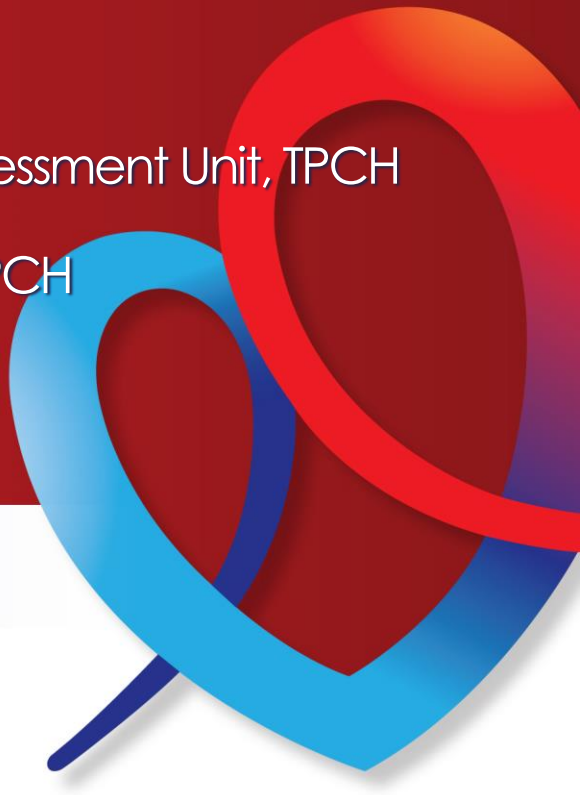
Cardio Vascular Risk Assessment

A Guide to Choosing the right tests and medications for your patients

Dr Niranjan Gaikwad MBBS, FRACP
Director Coronary Care Unit, Director of Chest Pain Assessment Unit, TPCH

Dr Ben Fitzgerald, Senior VMO, Department of Echo, TPCH



innovation and collaboration

Queensland Government

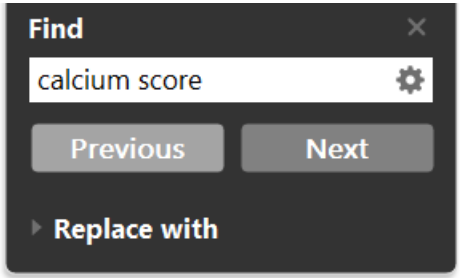
The Prince Charles Hospital Foundation
Finding cures. Saving lives.

Learning outcomes

1. Describe and discuss the assessment of CVD risk and the Heart Health Check.
2. Develop strategies for the management of lipid disorders and risk factors in asymptomatic patients with intermediate CVD risk.
3. Risk enhancers – a new concept in cardiovascular risk.
4. Discuss the role of calcium scoring in primary care.
5. Understand and discuss chest pain management protocols and the role of the Chest Pain Assessment Service (CPAS).

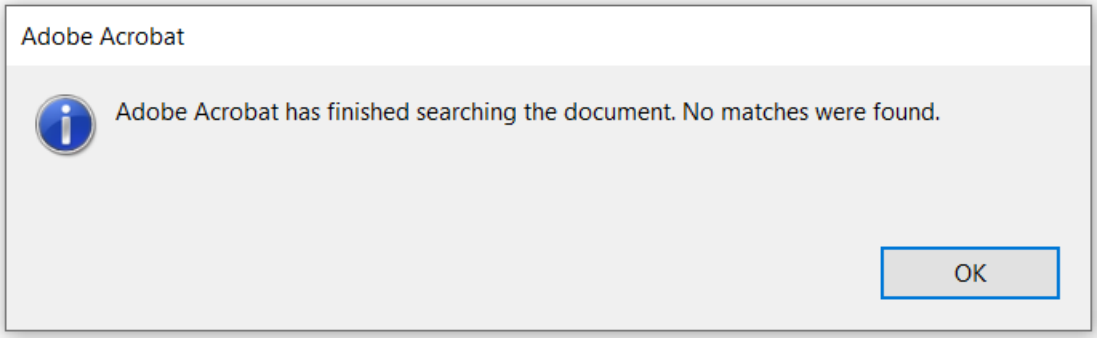
Preliminary Program

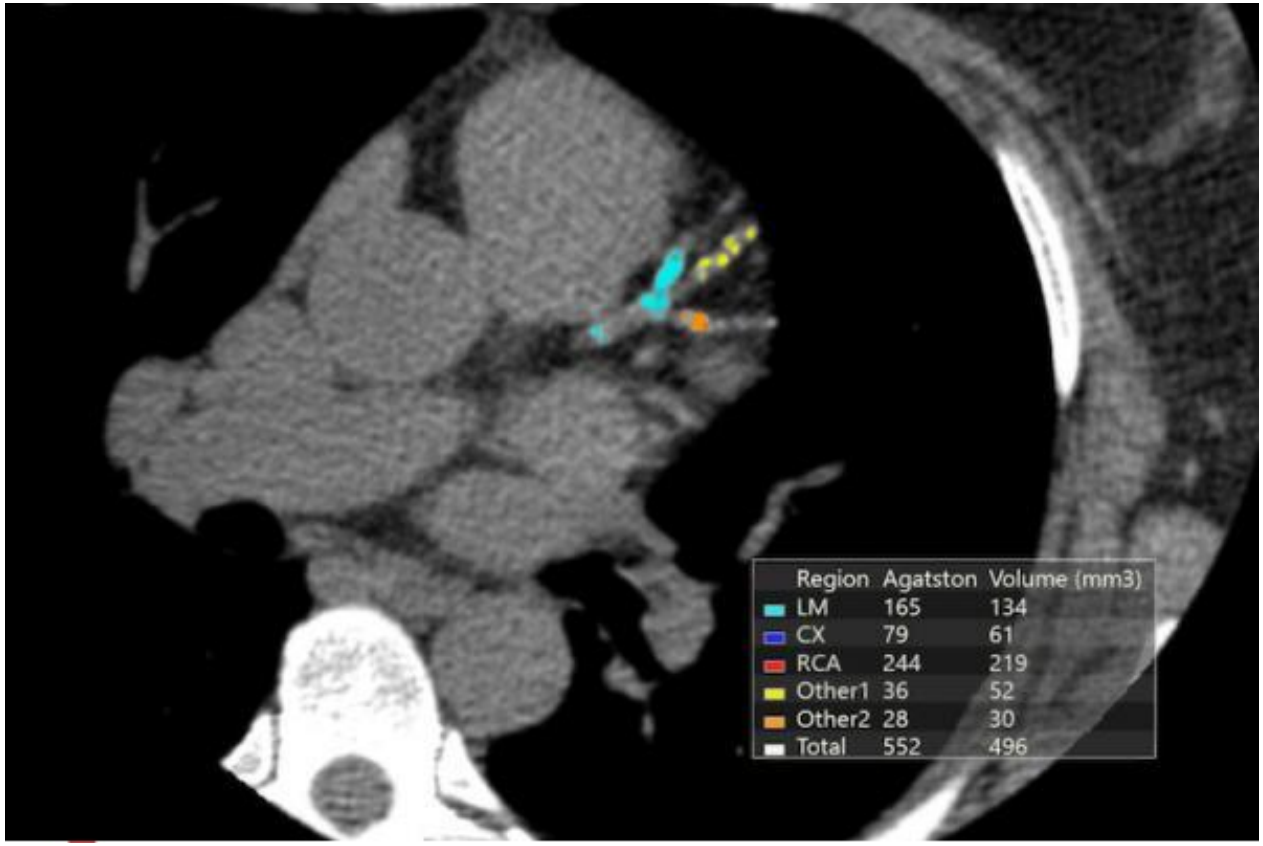
1. Assessing CVD risk and the Heart Health Check.
2. The role of calcium scoring in primary care.
3. Principles of cholesterol management.
4. An orientation to chest pain protocols at The Prince Charles Hospital and the role of the CPAS



Guidelines for the **management** of

Absolute cardiovascular disease **risk**




Region Agatston Volume (mm3)
LM 165 134
CX 79 61
RCA 244 219
Other1 36 52
Other2 28 30
Total 552 496

The Cardiac Society of Australia and New Zealand

Coronary Artery Calcium Scoring – Position Statement

Development of this position statement was coordinated by Christian Hamilton-Craig (co-chair), Gary Liew (co-chair), Jonathan Chan, Clara Chow, Michael Jelinek, Niels van Pelt and John Younger.
No authors have any relevant Conflict of Interest to disclose.

It was reviewed by the Quality Standards Committee and ratified at the CSANZ Board meeting held on Friday, 26th May 2017.

CSANZ position statement on Coronary Calcium Scoring

1. Patient groups to consider Coronary Calcium Scoring CAC is of most value in intermediate risk patients (absolute 10-year cardiovascular risk of 10-20%) who are asymptomatic, do not have known coronary artery disease and aged 45 – 75 years, where it has the ability to reclassify patients into lower or higher risk groups.

2. It may also be considered for lower risk patients (absolute 10-year cardiovascular risk 6-10%) particularly in those where traditionally risk scores under estimate risk e.g. especially in context of family history of premature CVD and possibly in patients with diabetes aged 40 to 60 years old.

CSANZ position statement on Coronary Calcium Scoring

CAC is not recommended for patients who are:

1. At very low risk (<5% absolute 10 year risk); or,

2. High risk (>20% absolute 10 year risk) - as testing is unlikely to alter the recommended management. This includes some patients who are automatically considered to be high risk (eg. diabetics over 60 years old or diabetics with albuminuria, chronic kidney disease (eGFR < 45 mL/min), BP > 180/110, familial hypercholesterolaemia and cholesterol > 7.5 mmol/L) and therefore should be managed aggressively with optimal medical therapy; or

3. Symptomatic or previously documented coronary artery disease

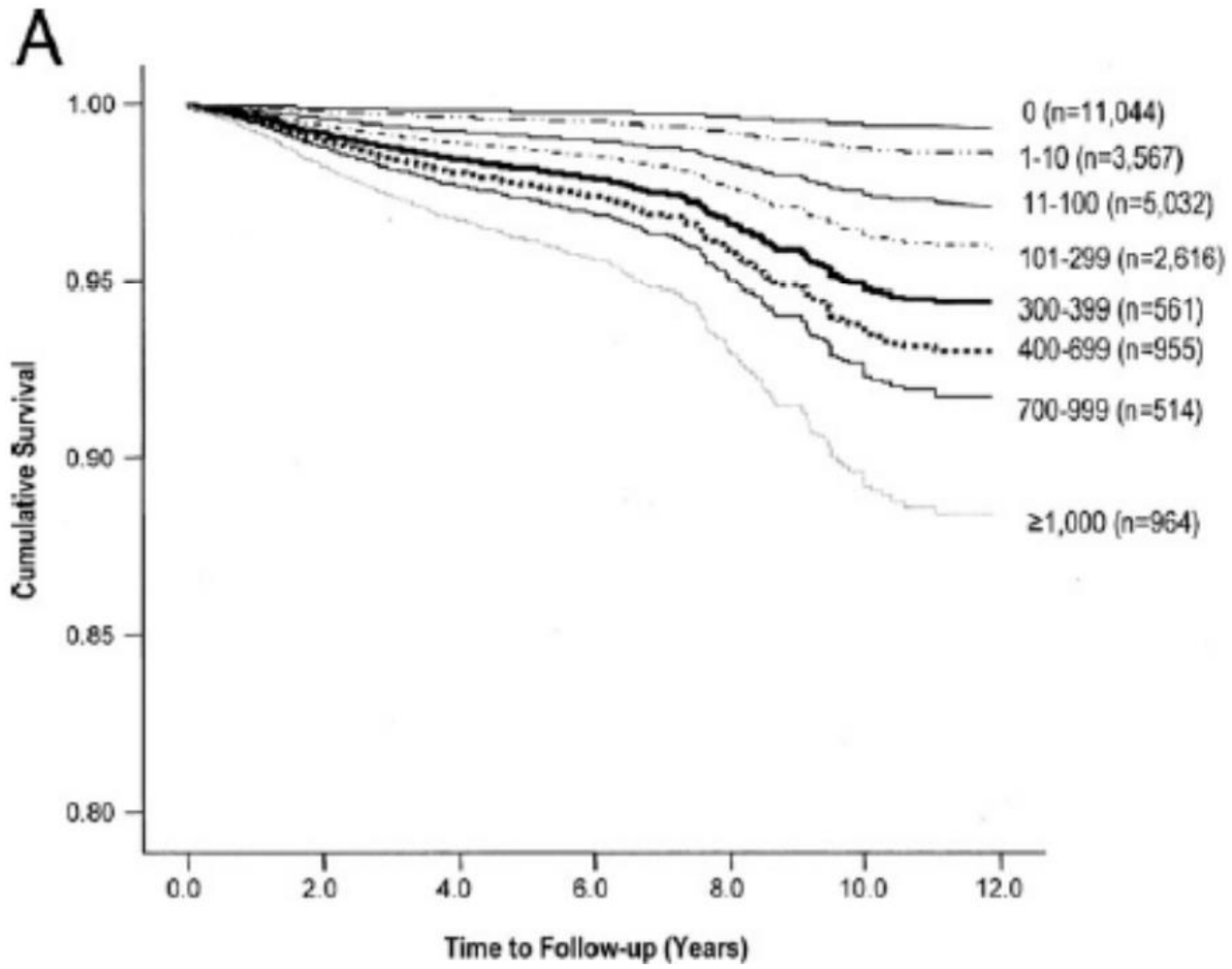
CSANZ position statement on Coronary Calcium Scoring

Recommendation: Asymptomatic patients suitable for CAC

- Aged 45-75 years with intermediate cardiovascular risk (10-20%)
- There is a possible role for CAC in those aged 45-75 years with lower cardiovascular risk (6-10%) as defined by FRS in:
  - o Those with a strong family history of premature CHD
  - o Diabetics aged 40 – 60 years old.
  - o Indigenous patients (Aboriginals, Maori and Pacific Island patients) >40 years old.

Coronary artery calcium (CAC) scores improve prognostic accuracy for atherosclerotic cardiovascular disease (ASCVD) outcomes

Increasing CAC predicts mortality



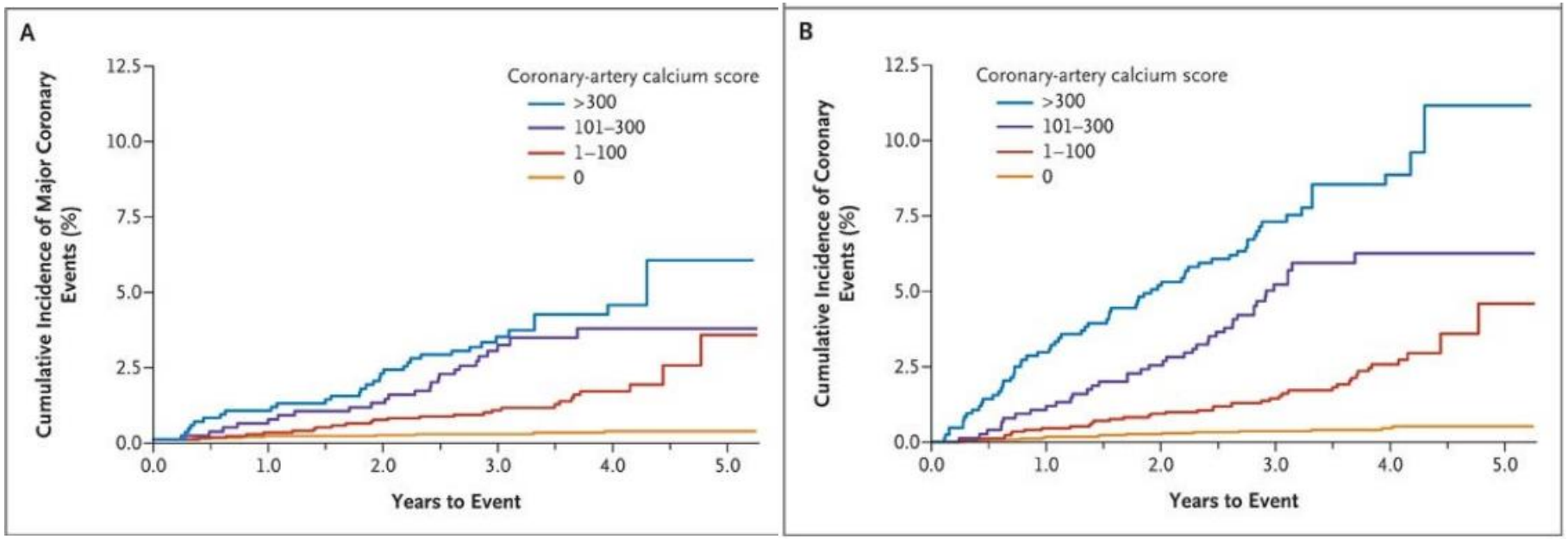
(Budoff et al, JACC 2007)

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Coronary Calcium as a Predictor of Coronary Events in Four Racial or Ethnic Groups

Robert Detrano, M.D., Ph.D., Alan D. Guerci, M.D., J. Jeffrey Carr, M.D., M.S.C.E., Diane E. Bild, M.D., M.P.H., Gregory Burke, M.D., Ph.D., Aaron R. Folsom, M.D., Kiang Liu, Ph.D., Steven Shea, M.D., Moyses Szklo, M.D., Dr.P.H., David A. Bluemke, M.D., Ph.D., Daniel H. O'Leary, M.D., Russell Tracy, Ph.D., Karol Watson, M.D., Ph.D., Nathan D. Wong, Ph.D., and Richard A. Kronmal, Ph.D.



N Engl J Med 2008;358:1336-45

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY VOL. 72, NO. 25, 2018

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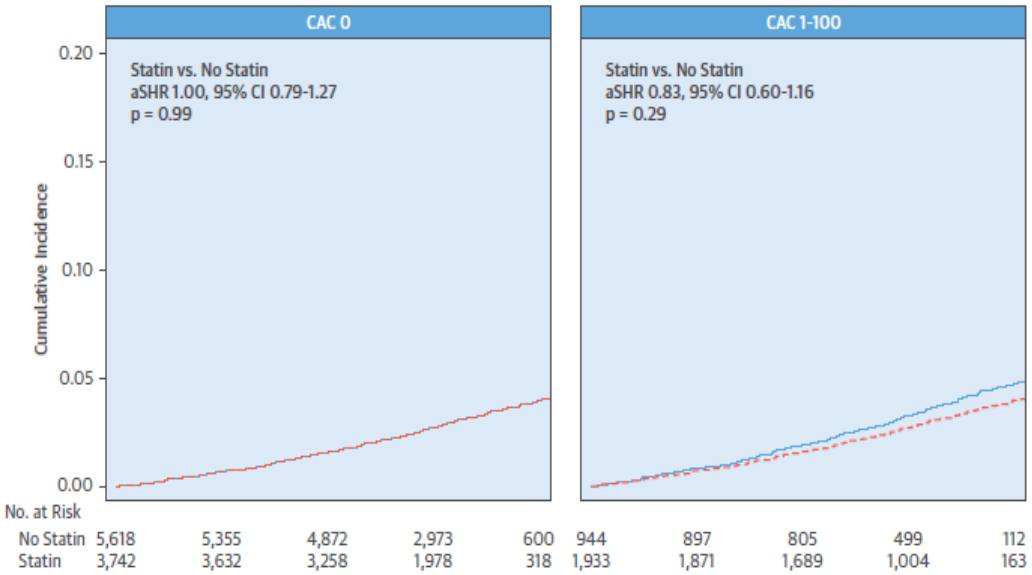
ORIGINAL INVESTIGATIONS

Impact of Statins on Cardiovascular Outcomes Following Coronary Artery Calcium Scoring

Joshua D. Mitchell, MD,[a] Nicole Fergestrom, MS,[b] Brian F. Gage, MD,[c] Robert Paisley, MD,[d] Patrick Moon, MD,[e] Eric Novak, MS,[a] Michael Cheezum, MD,[f] Leslee J. Shaw, PhD,[g] Todd C. Villines, MD[h]

Coronary artery calcium (CAC) scores improve prognostic accuracy for atherosclerotic cardiovascular disease (ASCVD) outcomes



Mitchell, J.D. et al. J Am Coll Cardiol. 2018;72(25):3233–42.

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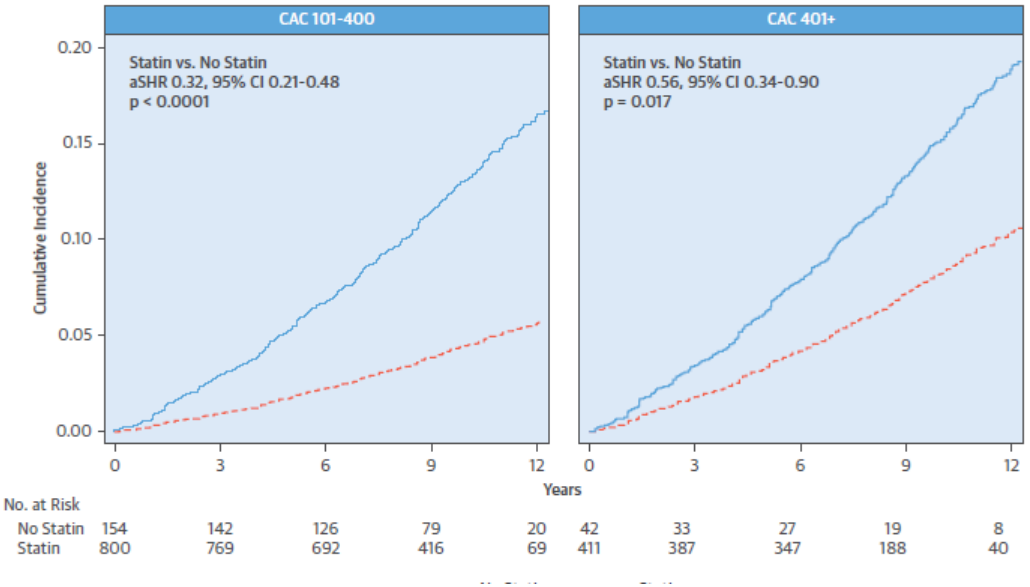

Mitchell, J.D. et al. J Am Coll Cardiol. 2018;72(25):3233–42.

Landmark Statin Trials Had Different Criteria for Statin Eligibility

WOSCOPS
- Men 45-64 years
  TC ≥ 252 + LDL-C ≥ 155

AFCAPS/TexCAPS
- Men 45-73 and women 55-73 years
  TC 180-264 + LDL-C ≥ 130-190 + HDL-C ≤ 45 (men) / ≤ 47 (women)

ASCOT-LLA
- Men and Women 40-79 years
  Untreated SBP ≥ 160 or DBP ≥ 100 mm Hg or treated SBP ≥ 140 or DBP ≥ 90 mm Hg + TC ≤ 251 + ≥ 3 risk factors besides HTN

CARDS
- Men and women 40-75 years
  Diabetes + LDL-C ≤ 159 + TG ≤ 600 + HTN and/or albuminuria and/or smoking

MEGA
- Men and women 40-70 years
  TC 220-270

JUPITER
- Men ≥ 50 and women ≥ 60 years
  LDL-C < 130 + hsCRP ≥ 2.0 mg/L

HOPE-3
- Men ≥ 55 and women ≥ 65 (or ≥ 60*) years + ≥ 1 additional risk factor†:
  High waist/hip ratio, smoking, low HDL-C, dysglycemia, renal dysfunction, and/or family history

JACC: CARDIOVASCULAR IMAGING VOL. 11, NO. 2, 2018

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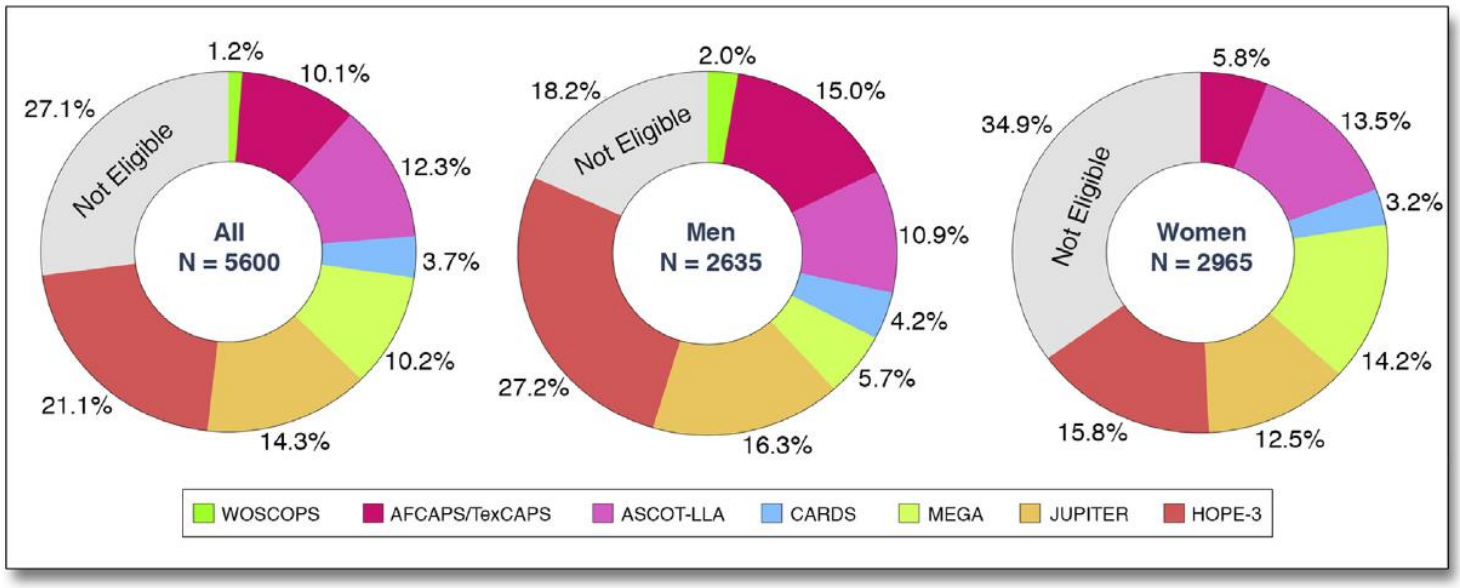
Statin Trials, Cardiovascular Events, and Coronary Artery Calcification

Implications for a Trial-Based Approach to Statin Therapy in MESA

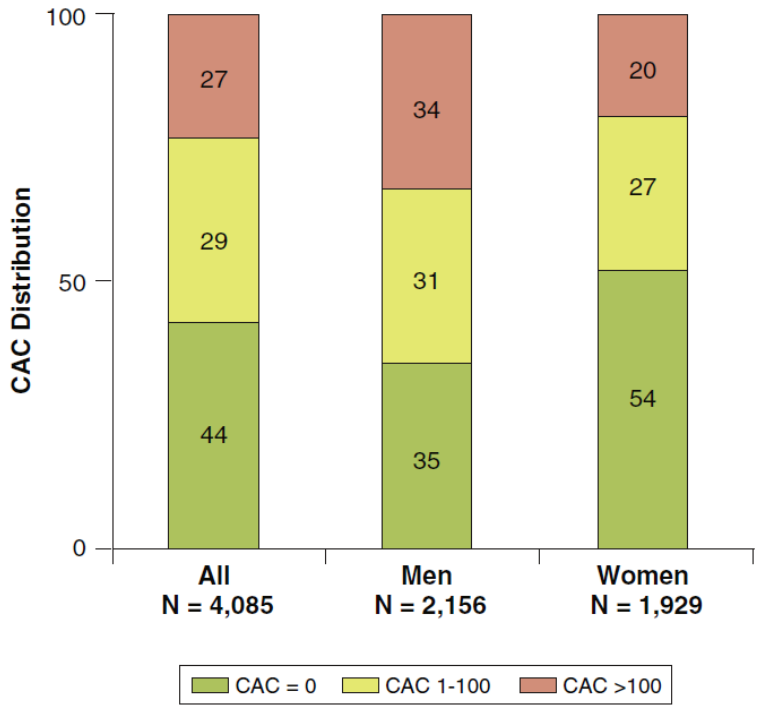
Martin Bødtker Mortensen, MD, PhD,[a] Erling Falk, MD, DMSc,[a] Dong Li, MD,[b] Khurram Nasir, MD, MPH,[c,d,e] Michael J. Blaha, MD, MPH,[e] Veit Sandfort, MD,[f] Carlos Jose Rodriguez, MD, MPH,[g] Pamela Ouyang, MD, MBBS,[h] Matthew Budoff, MD[b]

FIGURE 2 Statin Eligibility in MESA Using a Trial-Based Approach



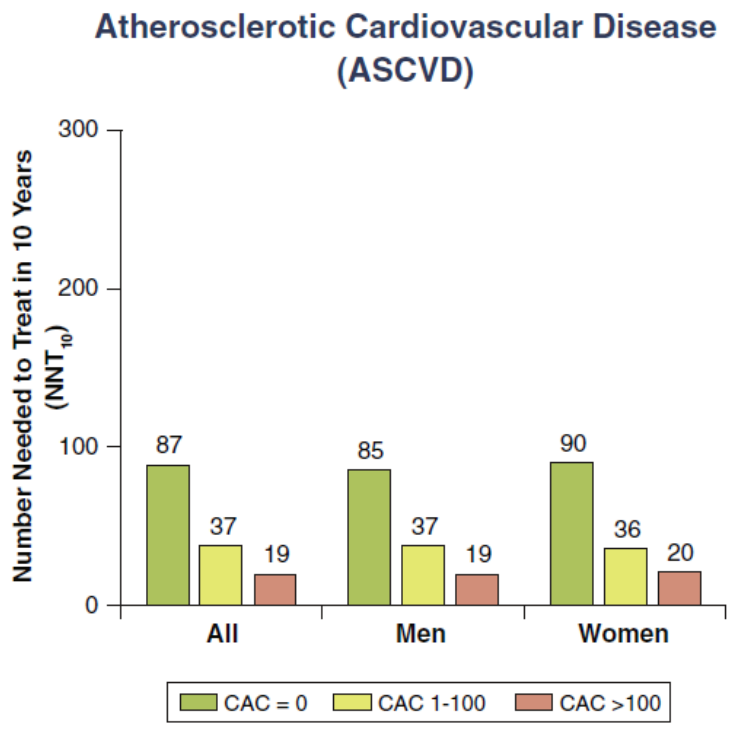
Diagrams illustrate the fraction of individuals from MESA who met enrollment criteria in RCTs of statin therapy. Individuals were selected consecutively in chronological order clockwise starting 12 o'clock; that is, first we selected individuals according to WOSCOPS criteria (1995), then we selected additional individuals according to AFCAPS/TexCAPS criteria (1998) and so on. RCT = randomized controlled trial; other abbreviations as in Figure 1.

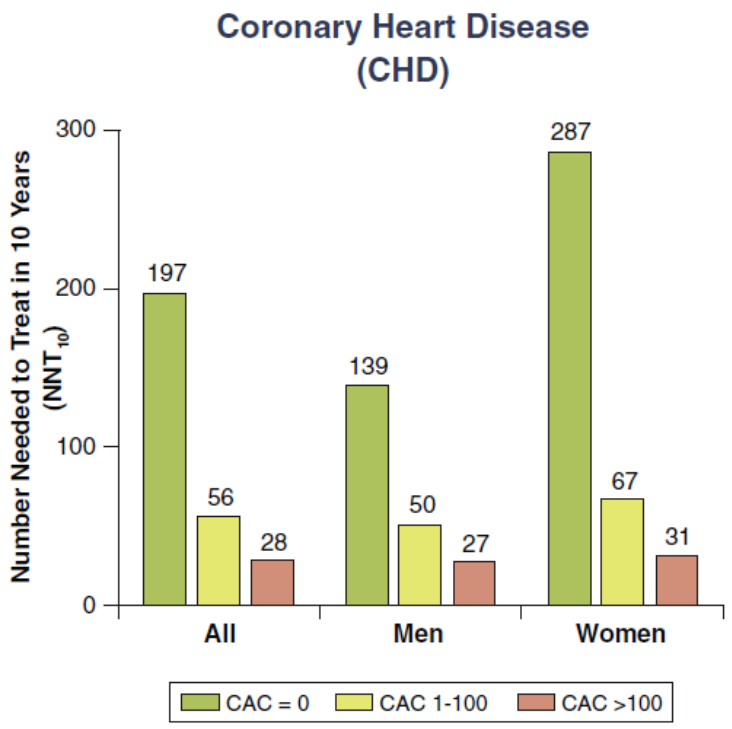
FIGURE 3 Distribution of CAC Among Individuals Eligible for Statin Therapy Using a Trial-Based Approach



In individuals for whom trial-based evidence supports efficacy of statin therapy, 44% had no sign of CAC. CAC = coronary artery calcium score.

FIGURE 5 Estimated Number Needed to Treat in 10 Years to Prevent 1 ASCVD or CHD Event Stratified by CAC Burden Among Individuals Eligible for Statin Therapy Under a Trial-Based Approach





NNT with ‘tailored’ approach

TABLE 3 NNT to Prevent First Occurrence of MACE Through 10 Years

CAC Score	Therapy	N	MACE	CIF*	ARR, %	NNT (NNH)	aSHR†	p Value
0	No statin	5,618	114	0.0295	−0.03	(3,571)	1.01	0.94
	Statin	3,742	100	0.0298				
1-100	No statin	944	32	0.0401	1.00	100	0.75	0.095
	Statin	1,933	76	0.0301				
101+	No statin	196	32	0.1409	8.53	12	0.38	<0.0001
	Statin	1,211	123	0.0556				

*Cumulative incidence of MACE at 10 years, calculated at observed marginal differences for covariates (means).
†aSHR calculated at 10 years.

ARR = absolute risk reduction; CIF = cumulative incidence function; NNH = number needed to harm; NNT = number needed to treat; other abbreviations as in Tables 1 and 2.

Mitchell, J.D. et al. J Am Coll Cardiol. 2018;72(25):3233–42.

2019 ACC/AHA Guideline on the Primary Prevention of Cardiovascular Disease

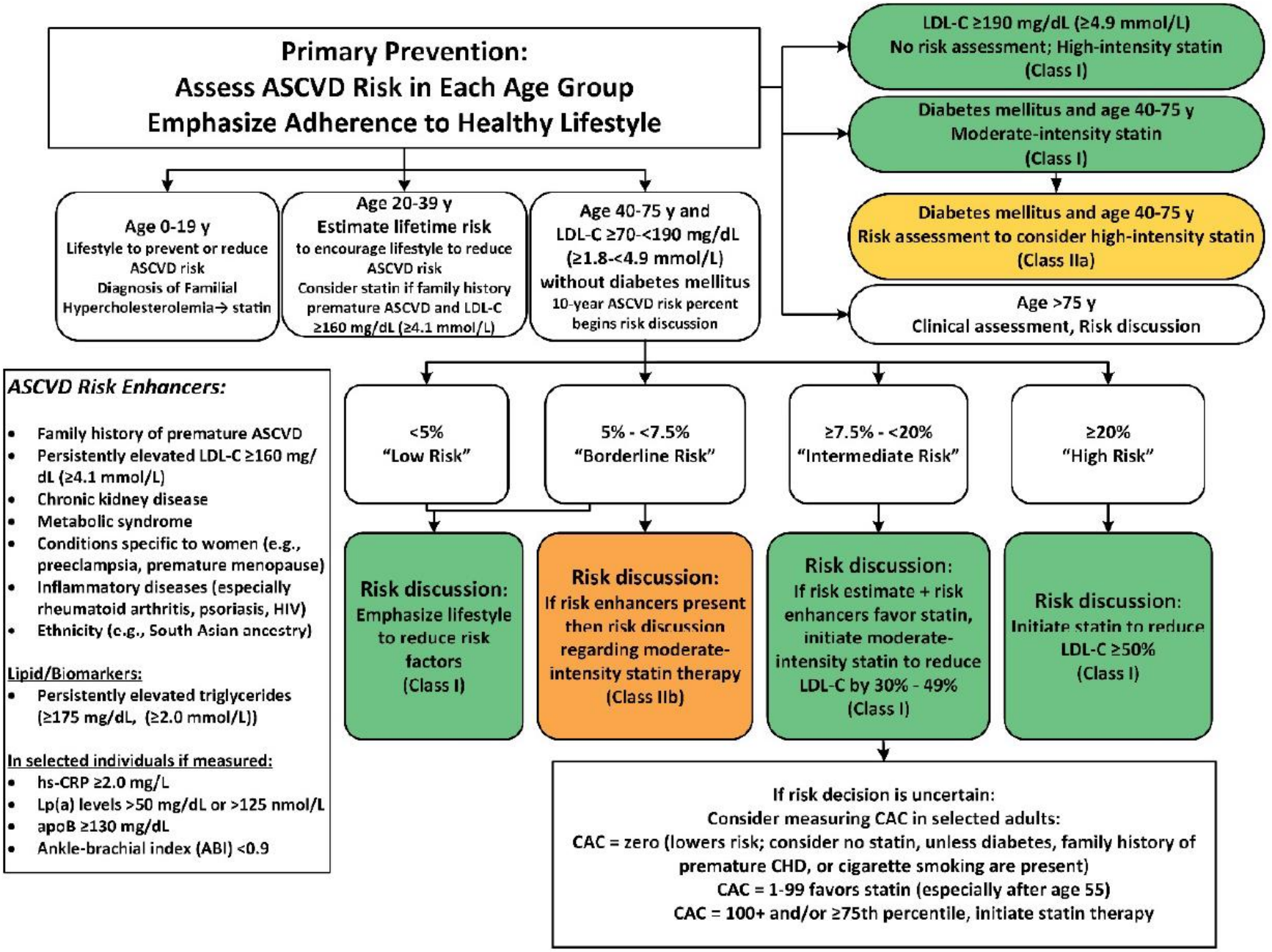
2.2. Assessment of Cardiovascular Risk

Recommendations for Assessment of Cardiovascular Risk Referenced studies that support recommendations are summarized in Online Data Supplement 3.		
COR	**LOE**	**Recommendations**
I	B-NR	1. For adults 40 to 75 years of age, clinicians should routinely assess traditional cardiovascular risk factors and calculate 10-year risk of ASCVD by using the pooled cohort equations (PCE) (S2.2-1, S2.2-2).
IIa	B-NR	2. For adults 20 to 39 years of age, it is reasonable to assess traditional ASCVD risk factors at least every 4 to 6 years (S2.2-1–S2.2-3).
IIa	B-NR	3. In adults at borderline risk (5% to <7.5% 10-year ASCVD risk) or intermediate risk (≥7.5% to <20% 10-year ASCVD risk), it is reasonable to use additional risk-enhancing factors to guide decisions about preventive interventions (e.g., statin therapy) (S2.2-4–S2.2-14).
IIa	B-NR	4. In adults at intermediate risk (≥7.5% to <20% 10-year ASCVD risk) or selected adults at borderline risk (5% to <7.5% 10-year ASCVD risk), if risk-based decisions for preventive interventions (e.g., statin therapy) remain uncertain, it is reasonable to measure a coronary artery calcium score to guide clinician–patient risk discussion (S2.2-15–S2.2-31).
IIb	B-NR	5. For adults 20 to 39 years of age and for those 40 to 59 years of age who have <7.5% 10-year ASCVD risk, estimating lifetime or 30-year ASCVD risk may be considered (S2.2-1, S2.2-2, S2.2-32–S2.2-35).

2019 ACC/AHA Guideline on the Primary Prevention of Cardiovascular Disease

Risk-Enhancing Factors

- **Family history of premature ASCVD** (males, age <55 y; females, age <65 y)
- **Primary hypercholesterolemia** (LDL-C 160–189 mg/dL [4.1–4.8 mmol/L]; non–HDL-C 190–219 mg/dL [4.9–5.6 mmol/L])*
- **Metabolic syndrome** (increased waist circumference [by ethnically appropriate cutpoints], elevated triglycerides [>150 mg/dL, nonfasting], elevated blood pressure, elevated glucose, and low HDL-C [<40 mg/dL in men; <50 mg/dL in women] are factors; a tally of 3 makes the diagnosis)
- **Chronic kidney disease** (eGFR 15–59 mL/min/1.73 m^2 with or without albuminuria; not treated with dialysis or kidney transplantation)
- **Chronic inflammatory conditions,** such as psoriasis, RA, lupus, or HIV/AIDS
- **History of premature menopause (before age 40 y) and history of pregnancy-associated conditions that increase later ASCVD risk, such as preeclampsia**
- **High-risk race/ethnicity** (e.g., South Asian ancestry)
- **Lipids/biomarkers**: associated with increased ASCVD risk
  - Persistently elevated* primary hypertriglyceridemia (≥175 mg/dL, nonfasting);
  - If measured:
    - **Elevated high-sensitivity C-reactive protein** (≥2.0 mg/L)
    - **Elevated Lp(a):** A relative indication for its measurement is family history of premature ASCVD. An Lp(a) ≥50 mg/dL or ≥125 nmol/L constitutes a risk-enhancing factor, especially at higher levels of Lp(a).
    - **Elevated apoB** (≥130 mg/dL): A relative indication for its measurement would be triglyceride ≥200 mg/dL. A level ≥130 mg/dL corresponds to an LDL-C >160 mg/dL and constitutes a risk-enhancing factor
    - **ABI** (<0.9)



Grundy SM, et al. 2018 Cholesterol Clinical Practice Guidelines *Circulation*. 2018

2019 ACC/AHA Guideline on the Primary Prevention of Cardiovascular Disease

Table 6. Selected Examples of Candidates for Coronary Artery Calcium Measurement Who Might Benefit From Knowing Their Coronary Artery Calcium Score Is Zero

Coronary Artery Calcium Measurement Candidates Who Might Benefit from Knowing Their Coronary Artery Calcium Score Is Zero
• Patients reluctant to initiate statin who wish to understand their risk and potential for benefit more precisely • Patients concerned about need to reinstitute statin therapy after discontinuation for statin-associated symptoms • Older patients (men 55–80 y of age; women 60–80 y of age) with low burden of risk factors (S4.4-42) who question whether they would benefit from statin therapy • Middle-aged adults (40–55 y of age) with PCE-calculated 10-year risk for ASCVD 5% to <7.5% with factors that increase their ASCVD risk, although they are in a borderline risk group.

Arnett et al. 2019 ACC/AHA Guideline on the Primary Prevention of Cardiovascular Disease: Executive Summary

Aspirin in primary prevention – A quick Reminder!

2019 ACC/AHA Guideline on the Primary Prevention of Cardiovascular Disease

Recommendations for Aspirin Use Referenced studies that support recommendations are summarized in Online Data Supplements 17 and 18.		
COR	**LOE**	**Recommendations**
IIb	A	1. Low-dose aspirin (75-100 mg orally daily) might be considered for the primary prevention of ASCVD among select adults 40 to 70 years of age who are at higher ASCVD risk but not at increased bleeding risk (S4.6-1–S4.6-8).
III: Harm	B-R	2. Low-dose aspirin (75-100 mg orally daily) should not be administered on a routine basis for the primary prevention of ASCVD among adults >70 years of age (S4.6-9).
III: Harm	C-LD	3. Low-dose aspirin (75-100 mg orally daily) should not be administered for the primary prevention of ASCVD among adults of any age who are at increased risk of bleeding (S4.6-10).

Day/Month/Year

68 F

Asymptomatic. Lifelong ballroom dancer

Coeliac, iron deficiency.

No traditional CV risk factors

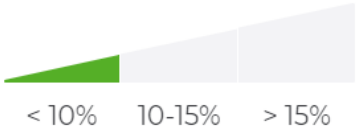
Mother had ? Coronary disease in late 60s..

What would you do?

Australian absolute cardiovascular disease risk calculator

Not secure | http://cvdcheck.org.au/calculator/

8%



This means you are at low risk of developing cardiovascular disease in the next 5 years.

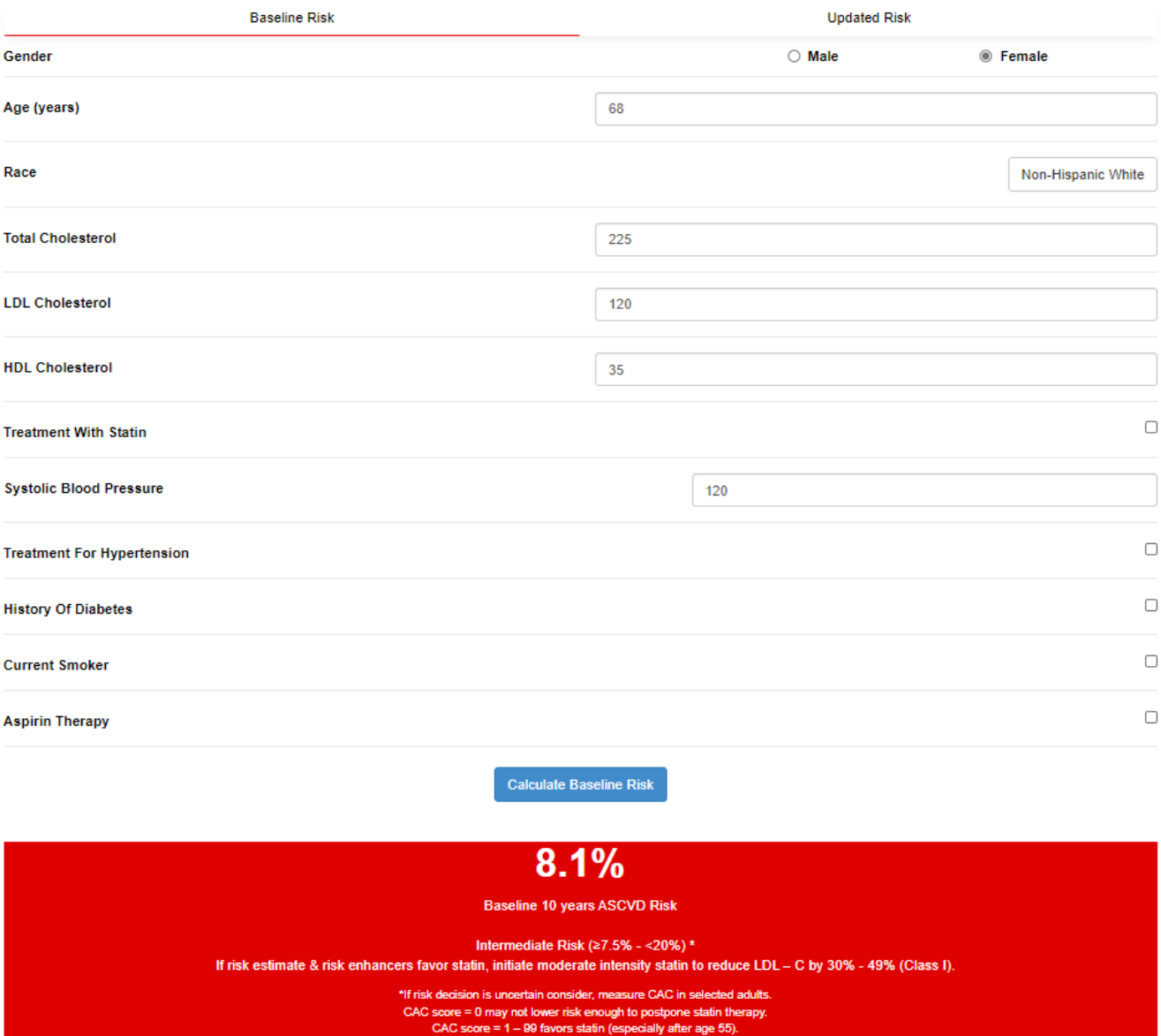
Show additional information

Summary

Gender	Female
Age	68 years
Systolic blood pressure	120 mmHg
Smoking status	No
Total cholesterol	5.8 mmol/L
HDL cholesterol	0.9 mmol/L
Diabetes	No
ECG LVH	No

2018 Prevention Guidelines Tool CV Risk Calculator

AHA/ACC



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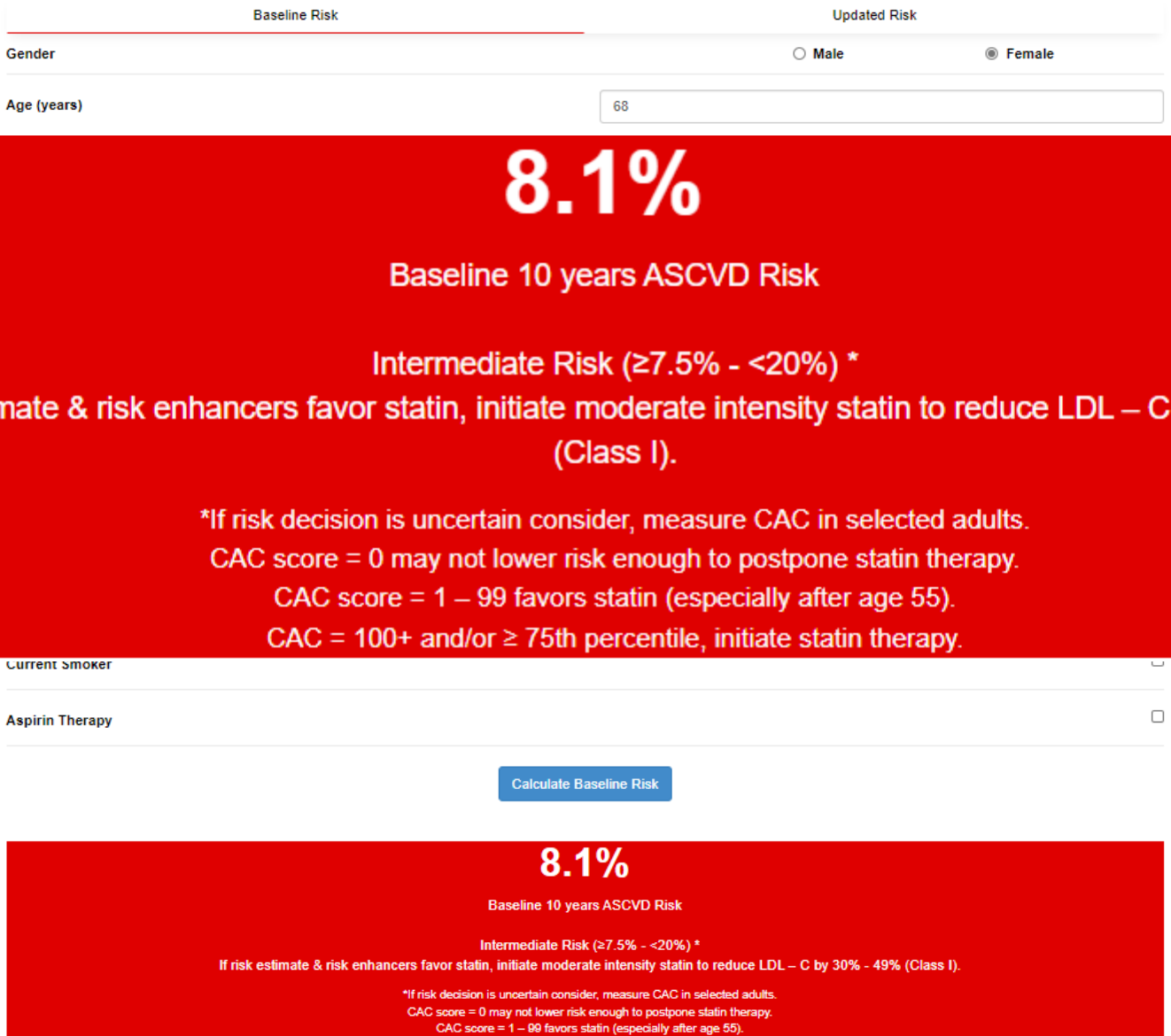
AHA/ACC



Day/Month/Year

68 F

Asymptomatic. Lifelong ballroom dancer

Coeliac, iron deficiency.

No traditional CV risk factors

Mother had ? Coronary disease in late 60s..

Coronary calcium score : 200!

What would you do?

Atherosclerosis
Volume 184, Issue 1, January 2006, Pages 201-206

Framingham risk equation underestimates subclinical atherosclerosis risk in asymptomatic women

Erin D. Michos [a], Khurram Nasir [a, b], Joel B. Braunstein [a], John A. Rumberger [c], Matthew J. Budoff [d], Wendy S. Post [a], Roger S. Blumenthal [a]

https://doi.org/10.1016/j.atherosclerosis.2005.04.004

- 2447 consecutive non-diabetic asymptomatic females (55 ± 10 years).
- Based upon FRE, 90% were classified as low-risk (FRE ≤9% 10-year risk of hard CHD events), 10% intermediate-risk (10–20%), and none were considered as high-risk (>20%).
- Coronary artery calcium was present in 33%. CAC ≥100 – 10% ,and CAC ≥400 - 3%
- Overall, 20% of women had age-gender derived ≥75th percentile CAC.
- According to FRE, the majority (84%) of women with significant CAC ≥75th percentile were classified as low-risk. Approximately half (45%) of low-risk women with ≥2 CHD risk factors and a family history of premature CHD had significant CAC.

https://doi.org/10.1016/j.atherosclerosis.2005.04.004

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ORIGINAL ARTICLE

Coronary Calcium as a Predictor of Coronary Events in Four Racial or Ethnic Groups

Robert Detrano, M.D., Ph.D., Alan D. Guerci, M.D., J. Jeffrey Carr, M.D., M.S.C.E., Diane E. Bild, M.D., M.P.H., Gregory Burke, M.D., Ph.D., Aaron R. Folsom, M.D., Kiang Liu, Ph.D., Steven Shea, M.D., Moyses Szklo, M.D., Dr.P.H., David A. Bluemke, M.D., Ph.D., Daniel H. O'Leary, M.D., Russell Tracy, Ph.D., Karol Watson, M.D., Ph.D., Nathan D. Wong, Ph.D., and Richard A. Kronmal, Ph.D.

Table 4. Risk of Coronary Heart Disease Associated with Coronary-Artery Calcium Score in Four Racial or Ethnic Groups.*

Racial or Ethnic Group	Major Coronary Event†			Any Coronary Event		
	No.	Hazard Ratio (95% CI)‡	P Value	No.	Hazard Ratio (95% CI)‡	P Value
White	41	1.17 (1.06–1.30)	<0.005	74	1.22 (1.13–1.32)	<0.001
Chinese	6	1.25 (0.95–1.63)	0.11	14	1.36 (1.12–1.66)	<0.005
Black	18	1.35 (1.16–1.57)	<0.001	38	1.39 (1.25–1.56)	<0.001
Hispanic	24	1.15 (1.02–1.29)	<0.025	36	1.18 (1.07–1.30)	<0.001

* CAC denotes coronary-artery calcium score, and CI confidence interval.
† Major coronary events were myocardial infarction and death from coronary heart disease.
‡ Hazard ratios were calculated with the use of Cox regression for coronary heart disease (major event and any event) for baseline levels of $\log_2(\text{CAC}+1)$ after adjustment for risk factors and interactions between racial or ethnic group and coronary calcium score and between racial or ethnic group and diabetes (the only significant interaction). Hazard ratios are calculated on the basis of a doubling of CAC+1.

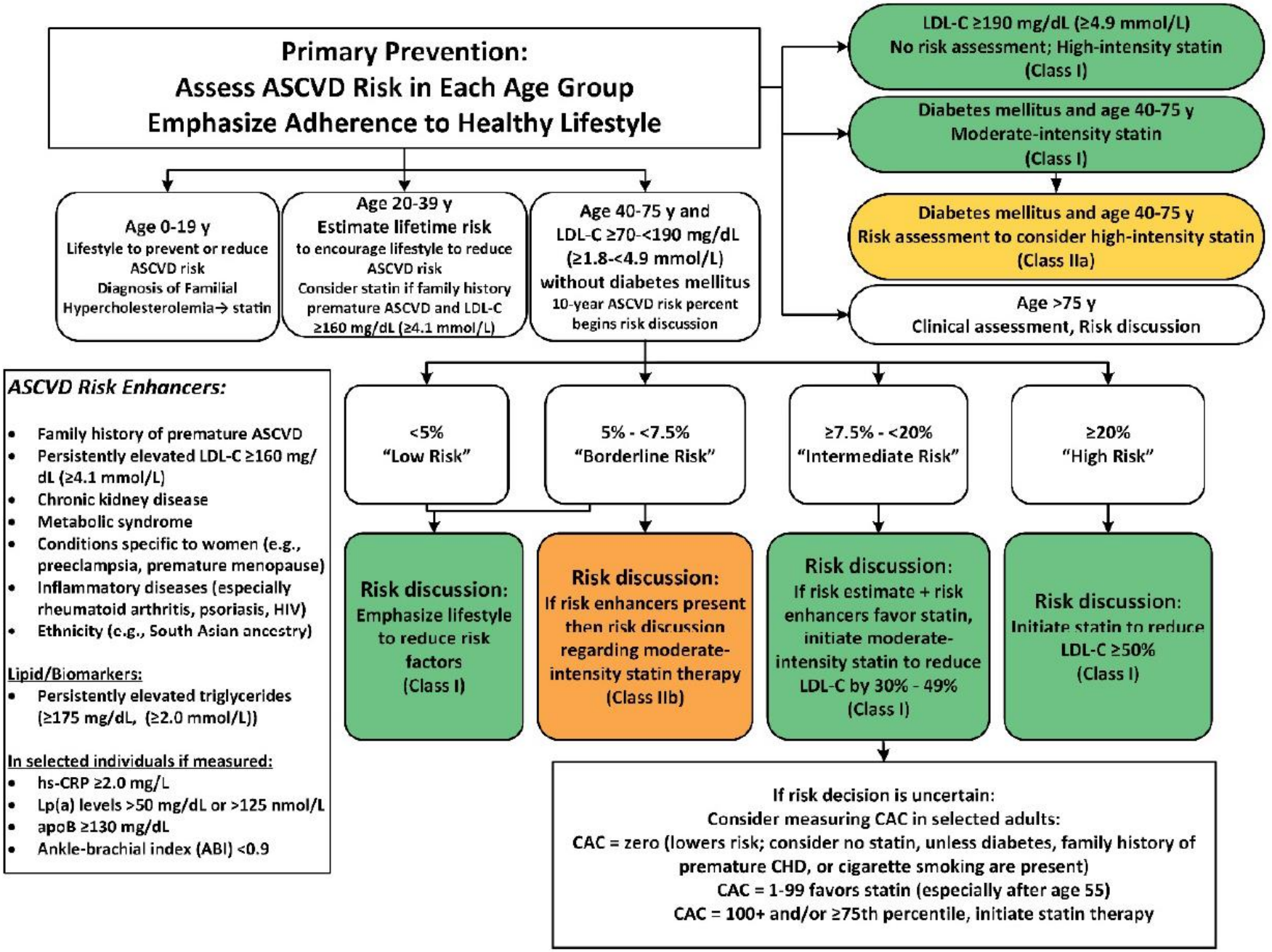
Using Coronary Artery Calcium Scoring as Preventative Health Tool to Reduce the High Burden of Cardiovascular Disease in Indigenous Australians

Hannah R. Kempton, MD, MMed, MSc [a*], Timothy Bemand, MD [b], Nikki K. Bart, MBBS, PhD, FRACP [a], Joseph J. Suttie, MBEth, PhD, FRACP [b,c]

[a]St Vincent's Hospital, Sydney, NSW, Australia
[b]Wagga Wagga Base Hospital, Wagga Wagga, NSW, Australia
[c]Riverina Cardiology, Wagga Wagga, NSW, Australia

- 687 Aboriginal people aged 20–74 years were followed up from a baseline examination in 1992–1995 through to 31 Dec 2003.
- The predicted CHD incidence using the Framingham function was 4.4 per 1000 person-years, while the observed incidence was 11.0 (95% CI, 8.7–13.9) per 1000 person-years.
- The observed number of CHD events (68) was 2.5 times the number predicted (27) using the Framingham function.
- The Framingham function was a particularly unreliable predictor for women, especially younger women, in whom the observed CHD rate was 30 times the predicted rate.

Figure 2. Primary Prevention



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Hispanic	24	1.15 (1.02–1.29)	<0.025	36	1.18 (1.07–1.30)	<0.001

* CAC denotes coronary-artery calcium score, and CI confidence interval.
† Major coronary events were myocardial infarction and death from coronary heart disease.
‡ Hazard ratios were calculated with the use of Cox regression for coronary heart disease (major event and any event) for baseline levels of $\log_2(\text{CAC}+1)$ after adjustment for risk factors and interactions between racial or ethnic group and coronary calcium score and between racial or ethnic group and diabetes (the only significant interaction). Hazard ratios are calculated on the basis of a doubling of CAC+1.

MESA 10-Year CHD Risk with Coronary Artery Calcification Back to CAC Tools

1. Gender	Male ○	Female ◉				
2. Age (45-85 years)	68	Years				
3. Coronary Artery Calcification		Agatston				
4. Race/Ethnicity	**Choose One**					
Caucasian	◉					
Chinese	○					
African American	○					
Hispanic	○					
5. Diabetes	Yes ○	No ◉				
6. Currently Smoke	Yes ○	No ◉				
7. Family History of Heart Attack (History in parents, siblings, or children)	Yes ◉	No ○				
8. Total Cholesterol	225	mg/dL	or	5.8	mmol/L	
9. HDL Cholesterol	35	mg/dL	or	0.9	mmol/L	
10. Systolic Blood Pressure	120	mmHg	or	16.0	kPa	
11. Lipid Lowering Medication	Yes ○	No ◉				
12. Hypertension Medication	Yes ○	No ◉				

Calculate 10-year CHD risk

The estimated 10-year risk of a CHD event for a person with this risk factor profile if we did not factor in their coronary calcium score would be 7.0%.

Footnote to go here

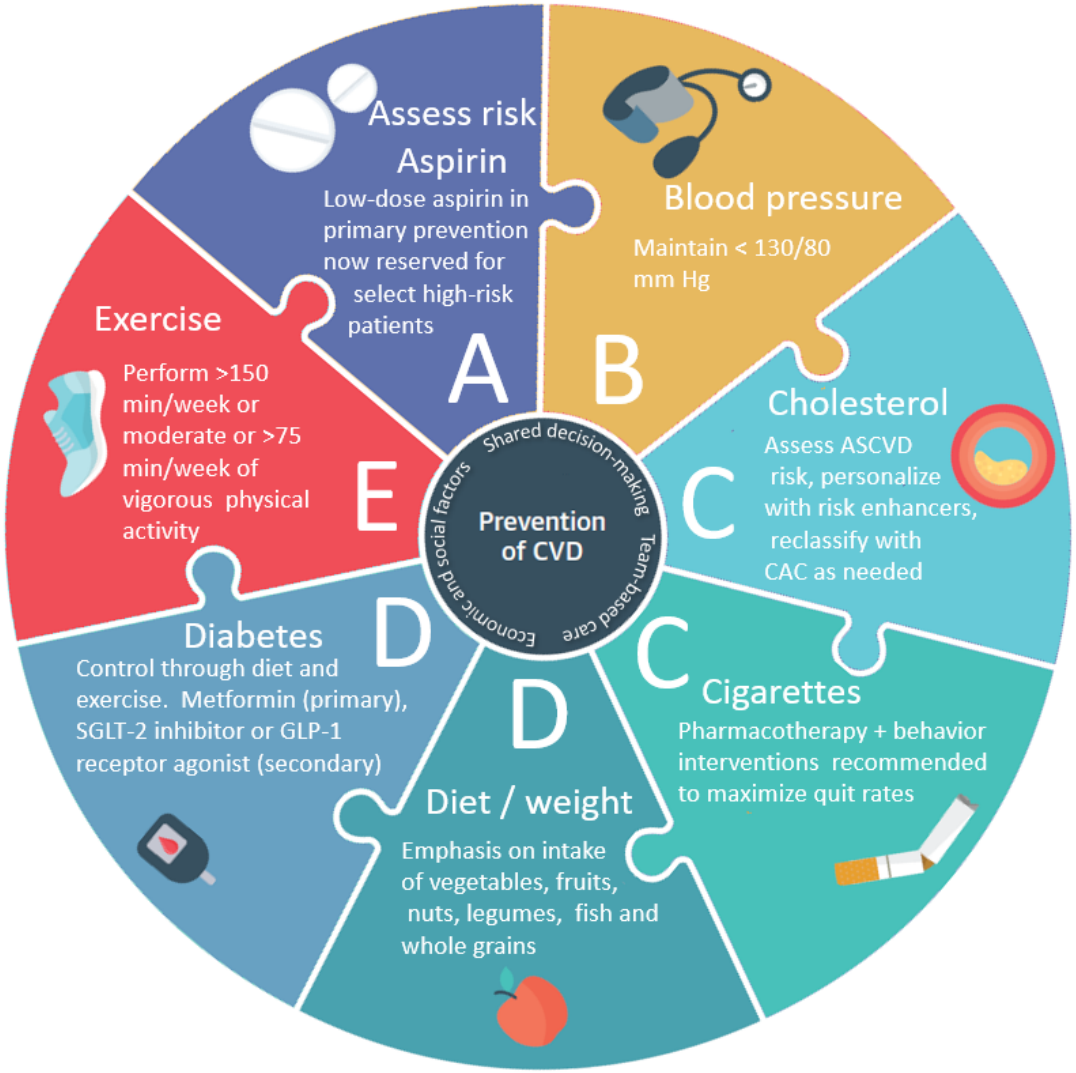
MESA 10-Year CHD Risk with Coronary Artery Calcification Back to CAC Tools

1. Gender	Male ○ Female ◉					
2. Age (45-85 years)	68	Years				
3. Coronary Artery Calcification	200	Agatston				
4. Race/Ethnicity	**Choose One**					
Caucasian	◉					
Chinese	○					
African American	○					
Hispanic	○					
5. Diabetes	Yes ○	No ◉				
6. Currently Smoke	Yes ○	No ◉				
7. Family History of Heart Attack (History in parents, siblings, or children)	Yes ◉	No ○				
8. Total Cholesterol	225	mg/dL	or	5.8	mmol/L	
9. HDL Cholesterol	35	mg/dL	or	0.9	mmol/L	
10. Systolic Blood Pressure	120	mmHg	or	16.0	kPa	
11. Lipid Lowering Medication	Yes ○	No ◉				
12. Hypertension Medication	Yes ○	No ◉				

Calculate 10-year CHD risk

The estimated 10-year risk of a CHD event for a person with this risk factor profile including coronary calcium is 11.7%. The estimated 10-year risk of a CHD event for a person with this risk factor profile if we did not factor in their coronary calcium score would be 7.0%.

Figure 1. ABCDE of Primary Prevention: Lifestyle Changes and Team-Based Care



Symptomatic Patients

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Queensland Government

Suspected Acute Coronary Syndrome Pathway HsTNI Trial Form

The Prince Charles Hospital

(Affix identification label here)

URN:

Family name:

Given name(s):

Address:

Date of birth: Sex: ☐ M ☐ F ☐ I

Presentation with clinical features consistent with an Acute Coronary Syndrome

ECG, HsTNI and MEWS observations on presentation; monitoring until fully evaluated

Aim for LOS < 4 hrs in ED

A recurrence of symptoms requires a reassessment of risk

Tick applicable risk criteria box or boxes

	High Risk Criteria (one or more)	Management
	Ongoing/ repetitive chest pain despite initial ED treatment	• Suspected **STEMI**: ED to call 3139 4004 **NSTEACS, COALA/NMR to review and manage patient** • Second ECG and HsTnI at 3 hr • Refer for admission or transfer • Admit to monitored bed even if second troponin negative • Consider DAPT and/or anticoagulation only required if trop positive • Low elevated HsTnI with negative Z score; COALA to discuss with allocated cardiology consultant.
	Ischaemic ECG changes	
	First troponin I (HsTnI) ≥10 ng/L – Female; ≥20ng/L – Male	
	Left Ventricular Ejection Fraction (LVEF) <40%	
	Sustained ventricular tachycardia	
	Hemodynamic compromise	
	Syncope	
	Acute Myocardial Infarction (AMI), Percutaneous Coronary Intervention (PCI) or Coronary Bypass Grafting (CABG) In the past 6months	
	Intermediate Risk	**Cardiology Management**
	No high-risk criteria	** **Refer 2nd troponin plan overleaf** ** **07:30 to 22:00** • Refer to CPAS (see overleaf for CPAS criteria) or refer to COALA/NMR **22:00 to 07:30** • Night medical registrar (NMR) can discharge patient if CPAS criteria is met *refer overleaf. • Ensure documentation complete, patient is allocated to a cardiologist prior to D/C, patient receives D/C paperwork. Handover sheet to be handed to CPAS Case Manager next am.
	Not low risk	
	Low Risk (All low risk criteria)	**Manage in ED Acute / SSU**
	≤ 40 years old	**Repeat HsTnI, ECG and MEWS observations at 2hrs** Monitoring not required **If 2nd HsTnI and z score negative, and ECG shows no ischaemic changes** • No further objective testing recommended • Discharge summary • Written advice for what to do if gets further pain • GP follow up for risk factor modification
	ECG no ischaemic changes	
	Absence of known CAD	
	First troponin I (HsTnI) <10 ng/L – Female < 20ng/L – Male	
	No cardiac risk factors* see definitions overleaf	
	eGFR > 60ml/min	
	Pain free after initial treatment in ED.	
	No other concerns via ED senior clinical judgement	

Name:	Designation:
Signature:	Date:

Page 1 of 2

SUSPECTED ACS PATHWAY HSTNI TRIAL FORM

Queensland Government

Suspected Acute Coronary Syndrome Pathway

THE PRINCE CHARLES HOSPITAL

(Affix identification label here)

URN:

Family name:

Given name(s):

Address:

Date of birth: Sex: ☐ M ☐ F ☐ I

CPAS Admission Criteria

	Symptom free for 30mins post analgesia – if ongoing symptoms – ED to discuss with COALA/NMR, to decide on suitability for CPAS. If patient seen by CPAS – CPAS to discuss with COALA/NMR.
	Normal / non-diagnostic ECG
	Negative troponin
	Non-cardiac cause unlikely e.g. normal LFT's, FBC and CXR
	No contraindications to EST, ESE, MPS or CTCA
	Observations within normal limits; MEWS 0
	Euvolemic
	No significant electrolyte disturbance e.g. K+ < 3 or >5.5, Na= < 128, acute renal failure
	Can be safely discharged home if second TNI is negative

CPAS patients should not have any other complex, unmanaged medical or social problems that would unnecessarily extend their length of stay or obviously require further inpatient treatment or review.

If Patient does not meet CPAS admission criteria refer to COALA

*Definitions: Cardiac risk factors for Low Risk Patients

	Diabetes	Yes to any – for intermediate risk pathway
	Coronary heart disease	
	Regular aspirin use	

If more than one of the following - for intermediate risk pathway

	Hypertension: Treated or untreated, formally diagnosed by a medical practitioner
	Family History: CAD in first degree male relative< 55 or first degree female relative < 65yrs of age
	Active Smoking: Any routine/habitual smoking (regardless of quantity) in the past 12 months.
	Dyslipidaemia: Treated or untreated: any history of dyslipidaemia diagnosed by a medical practitioner

Intermediate risk patients: Second troponin test (Performed and followed up by CPAS/COALA or NMR)
If inpatient Test possible – 2-hour troponin
If outpatient test planned – 3-hour troponin

DO NOT WRITE IN THIS BINDING MARGIN

Management of Patients at High Risk of ACS

	High Risk Criteria (one or more)	Management
	Ongoing/ repetitive chest pain despite initial ED treatment	• Suspected **STEMI:** ED to call 3139 4004 **NSTEACS, COALA/NMR to review and manage patient** • Second ECG and HsTnI at 3 hr • Refer for admission or transfer • Admit to monitored bed even if second troponin negative • Consider DAPT and/or anticoagulation only required if trop positive • Low elevated HsTnI with negative Z score; COALA to discuss with allocated cardiology consultant.
	Ischaemic ECG changes	
	First troponin I (HsTnI) ≥10 ng/L – Female; ≥20ng/L – Male	
	Left Ventricular Ejection Fraction (LVEF) <40%	
	Sustained ventricular tachycardia	
	Hemodynamic compromise	
	Syncope	
	Acute Myocardial Infarction (AMI), Percutaneous Coronary Intervention (PCI) or Coronary Bypass Grafting (CABG) In the past 6months	

Management of Patients at low risk of ACS

	ECG no ischaemic changes
	Absence of known CAD
	First troponin I (HsTnI) <10 ng/L – Female < 20ng/L – Male
	No cardiac risk factors* see definitions overleaf
	eGFR > 60ml/min
	Pain free after initial treatment in ED.
	No other concerns via ED senior clinical judgement

Repeat HsTnI, ECG and MEWS observations at 2hrs

Monitoring not required

If 2nd HsTnI and z score negative, and ECG shows no ischaemic changes

- No further objective testing recommended
- Discharge summary
- Written advice for what to do if gets further pain

Definitions of Cardiac Risk factors

*Definitions: Cardiac risk factors for Low Risk Patients	
Diabetes	Yes to any – for intermediate risk pathway
Coronary heart disease	
Regular aspirin use	
If more than one of the following - for intermediate risk pathway	
Hypertension: Treated or untreated, formally diagnosed by a medical practitioner	
Family History: CAD in first degree male relative< 55 or first degree female relative < 65yrs of age	
Active Smoking: Any routine/habitual smoking (regardless of quantity) in the past 12 months.	
Dyslipidaemia: Treated or untreated: any history of dyslipidaemia diagnosed by a medical practitioner	

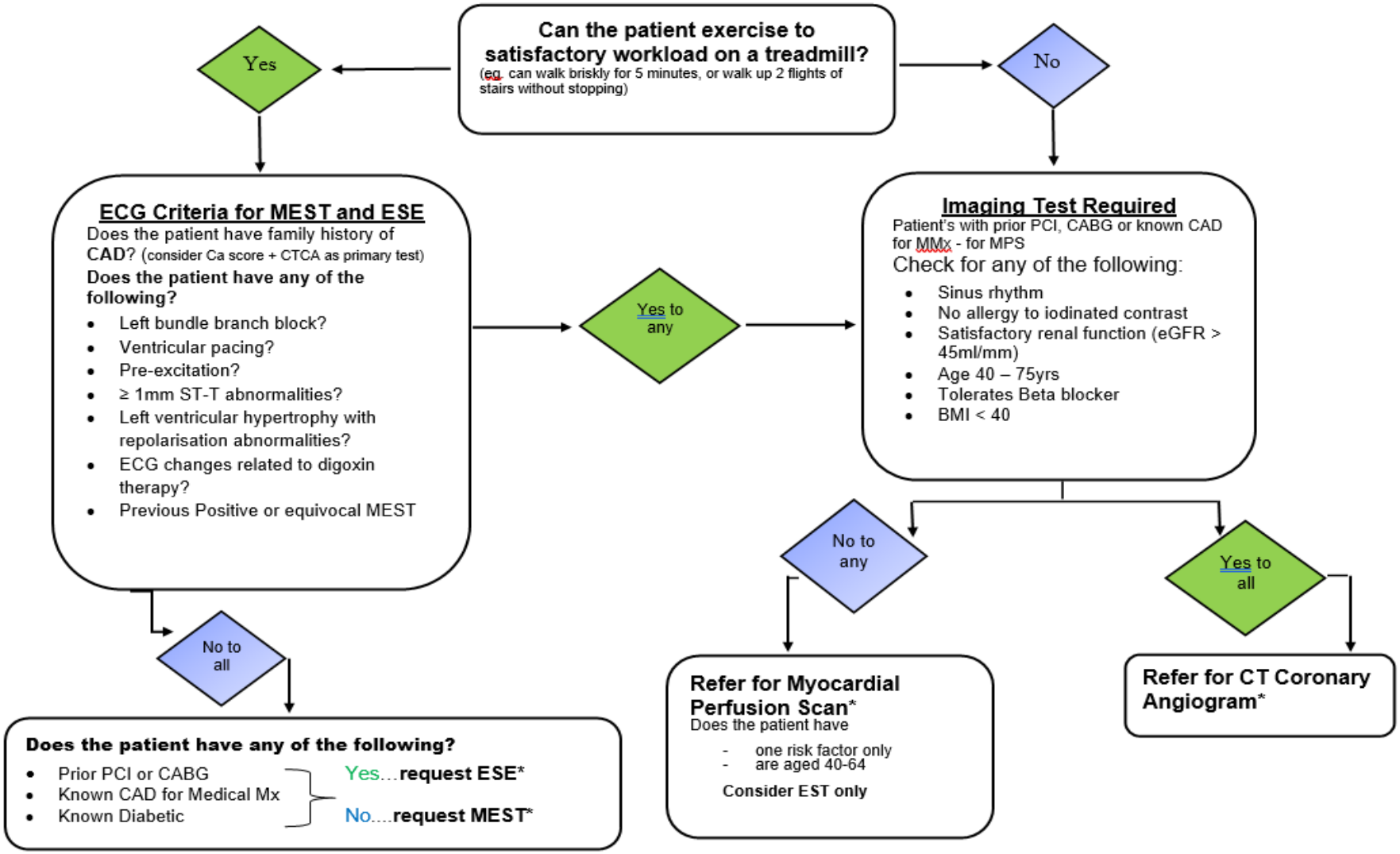
Intermediate Risk of ACS

	No high-risk criteria	** **Refer 2nd troponin plan overleaf** ** **07:30 to 22:00** • Refer to CPAS (see overleaf for CPAS criteria) or refer to COALA/NMR **22:00 to 07:30** • Night medical registrar (NMR) can discharge patient if CPAS criteria is met *refer overleaf. • Ensure documentation complete, patient is allocated to a cardiologist prior to D/C, patient receives D/C paperwork. Handover sheet to be handed to CPAS Case Manager next am.
	Not low risk	

Day/Month/Year here

CPAS TPCH

Decision Tree for CPAS Intermediate/ low Intermediate ACS Risk Testing



Do we always get it right?

Some interesting cases

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Day/Month/Year

71 Female: THR workup

Asymptomatic. High Calcium Score

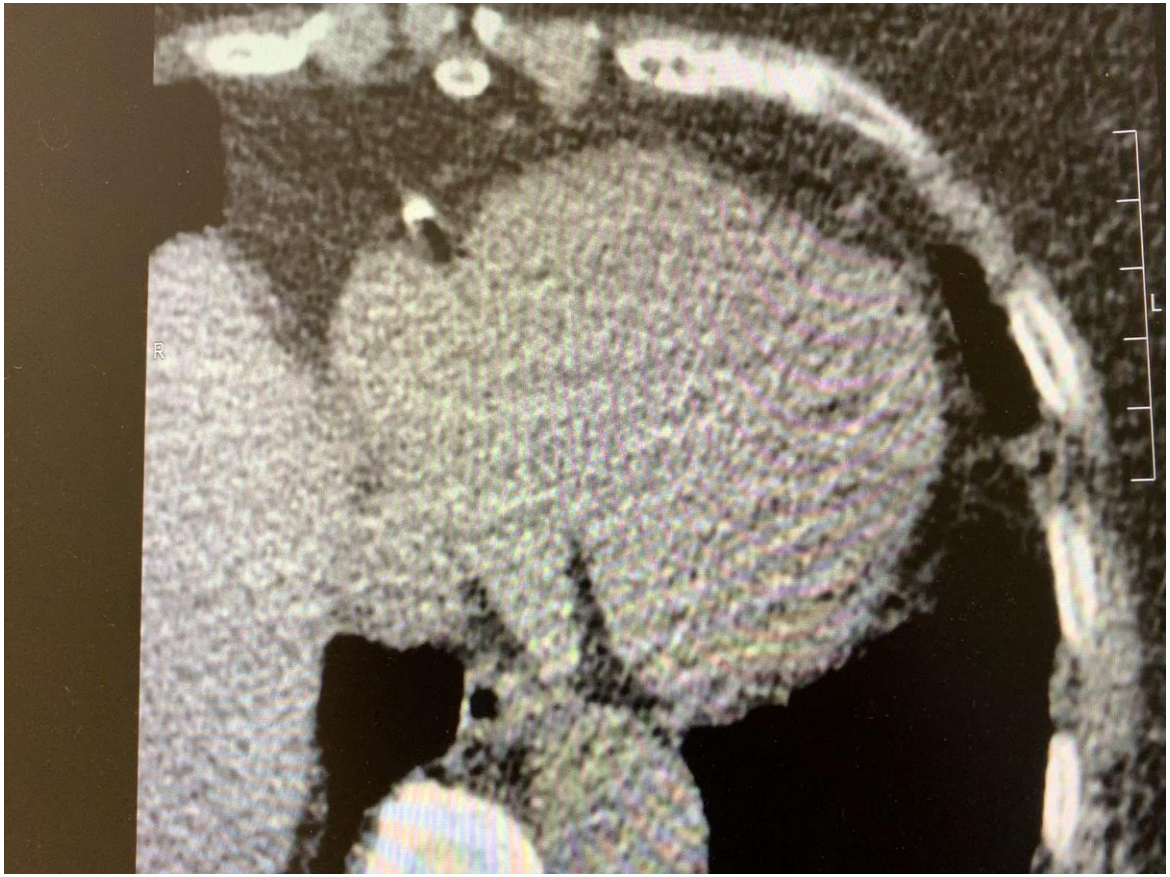
- HTN
- Previous stroke
- OA
- Left hepatic artery aneurysm
- Mild emphysema
- Dyslipidaemia
- Gout

Day/Month/Year

71 Female: THR workup

Artery	Lesions	Volume / mm³	Equiv. Mass / mg	Score
LM	1	138.2	31.65	175.0
LAD	2	670.6	160.82	863.4
CX	3	482.4	104.08	604.3
RCA	1	877.3	234.60	1151.9
Total	**7**	**2168.4**	**531.16**	**2794.6**
U1	1	4.8	0.70	3.0
U2	0	0.0	0.00	0.0

71 Female: THR workup



Day/Month/Year

DSE

Resting 12-Lead ECG: Sinus rhythm at a rate of 84 bpm.

Exam Protocol: Dobutamine was infused in increasing doses up to a maximum of 40 mcg/kg/min. A total of 600 mcg of Atropine was given during the dobutamine infusion.

Stress 12-Lead ECG: The peak heart rate achieved was 131 bpm, representing 87 % of age predicted maximum heart rate. The patient developed isolated ventricular ectopy and isolated supraventricular ectopy during dobutamine protocol. There were mild ST elevation inferiorly and ST depression laterally at peak stress.

Patient Tolerance: The resting blood pressure was 145/77 mmHg. There was a hypotensive BP response to the dobutamine infusion. The peak BP was 117/53 mmHg. The patient developed no symptoms during the stress exam.

Baseline Echo Findings: The left ventricular internal cavity size was normal. Overall LV systolic function was normal. EF = 71 %. No evidence of left ventricular hypertrophy. There were no resting regional wall motion abnormalities detected.

Low Dose Dobutamine: (10 ug/kg/min).

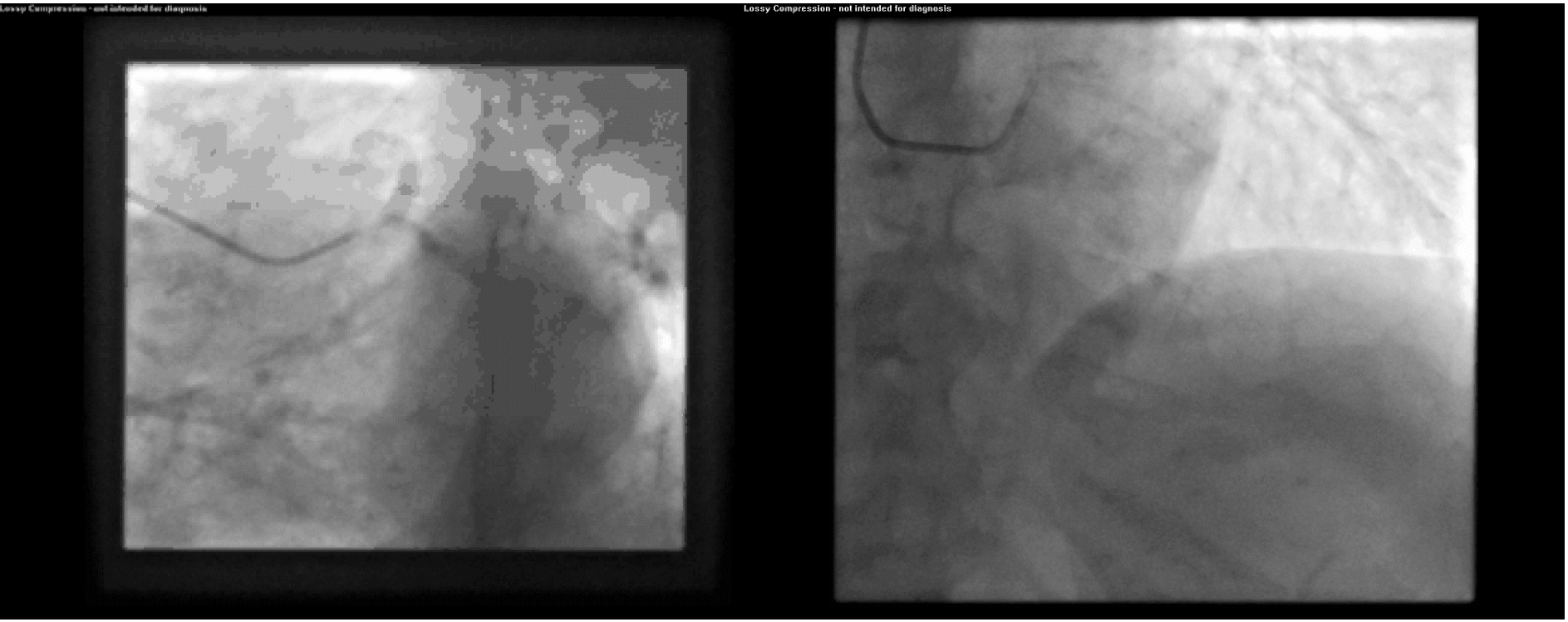
At low dose there was normal augmentation and motion of all left ventricular wall segments.

High Dose Dobutamine:

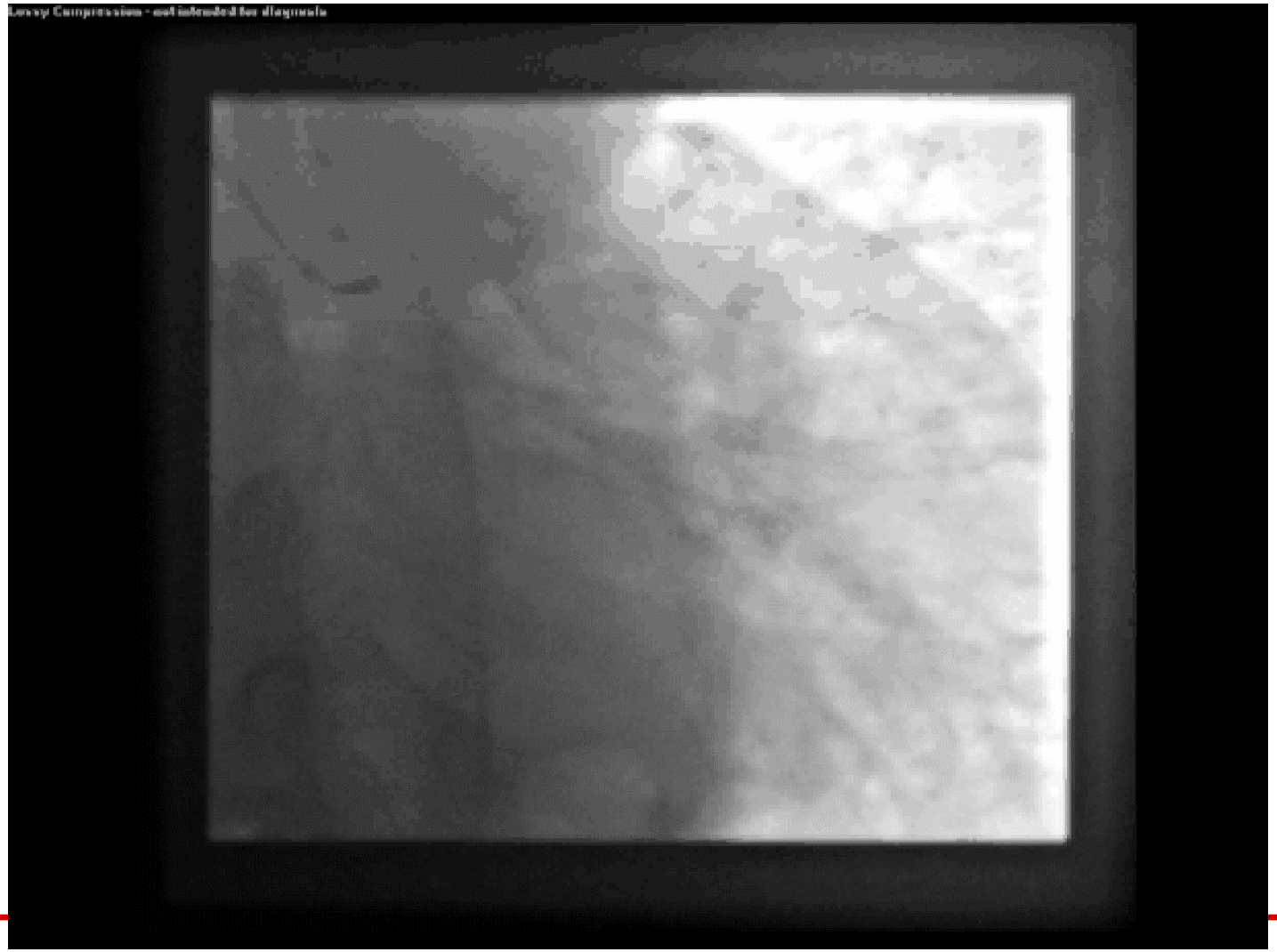
40 ug/kg/min: Continued augmentation in all LV wall segments with no evidence of ischaemia.
40 ug/kg/min: + 600 mcg of Atropine. Mild hypokinesis in the basal inferoseptal segment. Continued augmentation in all other LV wall segments. Appropriate improvement in overall systolic function.

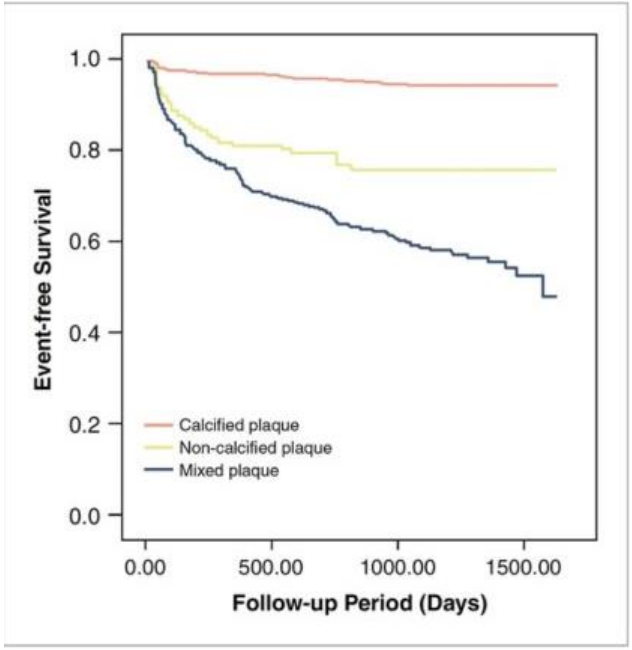
Day/Month/Year

ACS Post THR (!)



Day/Month/Year
ACS Post THR (!)





Kaplan–Meier estimates of survival from MACE for patients with calcified, mixed, and noncalcified plaque identified on CCTA. Reproduced from Hou et al.39
Abbreviations: CCTA, coronary computed tomography angiography; MACE, major adverse cardiac events

JACC Cardiovasc Imaging. 2012 Oct;5(10):990-9