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Multi Vessel Coronary Disease

COMPLETE REVASCULARIZATION is the GOAL

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Case

- 70 year Male
- Obesity, Hypertension, DL, Ex-smoker
- STEMI call out 02:30 AM
30 min chest pain with diaphoresis
bradycardia with borderline hypotension
Inferior STEMI on ECG

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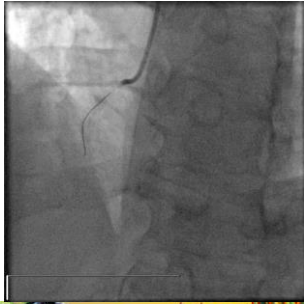


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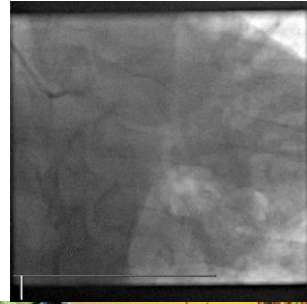
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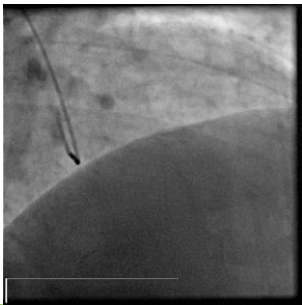
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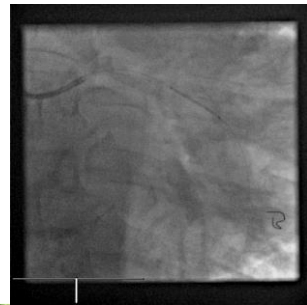
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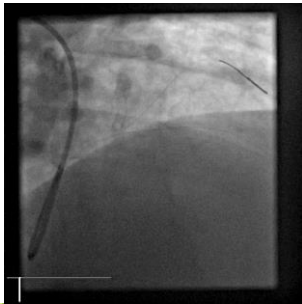
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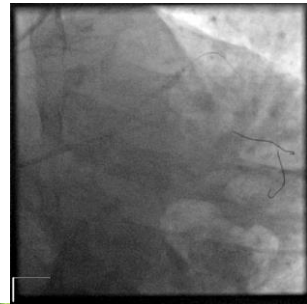
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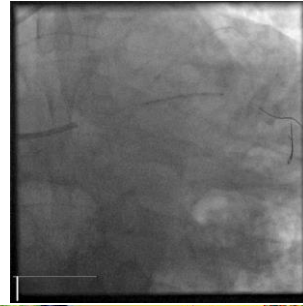
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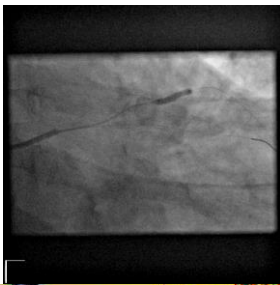
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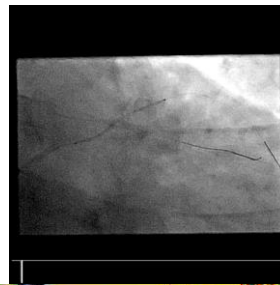
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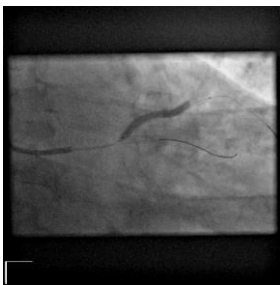
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SS = 23.5
170 ml contrast
1h 20 minutes
Discharged home
Day 3



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Multi vessel disease in STEMI

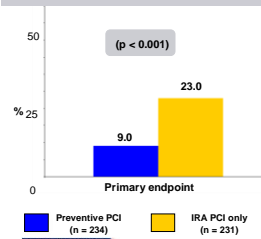
- 50% of patients with STEMI has MVD
- 30% of STEMI patients, 1 or more N-IRA have significant stenosis during index angiography
- MVD in ACS is associated with worse prognosis
- Likely benefit of complete revascularization is by reducing ischemic burden and recurrent ischemic events

Non-culprit lesions – often called “innocent bystander”!



PRAMI

Trial design: Patients presenting with STEMI undergoing primary PCI and with evidence of a nonculprit severe stenosis were randomized to either PCI of nonculprit vessel as well (preventive PCI) or PCI of infarct vessel only. Patients were followed for 36 months.



Results

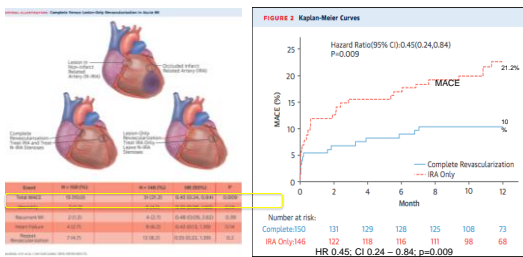
- Trial terminated early due to overwhelming benefit.
- Primary endpoint (CV death/nonfatal MI/refractory angina) for preventive PCI vs. IRA PCI: 9% vs. 23%; HR 0.35; CI 0.21-0.58; p < 0.001
- Nonfatal MI: 3% vs. 8.7%, p = 0.0009; refractory angina: 5.1% vs. 13.0%, p = 0.002; CV death: 4.7% vs. 11.7%, p = 0.07
- Repeat revascularization: 6.8% vs. 19.9%, p < 0.001

Improved ischemic outcomes at 3 years with complete revascularisation
Wald DS. N Engl J Med 2013;Sep 1:[Epub]



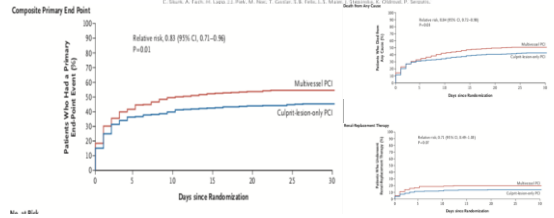
CvLPRIT TRIAL

Complete Versus Lesion-Only Primary PCI trial for STEMI & MVD



The NEW ENGLAND JOURNAL of MEDICINE

PCI Strategies in Patients with Acute Myocardial Infarction and Cardiogenic Shock



Contemporary complete revascularization trials in STEMI

	Do All now	Do All, stage	Do all now use FFR
	PRAMI (n=465)	CvLPRIT (n=296)	PRIMULTI (n=627)
No patients per center per year	19	23	105
Lesion criteria	>50% DS	>70% DS or >50% DS in 2 views	>50% DS and FFR <0.80 or >80% DS
Strategy for non-IRA lesions	Immediate	Immediate or staged within index admission	Staged within index admission
Primary endpoint	D/MI/refractory ischemia	D/MI/HF/fisch D R	D/MI/fisch D R
Power (80%)	20% reduced to 14% (30% Rx effect)	37% PEP reduced to 22% (40% Rx effect)	18% PEP reduced to 13% (30% Rx effect)
Result	23% reduced to 9% (65% Rx effect)	21% reduced to 10% (55% Rx effect)	22% reduced to 13% (44% Rx effect)



What about NSTEMI?

- Different population group
- More comorbidities
- More often complex MVD
- Culprit vessel is often not obvious, and can be multiple!

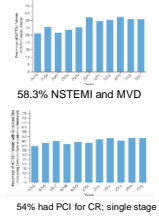




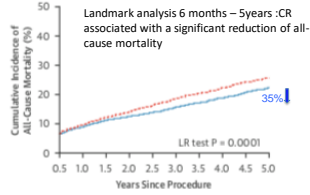
Complete Revascularization in NSTEMI

Complete Versus Culprit-Only Lesion Intervention in Patients With Acute Coronary Syndromes

Kosterholz S, Roffalo M, Siffert Eggert M, et al. J Am Coll Cardiol. 2018;72:1989-1999



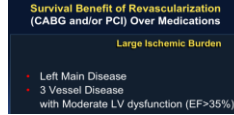
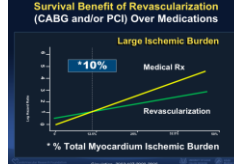
Observational cohort of 37,491 NSTEMI patients 2005 – 2015
8 heart attack centers in London



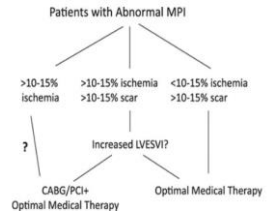
J Am Coll Cardiol. 2018;72:1989-1999



Revascularization in Stable CAD



Large observational studies showed benefit of ischemia driven revascularization



Conflicting evidence on revascularization?

COURAGE Trial

- No difference in Death/NFMI
- Reduced angina @ 1 year but no difference at 4.6 year
- Soft ischemia eligibility criteria; 60% had trivial or no ischemia on provocative testing
- 16% OMT crossed over to PCI in 10 months; >33% by 4.6 years!
- Only 2.7% DES
- 69% MVD but only 41% had > 1 stent:
- Incomplete revascularization

ORBITA Trial

- Single vessel obstructive disease with symptom
- No difference in angina and exercise capacity in OMT c/w PCI arm
- 85% of patients randomized to the placebo arm underwent PCI after the 6-week study period ended!
- At least 3 anti-anginal medication
- Too small, too short, wrong population, wrong end point
- It may be okay not to have intervention in single vessel disease!



ISCHEMIA Trial

International Study of Comparative Health Effectiveness With Medical and Invasive Approaches



Likely to answer some of the unanswered questions!

- >5000 patients with moderate-severe ischemia
- Blinded CTA to exclude no obstructive CAD, LM disease, and confirm obstructive CAD
- Long enrolment time – a hefty target!
- Altered inclusion criteria (ETT rather than imaging) may compromise the strength of the study!



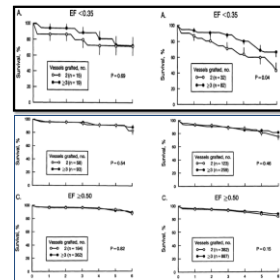
Guideline recommendation

Indications for revascularization in patients with stable angina or silent ischaemia			
For prognosis	LM disease with stenosis >50% ^a	I	A
	Any proximal LAD stenosis >50% ^a	I	A
	Two- or three-vessel disease with stenosis >50% ^a with impaired LV function (LVEF <35%) ^a	I	A
	Large area of ischaemia detected by functional testing (>10% LV) or abnormal invasive FFR ^a	I	B
For symptoms	Any haemodynamically significant coronary stenosis in the presence of limiting angina or angina equivalent, with an insufficient response to optimized medical therapy.	I	A

Revascularization more effectively relieves angina, reduces the use of anti-anginal drugs, improves exercise capacity and QOL*



The Concept of Complete Revascularization



Revascularization in severely symptomatic patients with 3 or more grafts provided survival benefit, particularly in patients with significant LV dysfunction

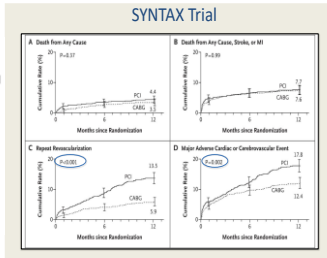




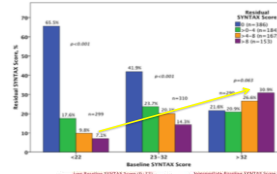
The management of patients with 3-vessel disease (3VD) according to ESC guidelines is largely influenced by the results of the pivotal SYNTAX trial.

However, since the completion of that trial major technical and procedural advances, influencing PCI outcomes, have taken place:

- New risk stratification tools.
- 2nd generation DES.
- Physiology- and imaging PCI guidance.
- Improved CTO PCI techniques.

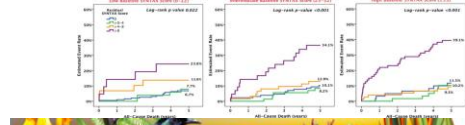


Impact of Incomplete Revascularization



Residual Syntax Score in SYNTAX Study

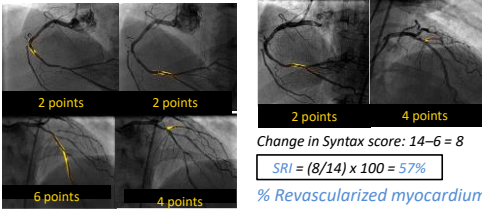
*RSS correlated with all cause mortality



The Syntax Revascularization Index (SRI)

Baseline SYNTAX Score = 14

Residual SYNTAX score = 6

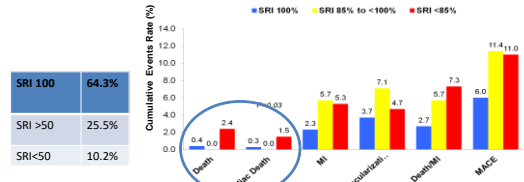


Strong independent predictor of adverse ischemic events after PCI with 1st generation DES



Impact of Incomplete Revascularization

SEEDS trial: Complex CAD undergoing 2nd generation DES PCI
Outcomes examined according to 3 SRI groups
Lesions >50% diameter stenosis in ≥ 1.5 mm vessels scored using SS algorithm



2-year Adverse Event Rates, N=1851
SRI $\ge 85\%$ is a "reasonable" goal for complete revascularization

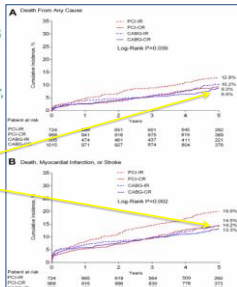


PCI for Complete Revascularization

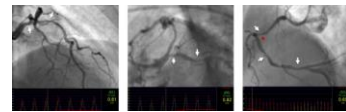
Comparison of Stenting Versus Bypass Surgery According to the Completeness of Revascularization in Severe Coronary Artery Disease

Patient-Level Pooled Analysis of the SYNTAX, PRECOMBAT, and BEST Trials

No difference in outcome with CABG if PCI achieved complete revascularization



Not all MVD is MVD
Role of Physiologic testing in MVD



EDITORIAL COMMENT

Treatment Strategy Change After Routine Pressure Wire Assessment for Coronary Artery Disease

What You See is "NOT" What You Get!

Bos-Kroon Koo, MD, PhD

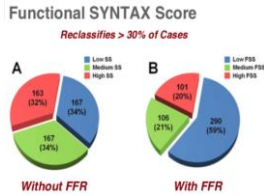


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Functional SYNTAX Score for Risk Assessment in Multivessel Coronary Artery Disease

FFR-guided SYNTAX Score (FSS) versus Conventional SYNTAX Score (SS)
 497 patients of the FFR-arm of FAME I
 SS re-calculated by 3 independent reviewers

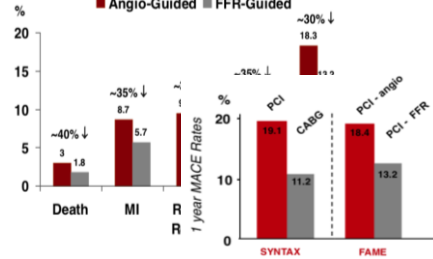


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1,005 patients with MVD randomized to FFR or Angio-guided PCI



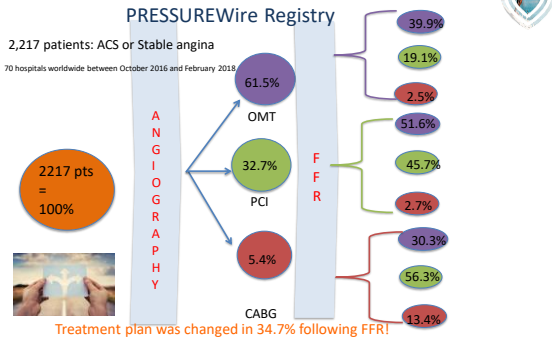
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PRESSUREWire Registry

2,217 patients: ACS or Stable angina
 70 hospitals worldwide between October 2016 and February 2018



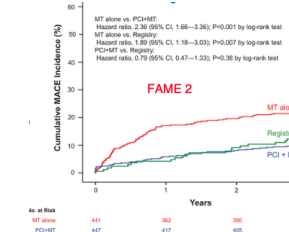
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Functionally Complete Revascularization

Physiologic assessment of MVD is important?
 Correlation between angiography and physiology differ
 FFR define ischemic segments – myocardium at threat
 Functional reclassification of anatomic disease



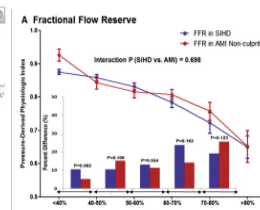
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FFR in assessment of non-culprit lesions

Fractional Flow Reserve and Instantaneous Wave-Free Ratio for Nonculprit Stenosis in Patients With Acute Myocardial Infarction

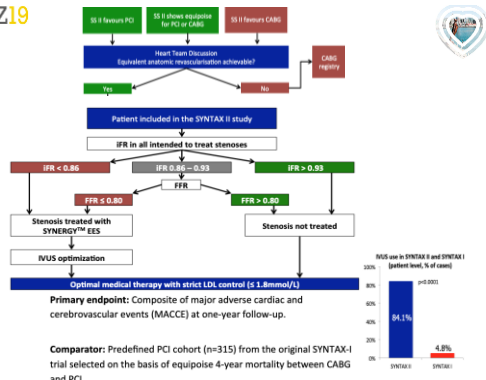


FFR in ACS with Multi Vessel disease
 Feasible in routine clinical practice
 Helps in clinical decision making
 Changes therapy frequently
 Associated with improved outcomes



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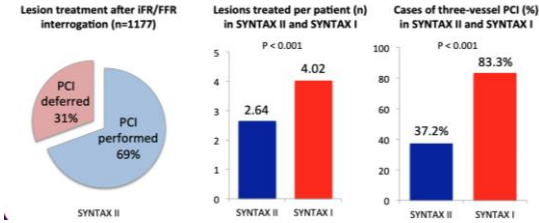
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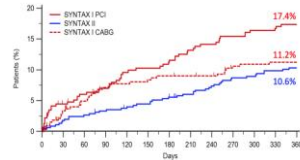
SYNTAX II Impact of intracoronary physiology on PCI



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SYNTAX II MACCE SYNTAX II and SYNTAX I PCI / CABG



- In patients with 3VD the use of the SYNTAX-II strategy was associated with improved clinical outcomes at one year, compared to matched patients treated percutaneously in the original SYNTAX-I trial.



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Recommendations on functional testing and intravascular imaging for lesion assessment

Recommendations	Class ^a	Level ^b
When evidence of ischaemia is not available, FFR or iwFR are recommended to assess the haemodynamic relevance of intermediate-grade stenosis. ^{15,17,18,39}	I	A
FFR-guided PCI should be considered in patients with multivessel disease undergoing PCI. ^{29,31}	IIa	B



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Myocardial revascularization in patients with CAD, heart failure, and LVEF ≤35%
CABG preferred
 PCI as alternative to CABG

Calculation of the Syntax Score, if left main or multivessel revascularization is considered

Completeness of revascularization prioritized, when considering CABG vs PCI

Three-vessel CAD without diabetes mellitus	I	A	I	A
Three-vessel disease with low SYNTAX score (0-22) ^{16,18,19,21,22,24,25,49}	I	A	I	A
Three-vessel disease with intermediate or high SYNTAX score (≥23) ^{16,18,19,21,22,24,25,49}	I	A	III	A
Three-vessel CAD with diabetes mellitus	I	A	III	A
Three-vessel disease with low SYNTAX score (0-22) ^{16,18,19,21,22,24,25,49,50-57}	I	A	III	A
Three-vessel disease with intermediate or high SYNTAX score (≥23) ^{16,18,19,21,22,24,25,49,50-57}	I	A	III	A



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Revascularization in Multi-vessel CAD

Debate over CABG versus PCI



- No difference in mortality
- Slightly increased stroke with CABG
- Reduced risk of recurrent MI
- Reduced risk of repeat revascularization

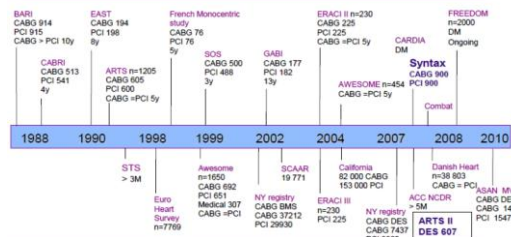


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CABG vs PCI Debate

Randomized Controlled Trials



Registries

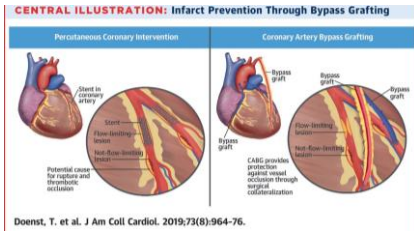


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CABG the Winner?



Incomplete revascularization with PCI c/w CABG



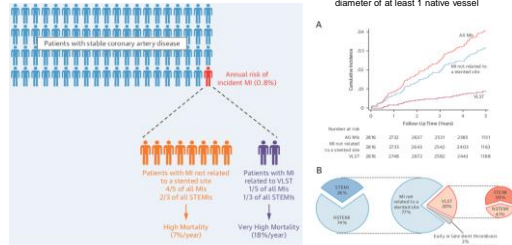
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Recurrent MI not related to stents

CORONOR Registry; > 4000 patients



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MV PCI: Challenges in Complete Revascularization

- Patient factors:
 - Cardiogenic shock with AMI
 - Diabetes
- Anatomic factors:
 - Calcification
 - Tortuosity
 - Branch point disease
 - Distribution of disease eg diffuse
 - CTO
- Procedural factors: procedure time, contrast load

CABG when appropriate is always an option



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Advances in Percutaneous Intervention

- Technical aspects
 - Radial access
 - Plaque modification techniques eg calcification
 - Bifurcation PCI
- Armamentarium
 - Wire and balloon technology
 - Stent technology
 - Adjunctive devices
 - More effective anti-platelet drugs and regimens
- Physiologic assessment
- IVUS guidance
- Success in CTO intervention



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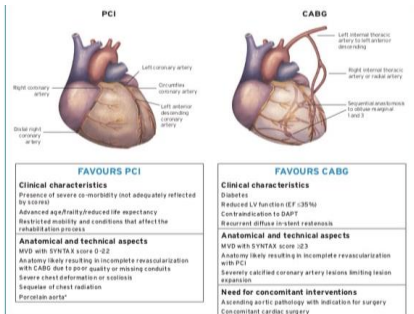
CABG or MV PCI

Decision making process

Predicted surgical mortality

anatomical complexity of CAD

anticipated completeness of revascularization

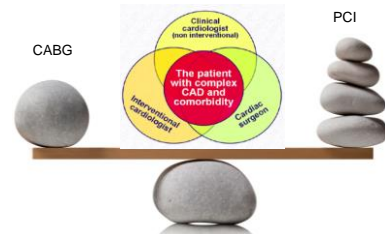


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Debate is Over



It is time for team work

Participation of the informed patient + acknowledgement of individual preference
 Individualized decision with a Heart team approach



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Treatment decision Individualized

- Is the patient Diabetic?
- Suitable for DAPT for appropriate duration?
- Is there high surgical risk?
- Is it technically feasible to revascularize major ischemic territories?
Feasibility does not mean Indication
- What is the patient preference?
– Important to ensure a detailed discussion



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Case

- 77 Indonesian Female
- ESRF secondary to Diabetic Nephropathy
- Pre-dialysis
- Chronic Thrombocytopenia
- Hep C Cirrhosis
- Severe LV dysfunction; EF ~20%
– Significant decline in LV function from normal EF last year



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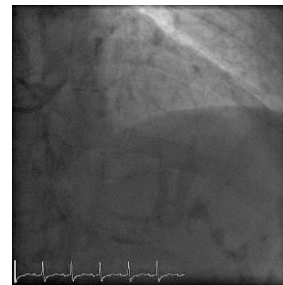
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Coronary angiography

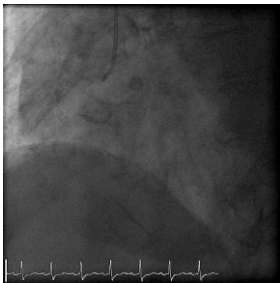


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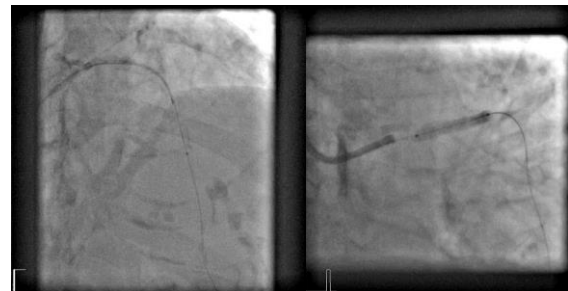


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IVUS guided PCI

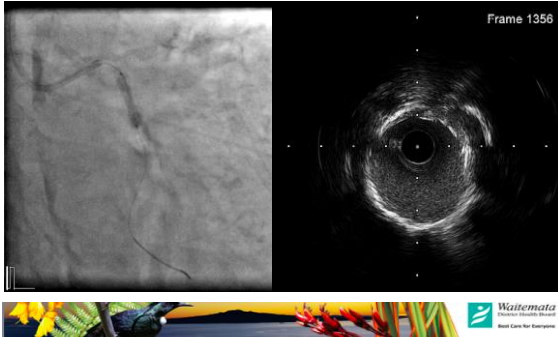


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Total 3 ml contrast

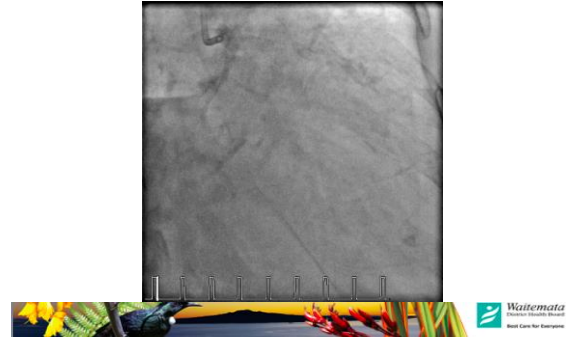


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Final angiogram with 6 mls contrast



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Conclusion

- In MVD, anatomic observation needs to be complemented by physiologic evaluation for reclassification of the disease burden
- Syntax score and surgical risk scores are useful tools for decision making
- Considerable refinement in revascularization techniques over the years have made MV PCI as a viable alternative to CABG in the current era.
- Complete and optimal revascularisation of ischemic myocardium should be the goal and FFR/iFR has important role in decision making.
- PCI is feasible in complex MVD in high risk surgical patients
- Optimal Medical Therapy to complement Optimal Revascularization



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If we can avoid the hard way



To achieve what the goal rather gently



Help our pts to avoid a tough journey



Rather a smooth & comfortable one!



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Thank You



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