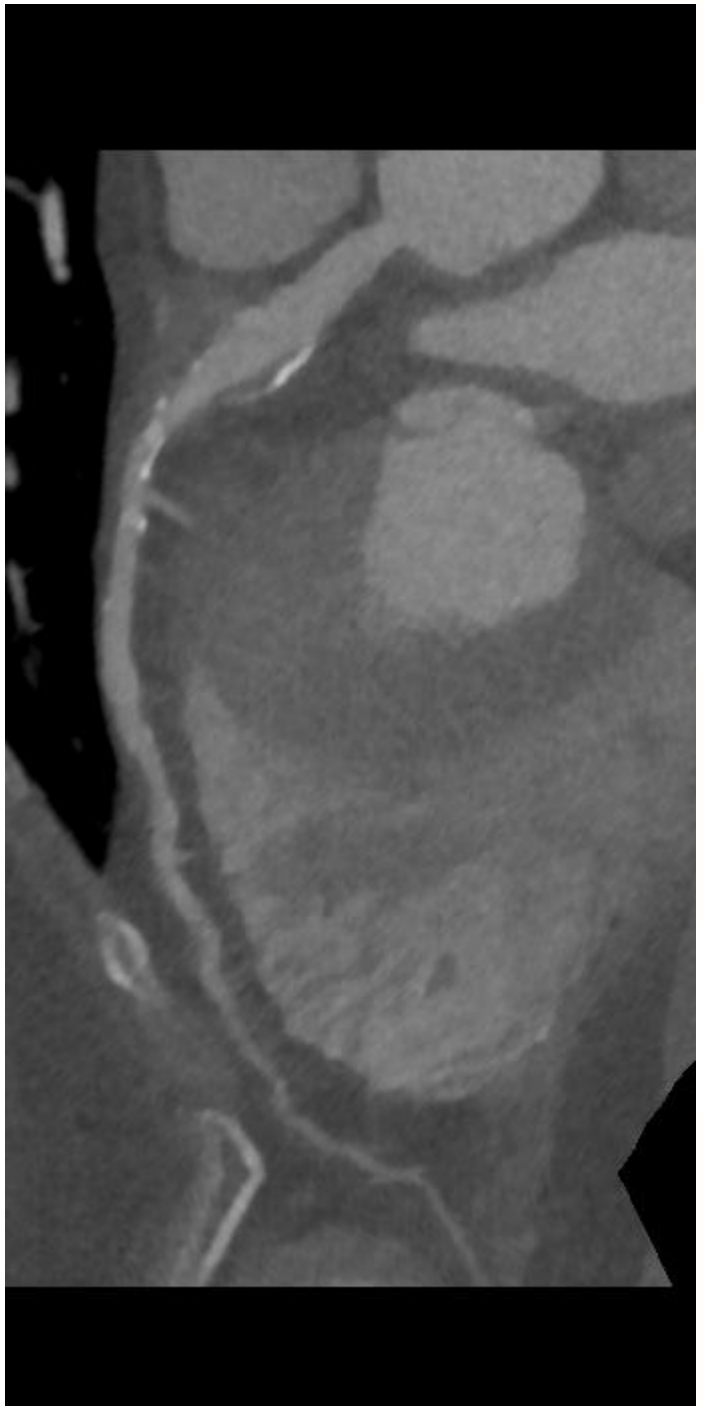
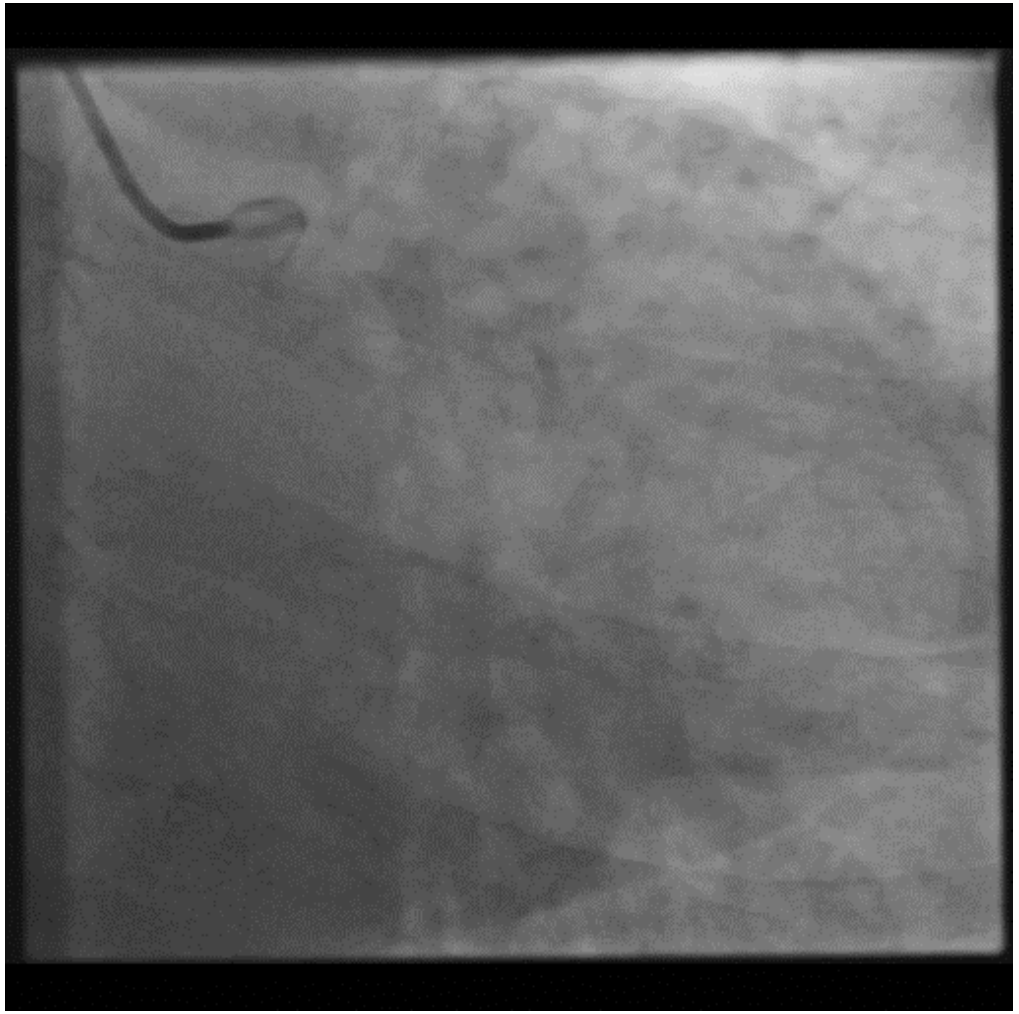


CTCA conclusion

- Diffuse coronary plaque, ectatic coronary arteries
- severe stenoses in the mid right coronary and right posterior lateral branch
- moderate to severe stenosis suspected in the proximal to mid LAD and second diagonal artery.

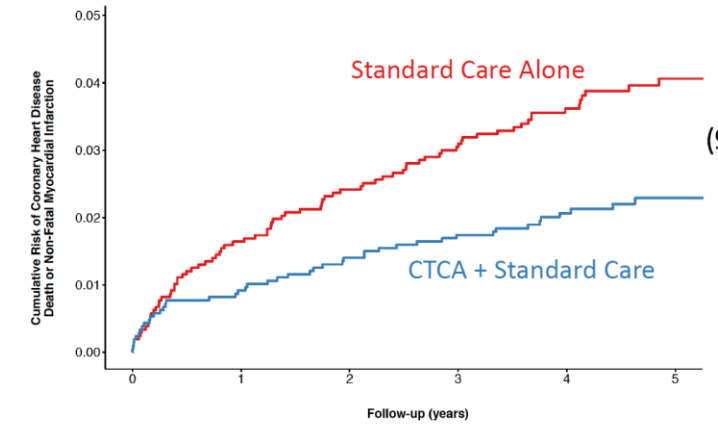


PCI to the distal RCA (culprit)
Moderate to severe mid RCA disease- medically treated
FFR to the LAD suggested non-flow limiting stenosis

- SCOT HEART- patients randomised to CTCA or standard care
- 40% reduction in coronary heart disease death or non fatal myocardial death if CTCA performed in stable chest pain patients

Principal Clinical End Point

Coronary Heart Disease Death or Non-Fatal Myocardial Infarction



Hazard Ratio 0.59
(95% CI, 0.41 to 0.84)
P=0.004

No. at Risk

Standard Care	2073	2033	2008	1994	1572	856
CCTA	2073	2051	2029	2015	1588	872

New England journal of medicine 2018;379:924-933.

Coronary CT angiography-guided management of patients with stable chest pain: 10-year outcomes from the SCOT-HEART randomised controlled trial in Scotland

*Michelle C Williams, Ryan Wereski, Christopher Tuck, Philip D Adamson, Anoop S V Shah, Edwin J R van Beek, Giles Roditi, Colin Berry, Nicholas Boon, Marcus Flather, Steff Lewis, John Norrie, Adam D Timmis, Nicholas L Mills, Marc R Dweck, David E Newby, on behalf of the SCOT-HEART Investigators**

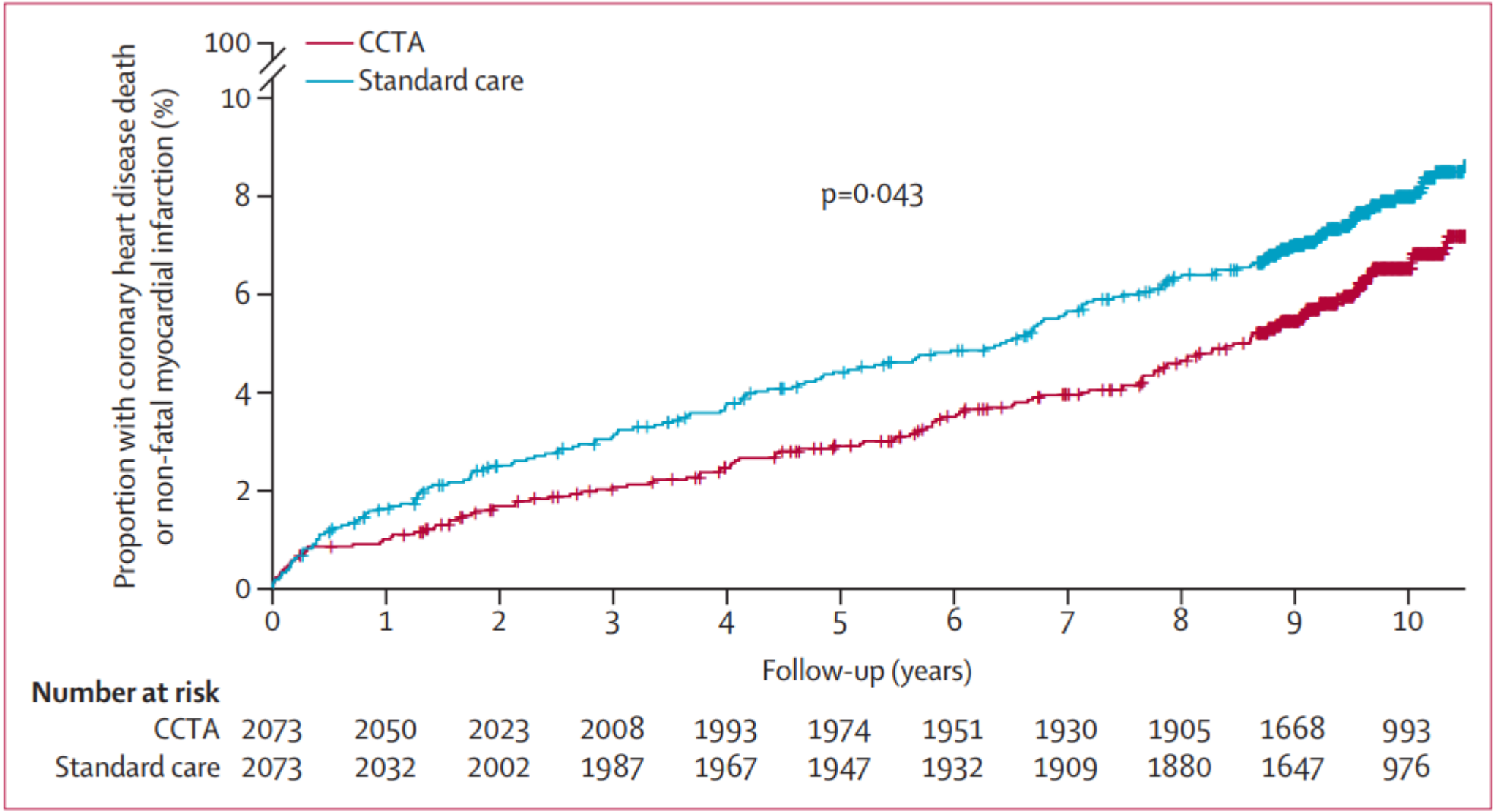
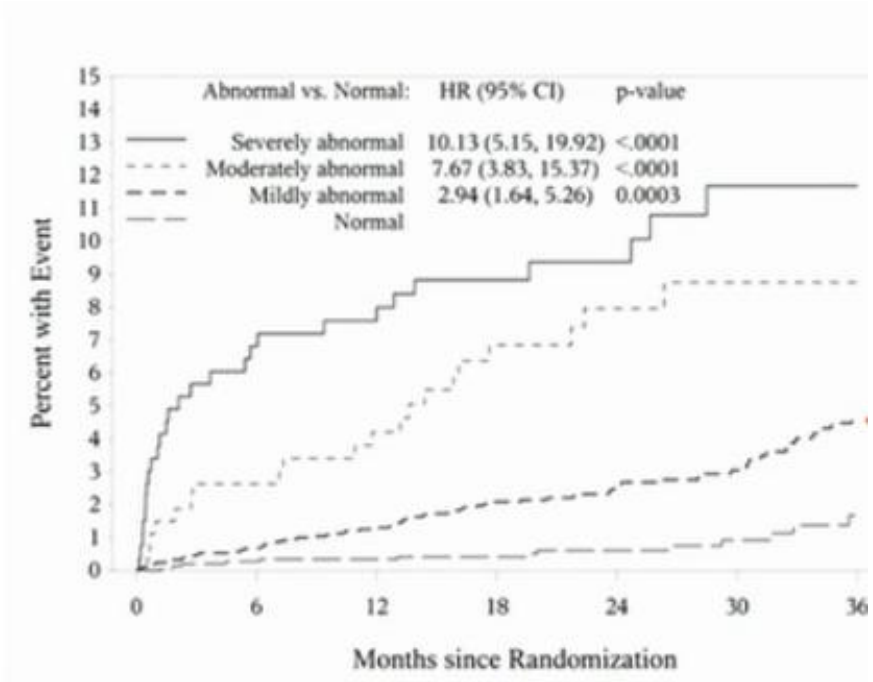


Figure 2: **Cumulative incidence for the primary outcome of coronary heart disease death and non-fatal myocardial infarction**

P value indicates the log-rank test. CCTA=coronary CT angiography.

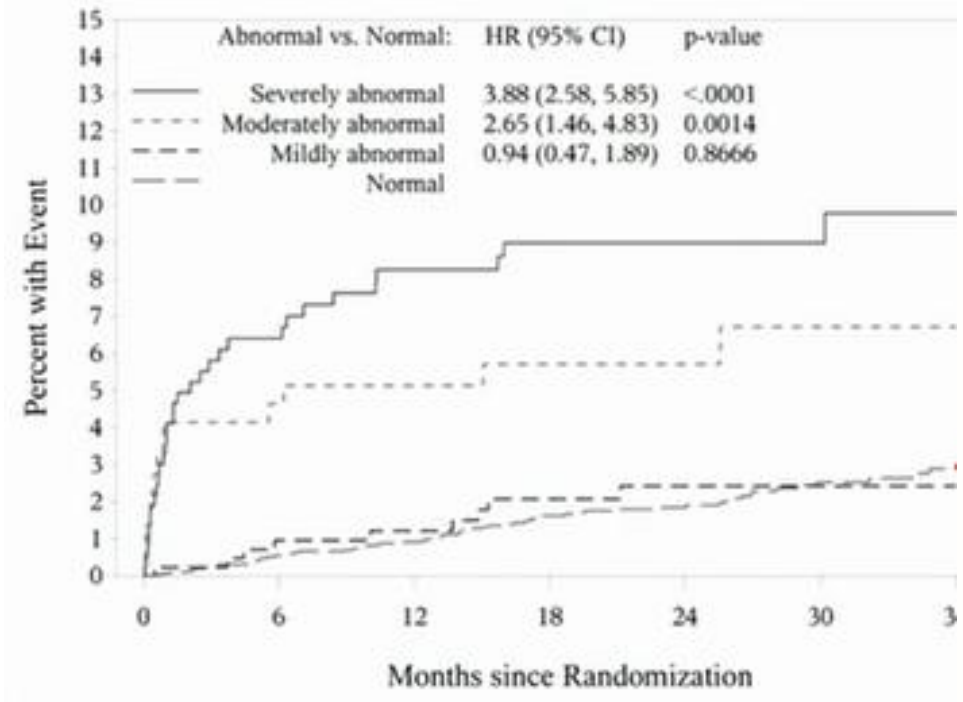
- CTCA approach leads to a (modest) sustained reduction in the primary outcome of death from CV cause or non fatal MI (mostly due to reduced non fatal MI)
- Rates of ICA and revascularisation similar
- More patients continued to be prescribed statins compared to SOC

- The improved diagnostic accuracy and subsequent increase in appropriate statin prescribing underpins the persistent benefit of the CTCA approach in preventing MI



CTCA

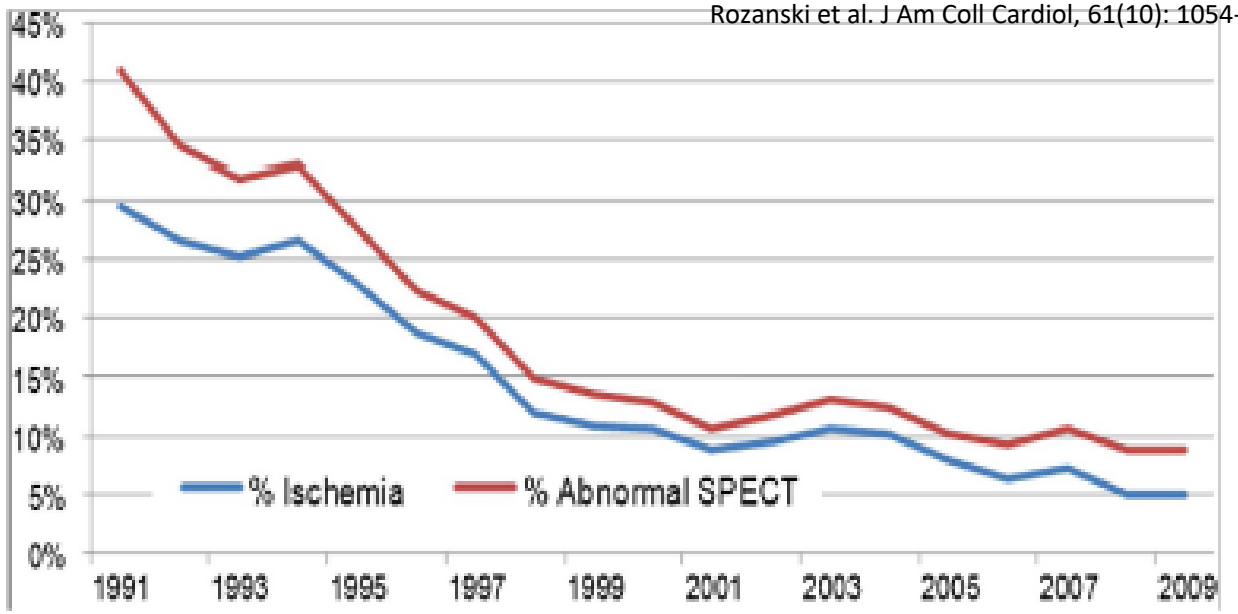
Improved risk stratification between normal and mild



Functional

- However… as testing for chest pain syndromes has increased less tests are positive
- ~5-10 % of tests are positive of ischaemia or obstructive CAD in outpatient setting
- In low/very low risk cases, testing can be deferred or not performed at all

Rozanski et al. J Am Coll Cardiol, 61(10): 1054-1065



In the Acute setting ~25 of CTCA show significant disease (>50% stenosis)

Other indications

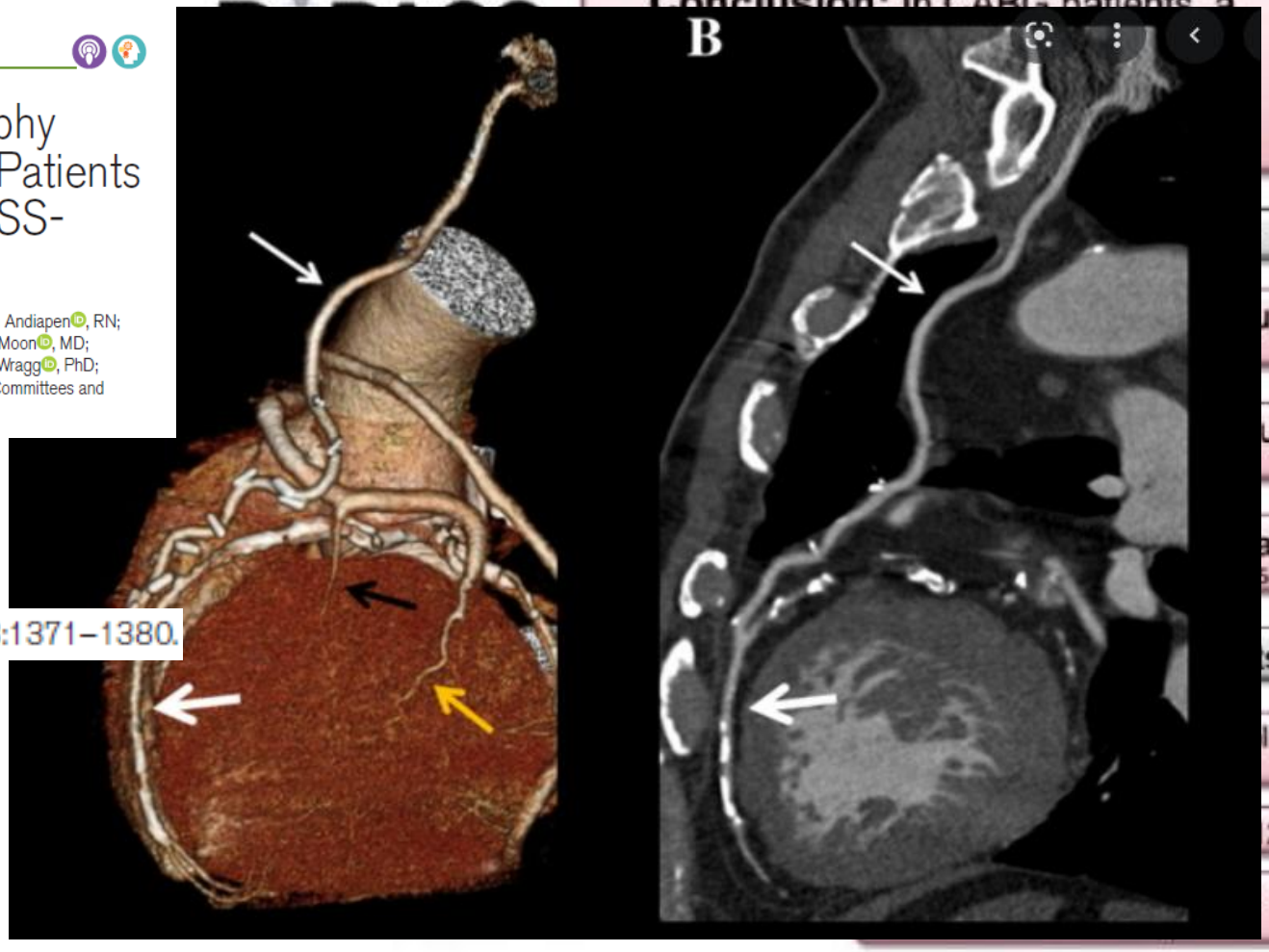
Circulation

ORIGINAL RESEARCH ARTICLE

Computed Tomography Cardiac Angiography Before Invasive Coronary Angiography in Patients With Previous Bypass Surgery: The BYPASS-CTCA Trial

Daniel A. Jones, PhD; Anne-Marie Beirne, MD; Matthew Kelham, MD; Krishnaraj S. Rathod, PhD; Mervyn Andiapen, RN; Lucinda Wynne, BSc; Thomas Godec, PhD; Nasim Forooghi, BSc; Rohini Ramaseshan, MD; James C. Moon, MD; Ceri Davies, MD; Christos V. Bourantas, PhD; Andreas Baumbach, MD; Charlotte Manisty, PhD; Andrew Wragg, PhD; Amrita Ahluwalia, PhD; Francesca Pugliese, PhD; Anthony Mathur, PhD; for the BYPASS-CTCA Trial Committees and Investigators*

Circulation. 2023;148:1371–1380.



NHS Barts Health NHS Trust

Conclusion: In CABG patients, a

uration ↓ 66% Relative Reduction

ury ↓ 92% Relative Reduction

action (5=v poor) ↑ 40% Relative Improvement

s

lications ↓ 80% Relative Reduction

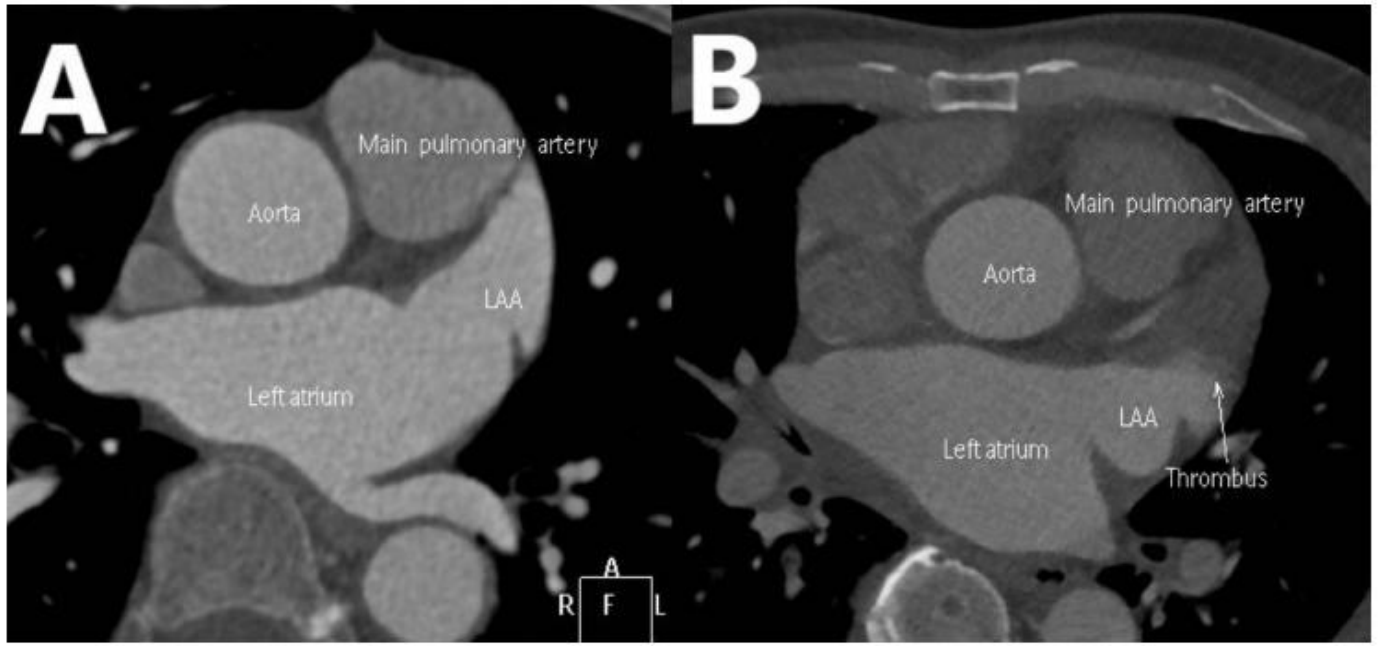
2m)

↓ 54% Relative Reduction

- CT pre PVI ablation
  - Assess for pulmonary venous anatomy
- CT LA pre DCCV

Cardiac Computed Tomography to exclude left atrial appendage thrombus in atrial arrhythmias prior to electrical cardioversion during the COVID-19 pandemic

Jeffrey Sebastian, Tina Thomas, Francis Wu, Su Yin Tang, Budresh Joshi, Niels van Pelt, Ruvin Gabriel, Tim Sutton, Mansi Turaga, Jen-Li Looi



Slow flow or probable thrombus in LA/LAA	10 (10.3%)
Definite LAA thrombus	4 (4.1%)

New Zealand Medical Journal. 2022; 135(1563): 111-114

- Radiologists are more now increasing aware of cardiac findings on non CTCA scans
- CT chest is always useful to review for coronary findings (and other cardiac abnormalities)

- 88yr man presents to ACH with acute severe chest and back pain
- Previous CABG 2003
- CT chest (to rule out aortic dissection)

- Non gated contrast CT on a dual source cardiac scanner
- Radiology report…. There is subtotal occlusion of the coronary graft arising from the anterior aorta… (Radiology Fellow)

- Trop 193-4110-3800 consistent with ACS likely related to graft disease
- Echo, moderate LV dysfunction and multiple RWMA’s
- CT Chest has given useful anatomical information regarding his grafts (LIMA and radial graft were noted to be patent)

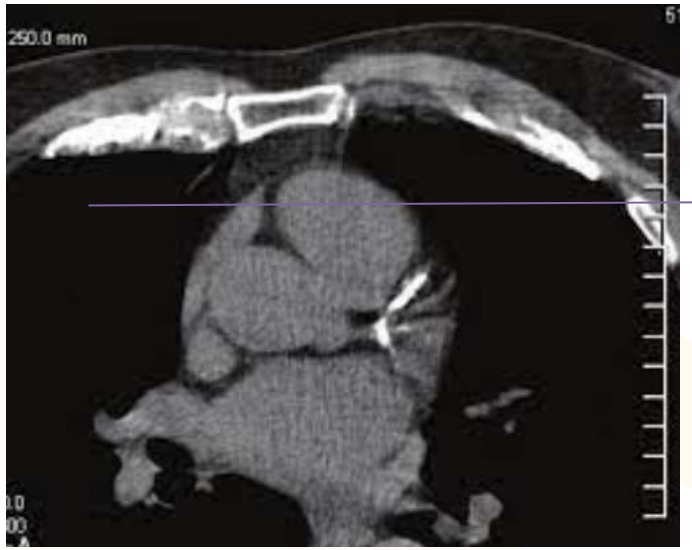
Components of a successful CT CA programme

- Good CT scanner
  - Temporal resolution /detector width

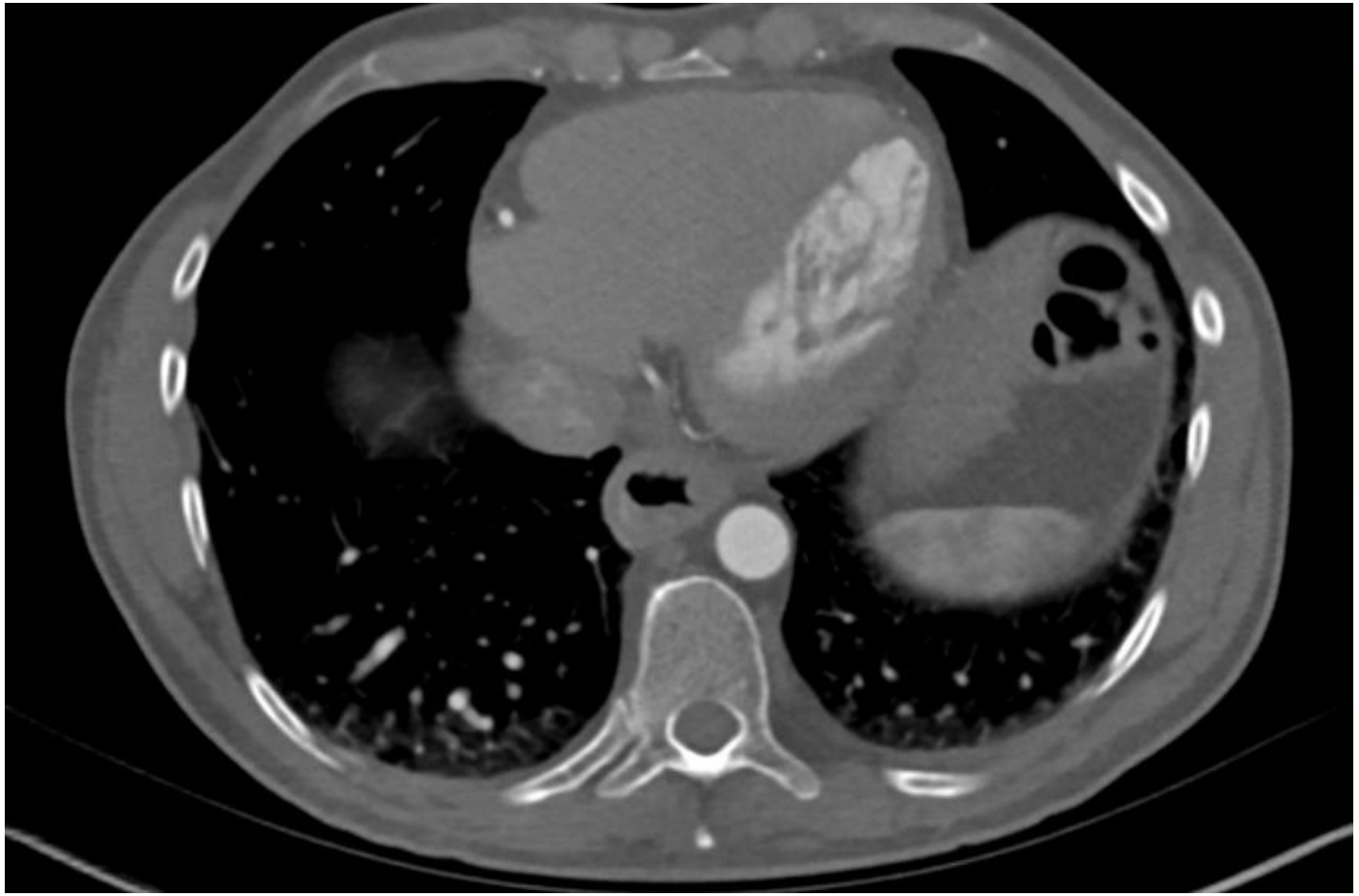
- MRT's trained in cardiac CT
    - With supervision by cardiologist/radiologist/cardiology speciality nurse
    - Selection of protocols suited to patient, heart rate
    - Dispensing GTN spray and betablocker
    - Reviewing scan – step artefact? Scan need to be repeated?

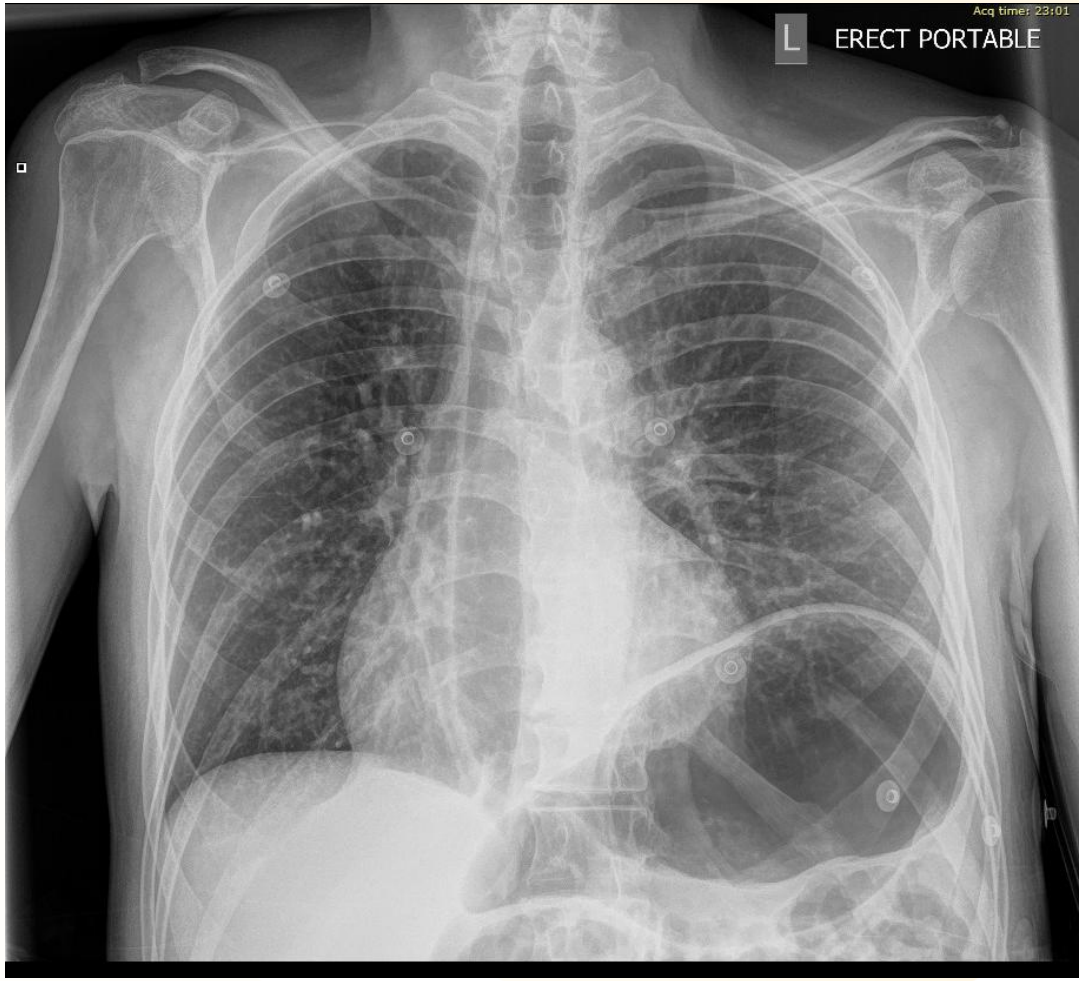
- For a successful inpatient CTCA programme- Cardiology nurse specialists are essential)
    - Screening referrals (acute and OP), patient preparation including consent
    - Co ordinate the scan
    - Efficient communication of results to medial teams

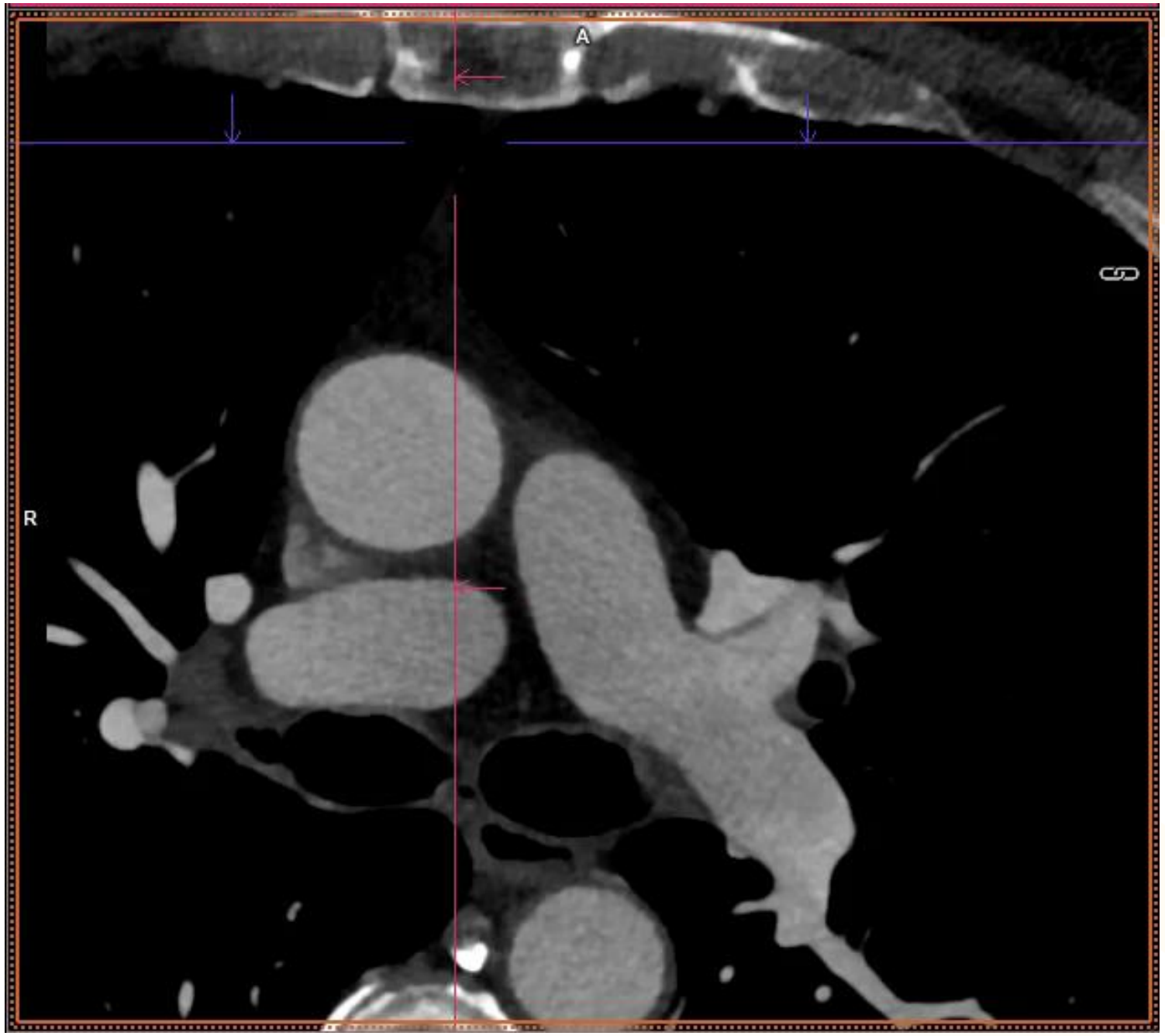
- CTCA protocols
- ECG gated CT calcium score scan followed by a contrast study
- CAC scan performed routinely pre CTCA
- Why?
  - Allows MRT to plan the CTCA
  - Check location of the first “step” if a step and shoot scan performed
  - Quantify coronary plaque burden (decision making for statins)



Approach to reporting a CTCA



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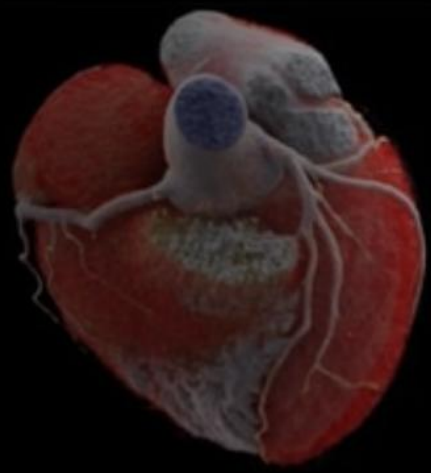
- Reporting by an (accredited) Cardiologist or Radiologist
  - Mix of axial images and curved reconstructions

- If Cardiologist report, scan is double read by a radiologist for non cardiac findings

- Pathway to reporting for Cardiologists
  - ***Not through*** Advanced Cardiology training
    - requirement is observe only **5** CTCA cw 50 CTCA in Advanced Radiology training
- Cardiac imaging fellowship
- Post FRACP training
  - Level A training course (5 days, then co report 50 live scans)

- In the USA the proportion of cardiologists reporting CTCA has fallen from 60% to ~40%
- Radiologists report the majority of CTCA in Europe
- Why should Cardiologists keep reporting CTCA in NZ?
  - We already report all other imaging modalities
  - We can add important clinical interpretation of the coronary findings (including management recommendations
  - Contribute to research and improving the quality of CTCA programmes



Cardiac CTCA Reporting - Level A - AU/NZ

Medical Imaging and Therapy

About Dates

Cardiac CTCA Reporting - Level A

Seats Available: 13

Instructor: Louise Humphrey

Date and time

Sep 13-17, 2025

8:00 AM - 5:00 PM NZST

Location

Ko Awatea Centre. Room: 103. Middlemore Hospital.

100 Hospital Road

Auckland 2025

New Zealand

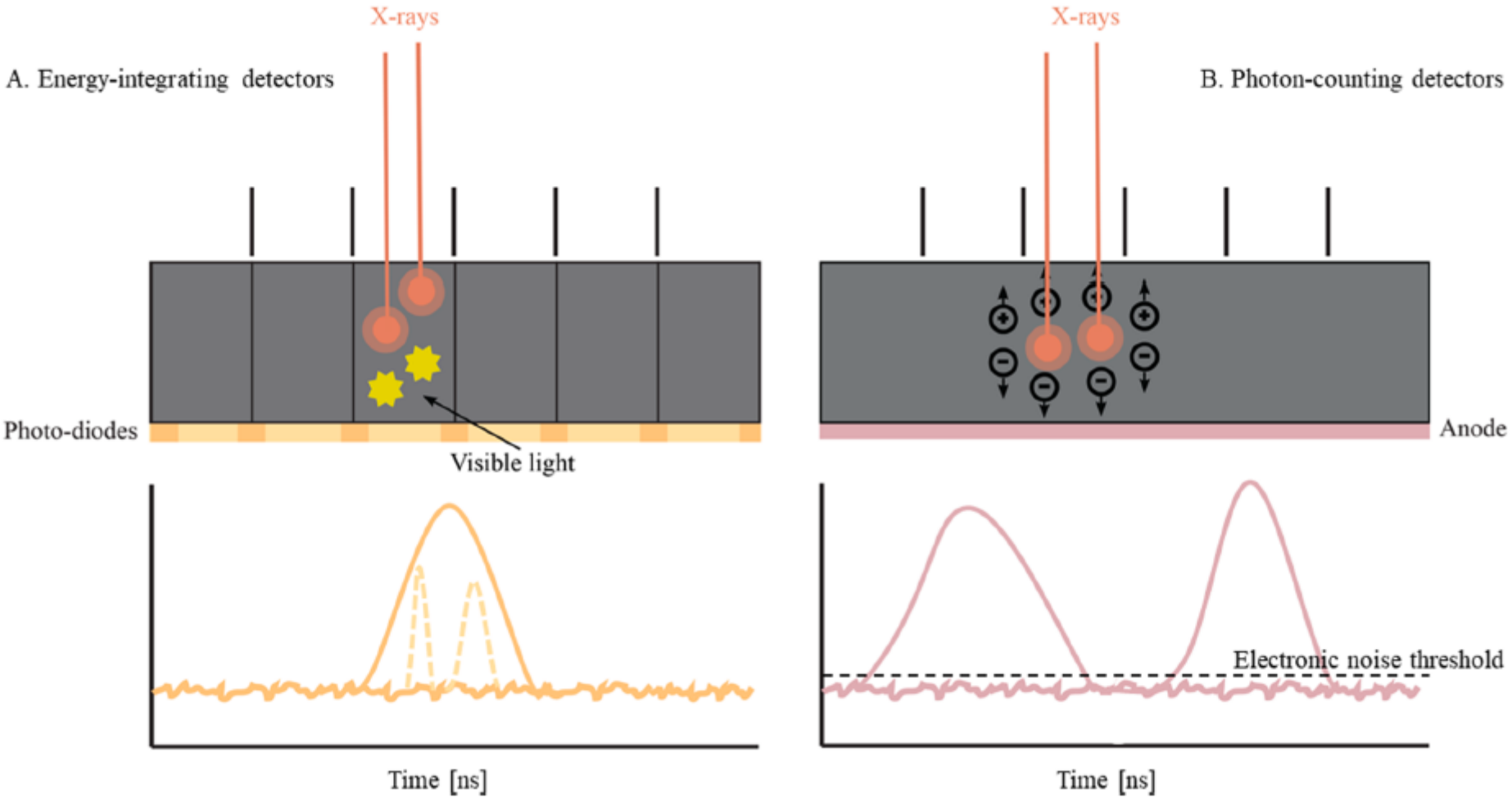
Sessions

Photon counting CT
biggest advance in CT in 20 years

- CT uses used contemporary energy integrating detectors (EID)
- This leads to significant ‘blooming artefacts’ in heavily calcified vessels/stents
- PCCT can image coronary arteries at multiple energies with allows ultra high spatial resolution down to ~0.1mm with reduced ‘blooming artefacts’
- Spectrally acquired images allow intrinsic subtraction of calcium and metal artefacts. Tissue characterisation is improved

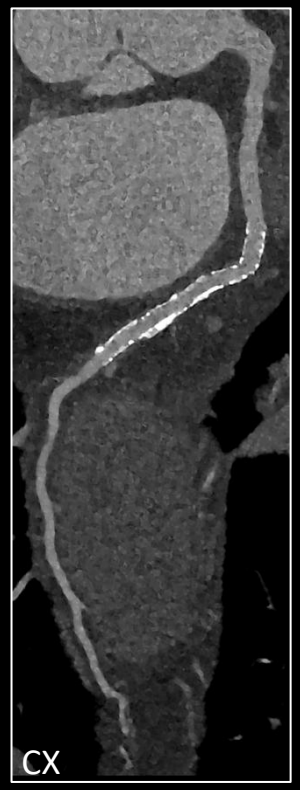
X Ray → Light → Electrical current

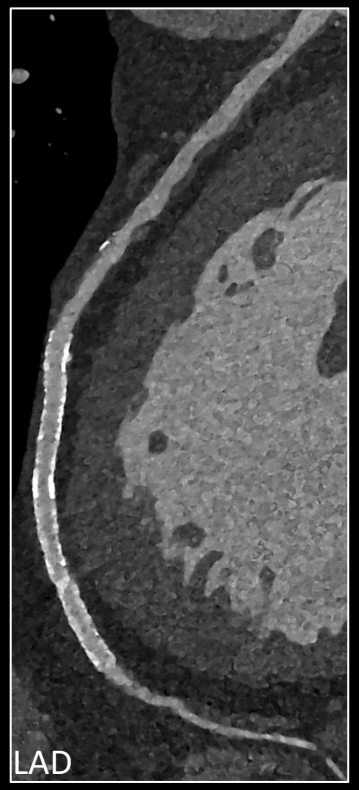
X Ray → Electrical current

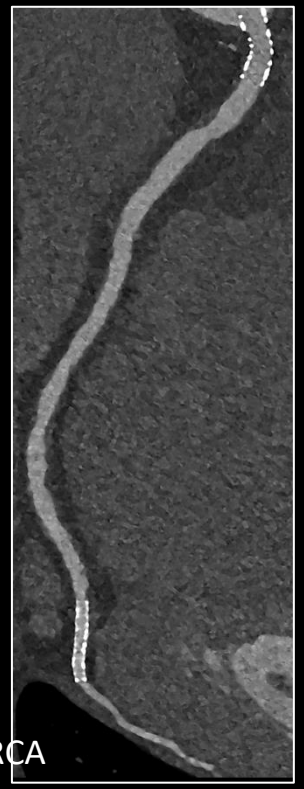


European Journal of Radiology 163 (2023) 110829

Quantum HD Cardiac imaging of a patient with 4 stents





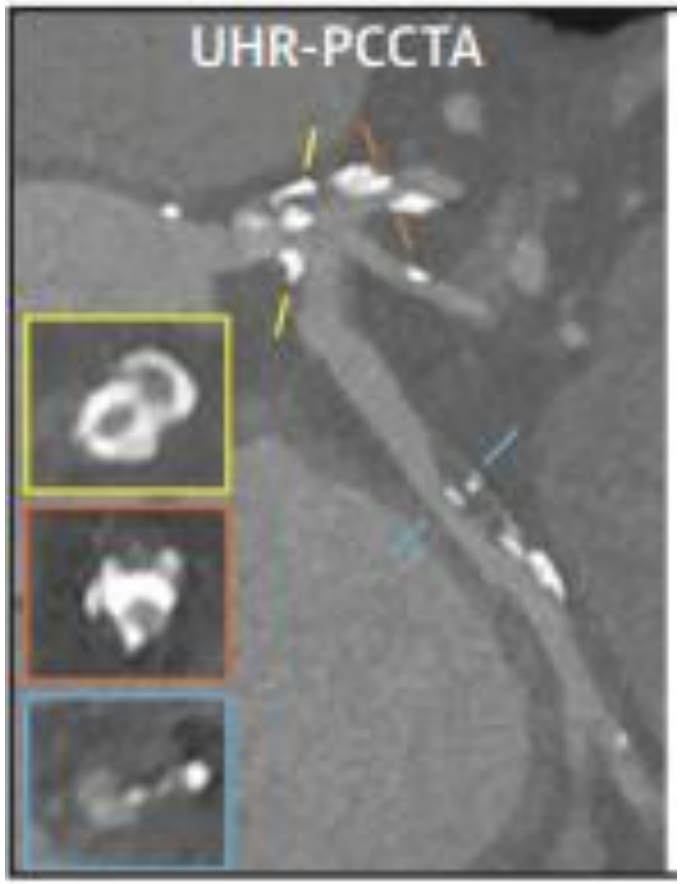


MPR | 0.2 mm | Bv72

cVRT

Quantum HD Cardiac | 120 kVp | $CTDI_{vol}$ 41.4 mGy

- Courtesy of University Medical Center of Freiburg, Freiburg, Germany



- PCCT leads to improved spatial resolution, reduced blooming artefact and with a degree of tissue characterisation
- Calcification subtraction looks a useful tool

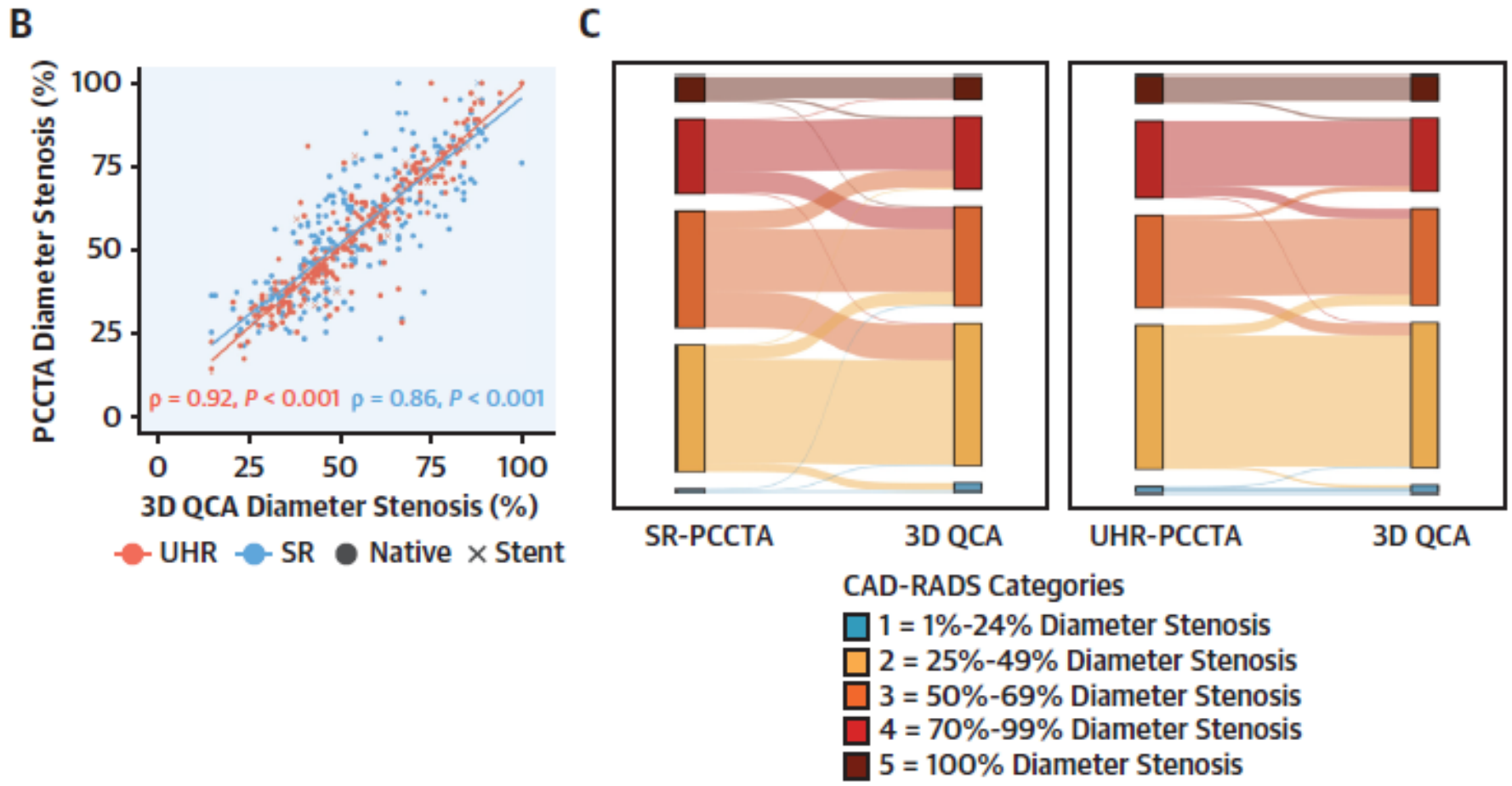
Benchmarking Photon-Counting Computed Tomography Angiography Against Invasive Assessment of Coronary Stenosis

Implications for Severely Calcified Coronaries

Rafail A. Kotronias, MBChB, MSc, Giovanni L. de Maria, MD, PhD, Cheng Xie, MBChB, Sheena Thomas, BSc, Kenneth Chan, MBBS, Leonardo Portolan, MD, Jeremy P. Langrish, MBBChir, PhD, Jason Walsh, MBChB, Thomas J. Cahill, MBBS, DPhil, Andrew J. Lucking, MBChB, PhD, Jonathan Denton, DCR, Robyn Farrall, BSc, Caroline Taylor, BSc, Nikant Sabharwal, MBChB, David A. Holdsworth, BMBCh, DPhil, Thomas Halborg, MSc, Stefan Neubauer, MD, Adrian P. Banning, MBChB, MD, Keith M. Channon, MBChB, MD, Charalambos Antoniades, MD, PhD, the OxAMI and ORFAN Investigators

JACC: CARDIOVASCULAR IMAGING, VOL. ■, NO. ■, 2025
■ 2025:■-■

- A comparison of PCCT with ICA in patients presenting with ACS



Kotronias RA, et al. JACC Cardiovasc Imaging. 2025;■(■):■-■.

Ultra high resolution CTCA has remarkably good correlation with QCA in a patient with a lot of calcified coronary plaque

TABLE 3 Plaque Characteristics and Stenosis Quantification

	3D QCA (n = 343)	SR-PCCTA (n = 292)	UHR-PCCTA (n = 271)
Characteristics			
% diameter stenosis	53 (40-71)	56 (40-72)	54 (39-72)
Minimum luminal diameter, mm	1.1 (0.7-1.6)	1.2 (0.7-1.7)	1.1 (0.6-1.50)
CAD-RADS			
1	8 (2)	3 (1)	6 (2)
2	143 (42)	107 (36)	112 (41)
3	98 (29)	98 (34)	72 (27)
4	71 (21)	63 (22)	60 (22)
5	23 (7)	21 (7)	21 (8)

Values are median (Q1-Q3) or n (%).

3D = 3-dimensional; CAD-RADS = Coronary Artery Disease-Reporting and Data System; QCA = quantitative coronary angiography; other abbreviations as in Table 1.

UHR-PCCT has higher diagnostic accuracy

More cases are accurately classified as CADS 2 or 3 (potentially less need for ICA or other investigations)

Disadvantage of the ultra high resolution PCCT

- more data generated
- Increase in radiation dose of 2-3 fold

Conclusions..

- CTCA is continuing to evolve and is established as a first line investigation for chest pain syndromes
- Cardiologist should continue to be active in CTCA
- PCCT is likely to replace conventional CT in the next 10 years

Thanks, Niels Van Pelt

NielsVP@adhb.govt.nz