Evaluating clinical Risk and Guiding management with SPECT imaging.

A/Professor Nathan Better
University of Melbourne
Cardiologist and Deputy Director of Nuclear Medicine
Royal Melbourne Hospital

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Presentation

1. Case study
2. Indications for Nuclear cardiology
3. Diagnosis v. prognosis – perfusion & function
4. Guiding management
5. Radiation reduction – how do we incorporate it into our daily routine?

54 yo male - Asymptomatic

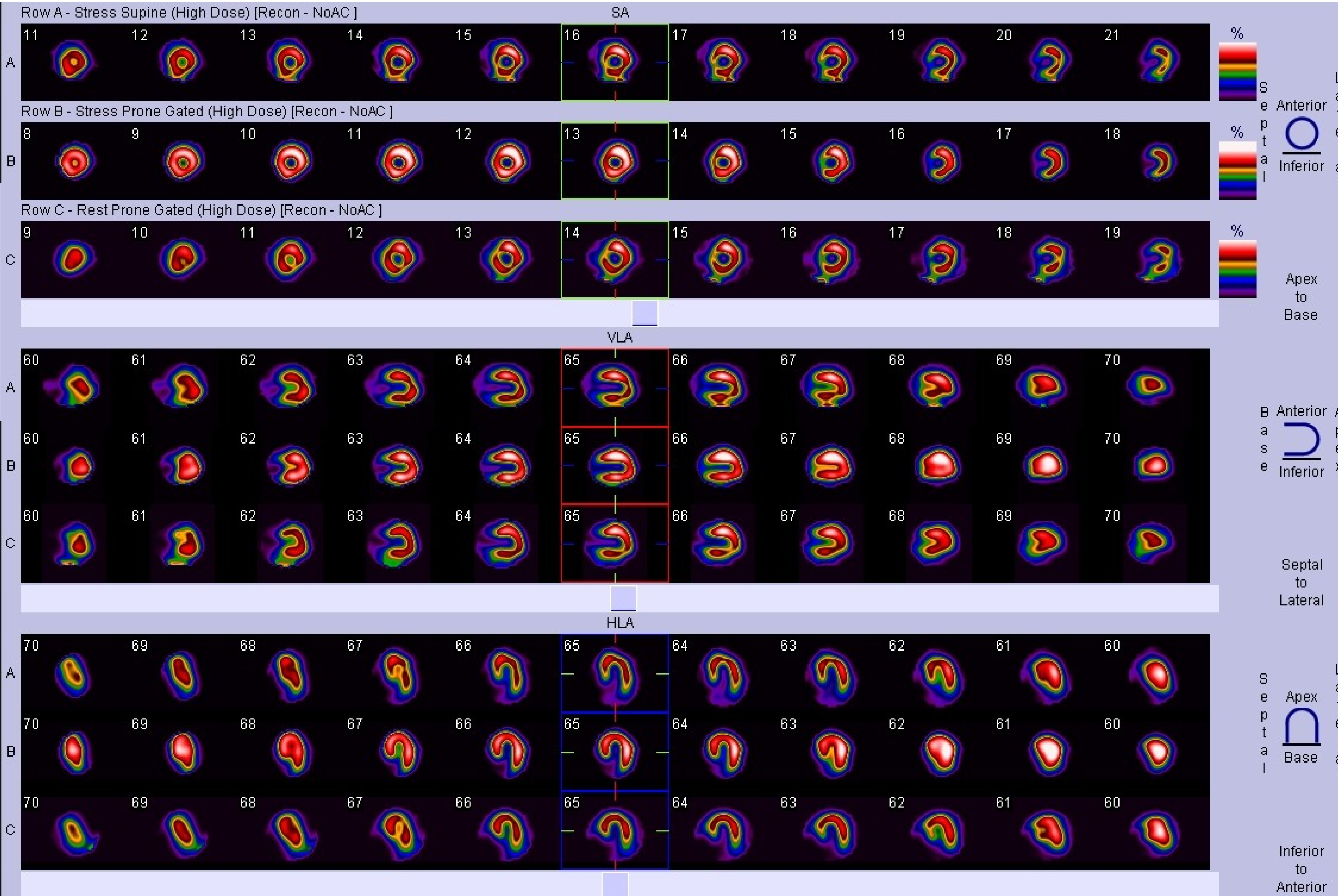
- Diabetic.
- Strong FH
- Smoker

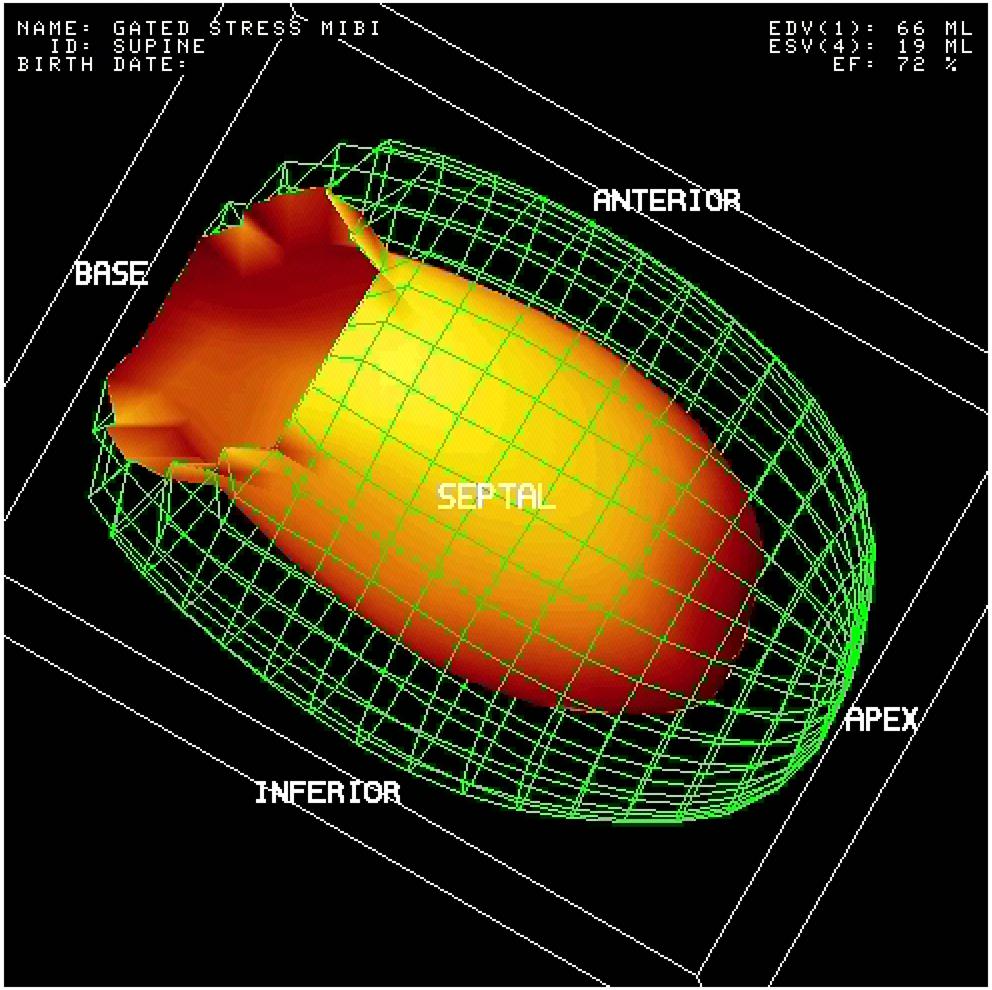
- Appropriate or not for MPI?
  – Let’s vote

MPI for Asymptomatic pts Feb 2011 Hendel et al JNC

Indication	*Appropriate use score (1-9)*
Detection of CAD/risk assessment	
High CHD risk (ATP III risk criteria)	***A (7)***
Intermediate CHD risk (ATP III risk criteria) ECG uninterpretable	***U (5)***
Intermediate CHD risk (ATP III risk criteria) ECG interpretable	***I (3)***
Low CHD risk (ATP III risk criteria)	***I (1)***
Risk assessment with prior coronary calcium Agatston Score	
Agatston score less than 100	***I (2)***
Agatston score between 100 and 400 Low to intermediate CHD risk	***U (5)***
Agatston score between 100 and 400 High CHD risk	***A (7)***
Agatston score greater than 400	***A (7)***

Risk assessment: post-revascularization (PCI or CABG)*	
Incomplete revascularization ***Additional revascularization feasible***	***A (7)***
Greater than or equal to 5 years after CABG	***A (7)***
Less than 5 years after CABG	***U (5)***
Greater than or equal to 2 years after PCI	***U (6)***
Less than 2 years after PCI	***I (3)***
Risk assessment with normal prior stress imaging study	
Last stress imaging study done more than or equal to 2 years ago ***Intermediate to high CHD risk (ATP III risk criteria)***	***U (6)***
Last stress imaging study done less than 2 years ago ***Low CHD risk (ATP III risk criteria)***	***I (1)***
Last stress imaging study done less than 2 years ago ***Intermediate to high CHD risk (ATP III risk criteria)***	***I (3)***
Last stress imaging study done more than or equal to 2 years ago ***Low CHD risk (ATP III risk criteria)***	***I (3)***
Risk assessment with abnormal prior stress imaging study, no prior revascularization	
Poor exercise tolerance (less than or equal to 4 METs) ***Intermediate clinical risk predictors***	***U (5)***
Known CAD on coronary angiography OR prior abnormal stress imaging study ***Last stress imaging study done less than 2 years ago***	***I (3)***
Risk assessment: within 3 months of an ACS—asymptomatic post-revascularization (PCI or CABG)	
Evaluation prior to hospital discharge	***I (1)***


Row A - Stress Supine (High Dose) [Recon - NoAC]
SA
11 12 13 14 15 16 17 18 19 20 21
Row B - Stress Prone Gated (High Dose) [Recon - NoAC]
8 9 10 11 12 13 14 15 16 17 18
Row C - Rest Prone Gated (High Dose) [Recon - NoAC]
9 10 11 12 13 14 15 16 17 18 19
%
Septal
Anterior
Inferior
Lateral
Apex to Base
VLA
60 61 62 63 64 65 66 67 68 69 70
Base
Anterior
Inferior
Apex
Septal to Lateral
HLA
70 69 68 67 66 65 64 63 62 61 60
Septal
Apex
Base
Lateral
Inferior to Anterior


NAME: GATED STRESS MIBI
ID: SUPINE
BIRTH DATE:
EDV(1): 66 ML
ESV(4): 19 ML
EF: 72 %
ANTERIOR
BASE
SEPTAL
APEX
INFERIOR

RAO

Diagnosis

NORMAL!!

But….. Is there more information??


A
Symbia T2
syngo CT 2007E>Symbia T2>8.5.10.6 SP1>VA60A
FFS
R
10cm
CQ !
kV 130
eff.mAs 14
TI 0.8
GT 0.0
500 0/0
B08s L3C0 A2
W 600
C 200

SPECT and calcium scoring – complimentary data
Chang et al JACC 11/09

n = 1126 F/U over 6.9 years

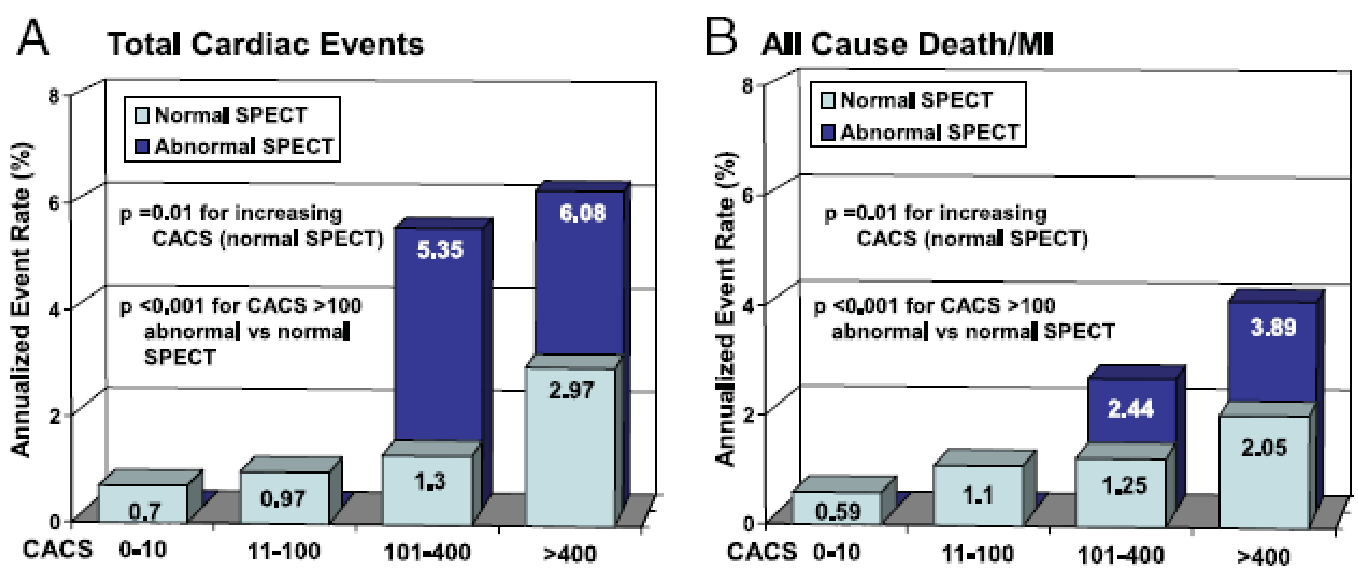


Figure 5 Adjusted Annualized Event Rates Based on CACS and SPECT Results

Adjusted annualized total cardiac death, MI, and coronary revascularization (**A**) and all-cause death/MI (**B**) event rates based on CACS and SPECT results. Abbreviations as in Figures 1 and 2.

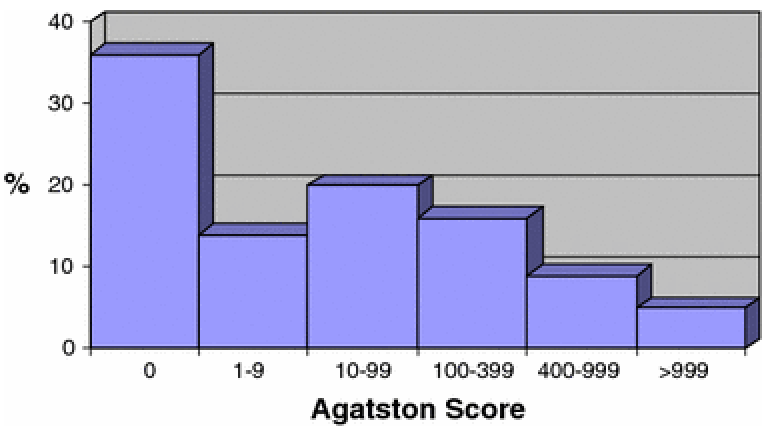
Final Management

- Pt reassured that symptom non-cardiac
- Prognosis good – or is it??
- Do we now use a statin and aspirin?

PET/CT and Calcium scores

Bybee et al JNC 4/10

Normal PET



n =760. No CAD

At start, 52 % on ASA, 49 % statin

At 30/7,

43 % had Rx added or increased.
CAC > 400 increases this x 2!!

INDICATIONS FOR NUCLEAR CARDIOLOGY

DIAGNOSTIC

1. Chest pain FI - Equivocal ex. ECG, baseline ECG changes (LBBB, BBB, old MI, Digoxin, etc)
2. Atypical syndromes - SOB, etc.
3. Acute chest pain syndromes - “Hot” MIBIs
4. Pharmacological testing

INDICATIONS FOR NUCLEAR CARDIOLOGY

PROGNOSTIC

1. Post MI – early and late (risk stratification)
2. Significance of a specific lesion
3. Myocardial viability
4. Risk of non-cardiac surgery
5. Gated blood pool scans – chemotherapy, congenital, suboptimal echo, accurate LVEF and RVEF. Role with exercise.

NUCLEAR CARDIOLOGY - Diagnosis

- Sensitivity 80-90 %
- Specificity 80-90 %

- Thallium-201 = Tc 99 sestamibi
  - Kiat et al AHJ 1990

Diagnostic accuracy of MPI without post-test referral... Johansen et al JNC 10/05

357 pts with stable angina referred for angiography.

Rest Thallium/stress MIBI (gated) (50% pharm)

Physicians blinded to result.

MPI- normal 215, reversible 118, fixed 24.

Angio- normal 231, abnormal 126

MPI result blinded.

Sensitivity = 75 %, Specificity =79 %

For 3VD p=.05, Overall trend p <.0001

Normal Tc-99m tetrofosmin study

- 4728 pts. 5 U.S. sites
- 1/3 adenosine SPECT. 2/3 exercise SPECT
- 0.6 % annualised mortality rate

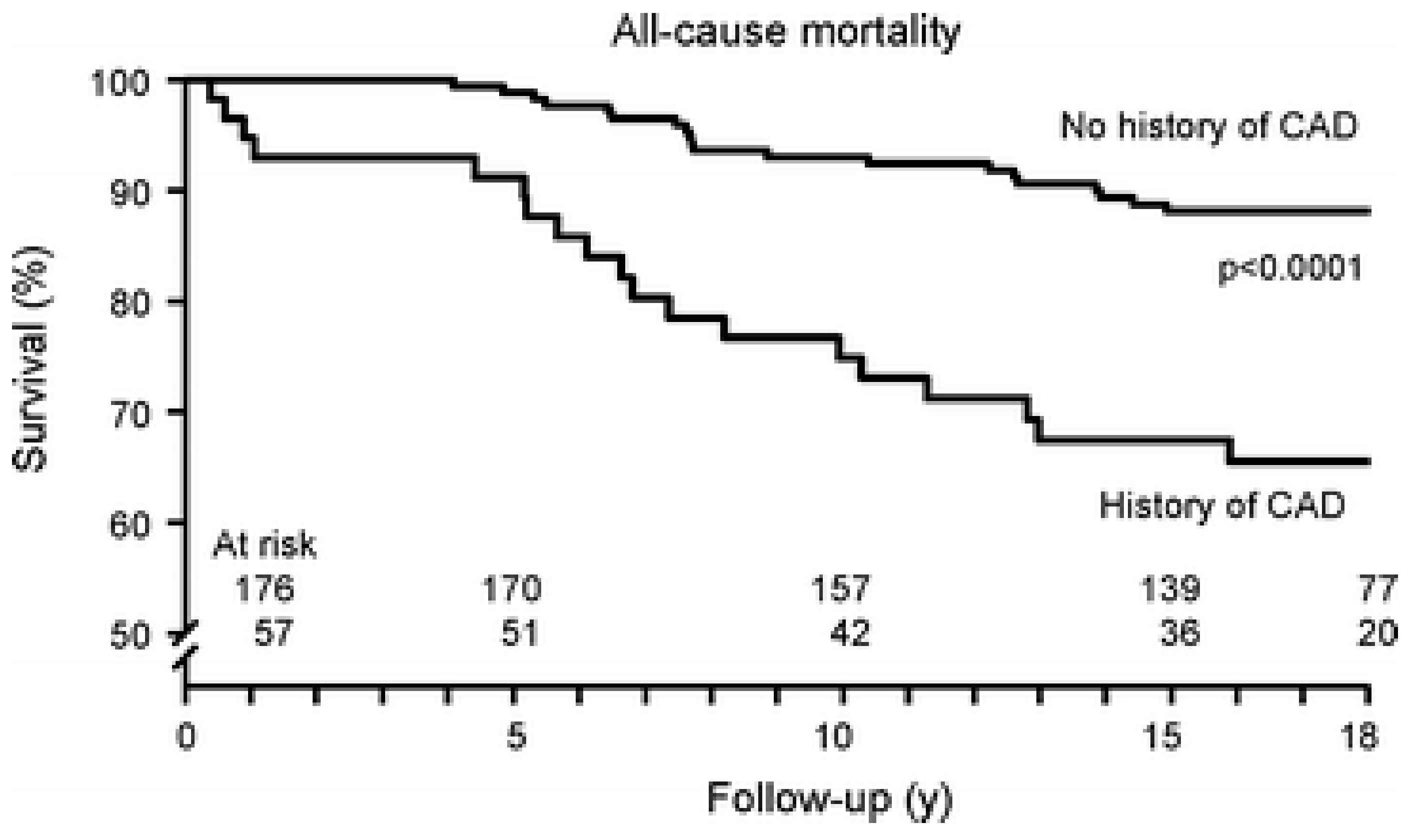
L.Shaw et al….JNM 2/03

15-Year outcome after normal exercise 99mTc-sestamibi myocardial perfusion imaging: What is the duration of low risk after a normal scan? Schinkel et al JNC 6/12

Event	Annualised event rate
All-cause mortality	1.1%
Cardiac mortality	0.3 %
Cardiac death/MI	0.7 %
Major cardiac event rate	1.8 %

15-Year outcome after normal exercise 99mTc-sestamibi myocardial perfusion imaging: What is the duration of low risk after a normal scan?

Schinkel et al JNC 6/12



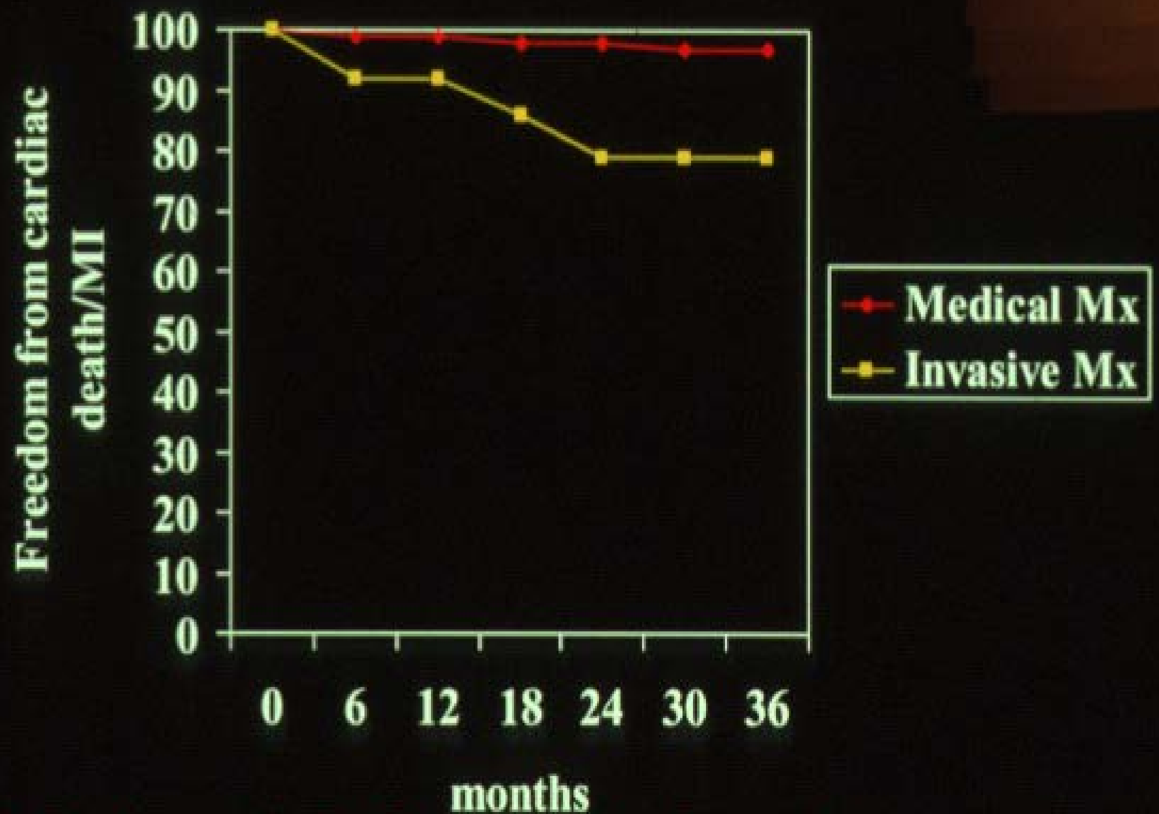
Non high risk IHD.. O'Keefe et al JNC 2/98

- Exercise or pharmacological testing
- n= 3374. 3 year follow-up. Retrospective.
- High risk = 2/3 of multivessel ischaemia, LAD ischaemia or increased lung uptake
- Non high risk = ischaemia, but not above

1352 / 3374 – 116 cath, 99 revascularised
1236 medical Mx

Non-high risk IHD

O'Keefe et al …JNC 2/98



P = .0091

Referral for invasive MX = only independent correlate of CER

Comparison of short time survival with Revascularisation v. Medical Therapy

Hachamovitch et al Circ 6/03

n = 10,627 pts

No prior CAD. Ex or adenosine sestamibi SPECT

Treatment within 60 days

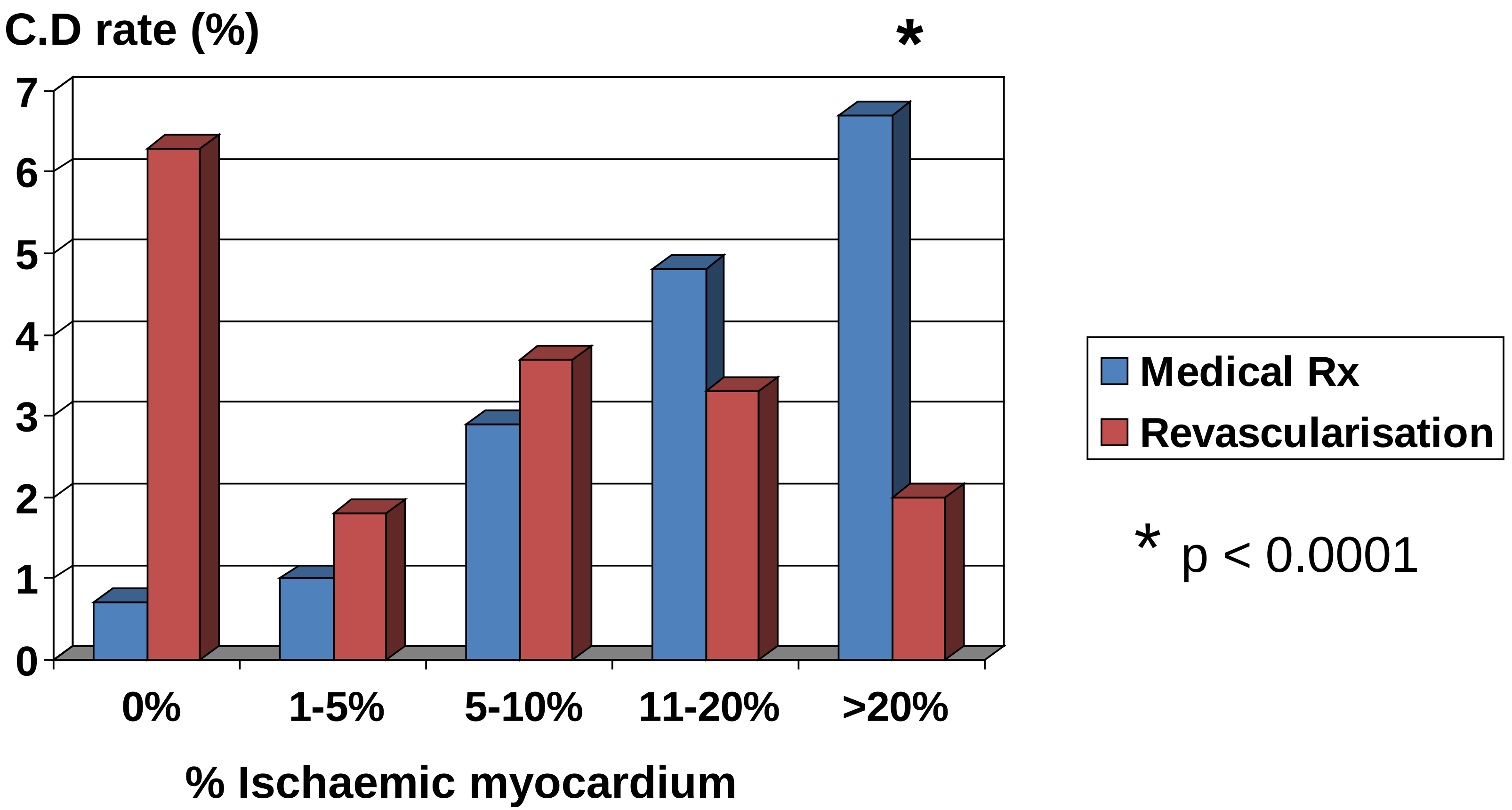
671 pts revasc v. 9956 pts medical Rx

146 patients died

90.6 % patients followed for 1.9 $\pm$ 0.6 years

Comparison of short time survival with Revascularisation v. Medical Therapy

Hachamovitch et al Circ 6/03



* $p < 0.0001$

Comparison of short time survival with Revascularisation v. Medical Therapy

Hachamovitch et al Circ 6/03

Conclusions

Survival benefit for revascularisation if –

- > 12.5 % myocardium ischaemic
- high risk patients (elderly, women, diabetics)

Normal MIBI in proven CAD.

Yang et al…NMC 4/06

Coronary angio + / MIBI –

n = 90. 50 +/- 19 month follow-up.

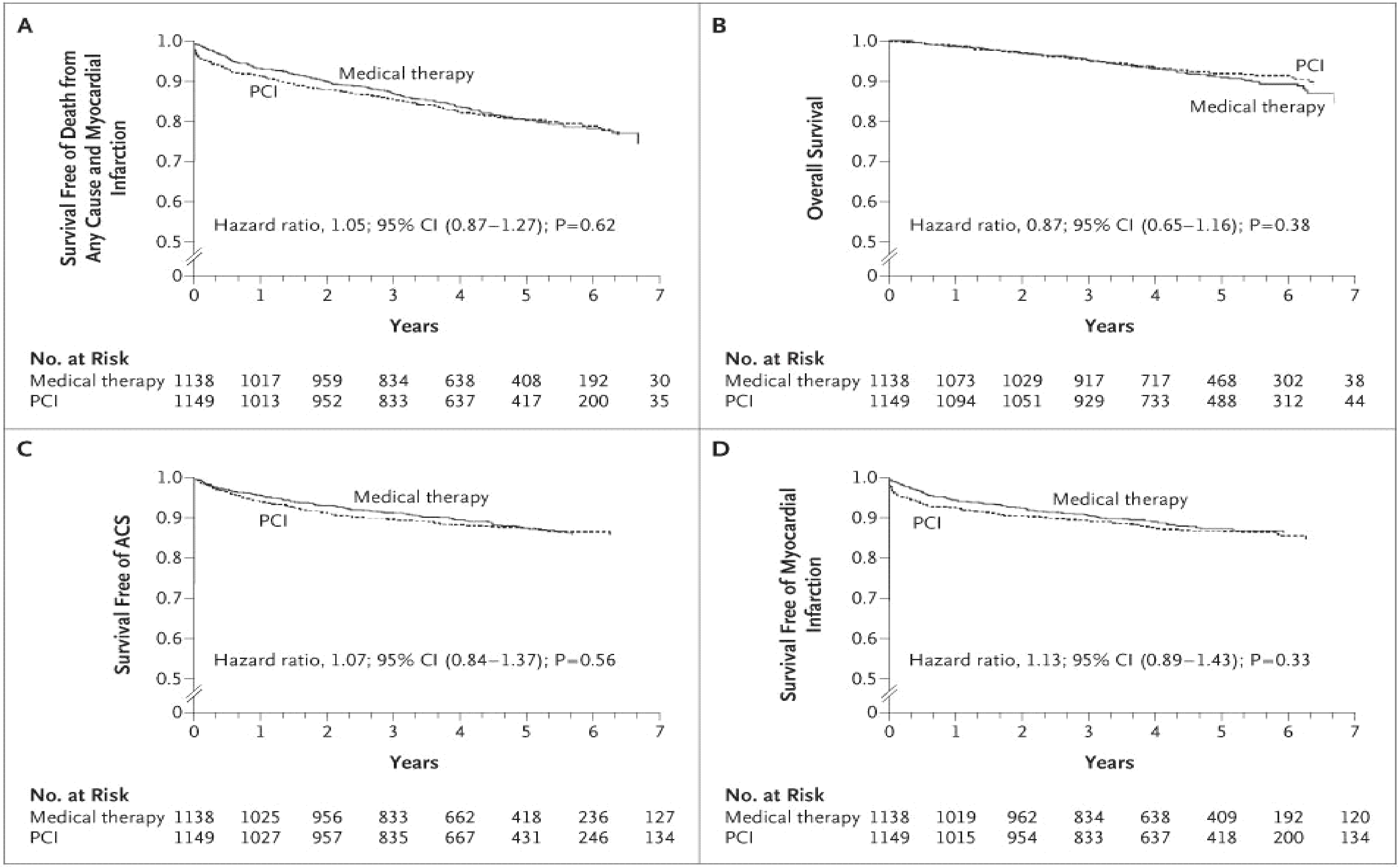
Controls n = 60. (Angio - / MIBI -)

Hard cardiac events (non-fatal MI) = 3

Annualised HCE 0.6 % v. 0.3% (p=ns)

Soft CE (late revascularisation) = 1.9%, but this group had same HCE as medical therapy group!

BUT to see a lesion and not dilate it, you need……..



Boden et al… NEJM 4/07 (COURAGE trial). n=2287

Optimal med therapy +/- PCI

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 SEPTEMBER 13, 2012 VOL. 367 NO. 11

Fractional Flow Reserve–Guided PCI versus Medical Therapy in Stable Coronary Disease

Bernard De Bruyne, M.D., Ph.D., Nico H.J. Pijls, M.D., Ph.D., Bindu Kalesan, M.P.H., Emanuele Barbato, M.D., Ph.D., Pim A.L. Tonino, M.D., Ph.D., Zsolt Piroth, M.D., Nikola Jagic, M.D., Sven Mobius-Winckler, M.D., Gilles Rioufol, M.D., Ph.D., Nils Witt, M.D., Ph.D., Petr Kala, M.D., Philip MacCarthy, M.D., Thomas Engström, M.D., Keith G. Oldroyd, M.D., Kreton Mavromatis, M.D., Ganesh Manoharan, M.D., Peter Verlee, M.D., Ole Frobert, M.D., Nick Curzen, B.M., Ph.D., Jane B. Johnson, R.N., B.S.N., Peter Jüni, M.D., and William F. Fearon, M.D., for the FAME 2 Trial Investigators*

AHA ….. Shaw et al 11/07 Circ 1/08

Nuclear sub-study 314 pts

Ischaemia reduction > 5 % reduces risk

Residual ischaemia at 18/12 > 5 % increases risk

EXERCISE CAPACITY and CER – (n = 9000)

Outcome (% predicted METs achieved)	Adjusted hazard ratio (95% CI)
MI	
•<85	2.36 (1.55–3.60)
•85–100	0.79 (0.46–1.36)
•>100	1 (reference)
Unstable angina	
•<85	2.39 (1.78–3.21)
•85–100	1.31 (0.94–1.81)
•>100	1 (reference)
CABG, PCI	
•<85	1.75 (1.46–2.08)
•85–100	1.08 (0.90–1.31)
•>100	1 (reference)
All-cause mortality	
•<85	2.90 (1.88–4.47)
•85–100	1.08 (0.90–1.31)
•>100	1 (reference)

Peterson PN et al. *Arch Intern Med* 2008; 168:174-179.

High workload stress test

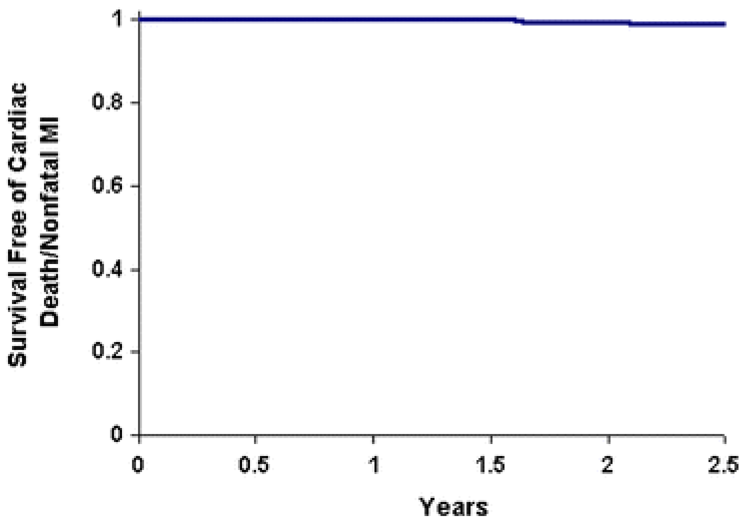
Bourque et al JACC 8/09

n =1056 pts with exercise ECG to predict >10 % LV ischaemia

➢ >10 mets achieved	0.4 % pts
➢ If no ECG changes	0 %
➢ <7 mets achieved	7.1 % pts

Prognosis in patients achieving ≥10 METS on exercise stress testing: Was SPECT imaging useful?

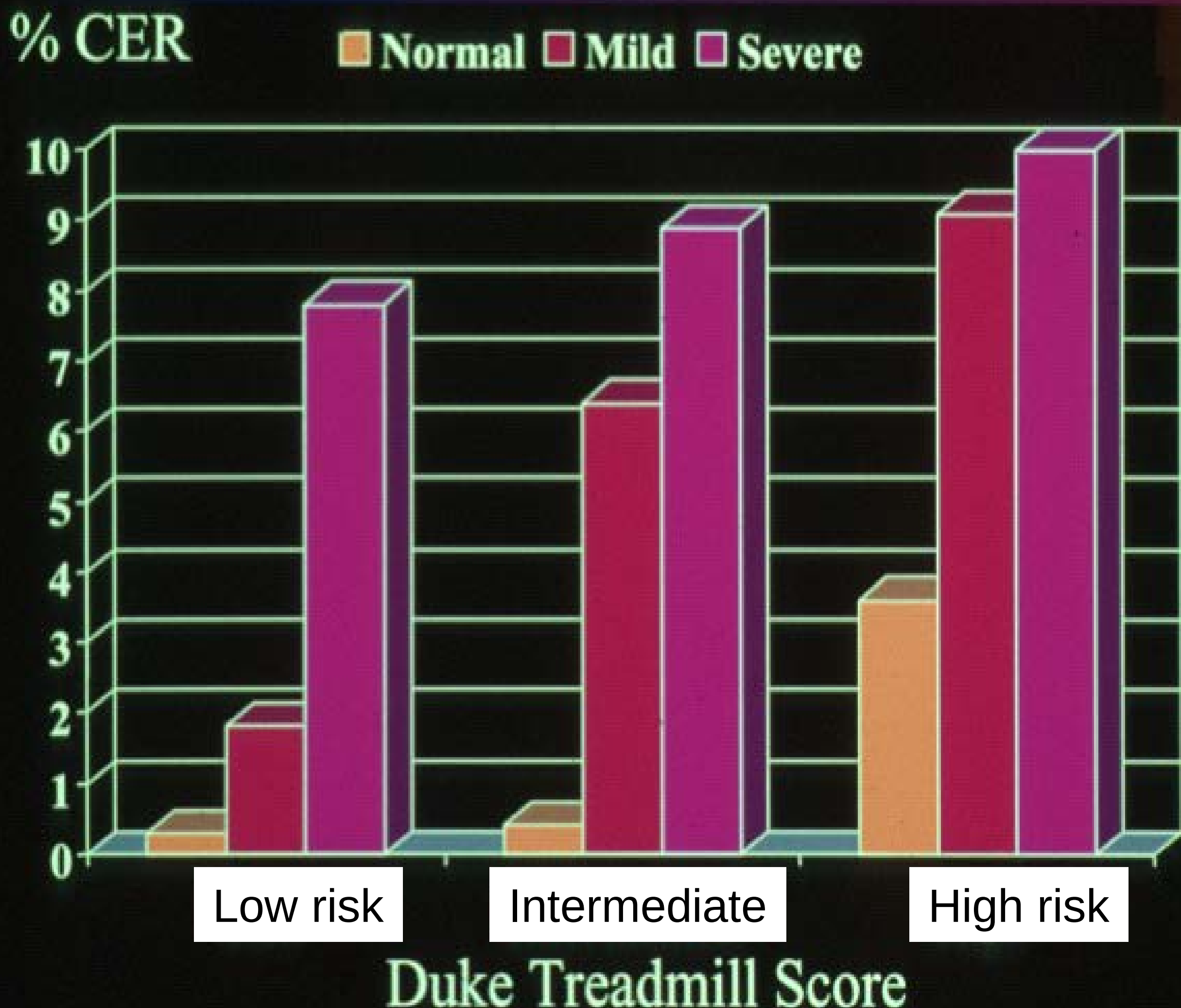
Jamieson M. Bourque et al…. JNC 4/11



Conclusion… MPI (and other testing) limited value in this group!!!!

Australia's Response for Preventing the Metabolic Syndrome: Walking the Dog

Incremental prognostic value & exercise SPECT



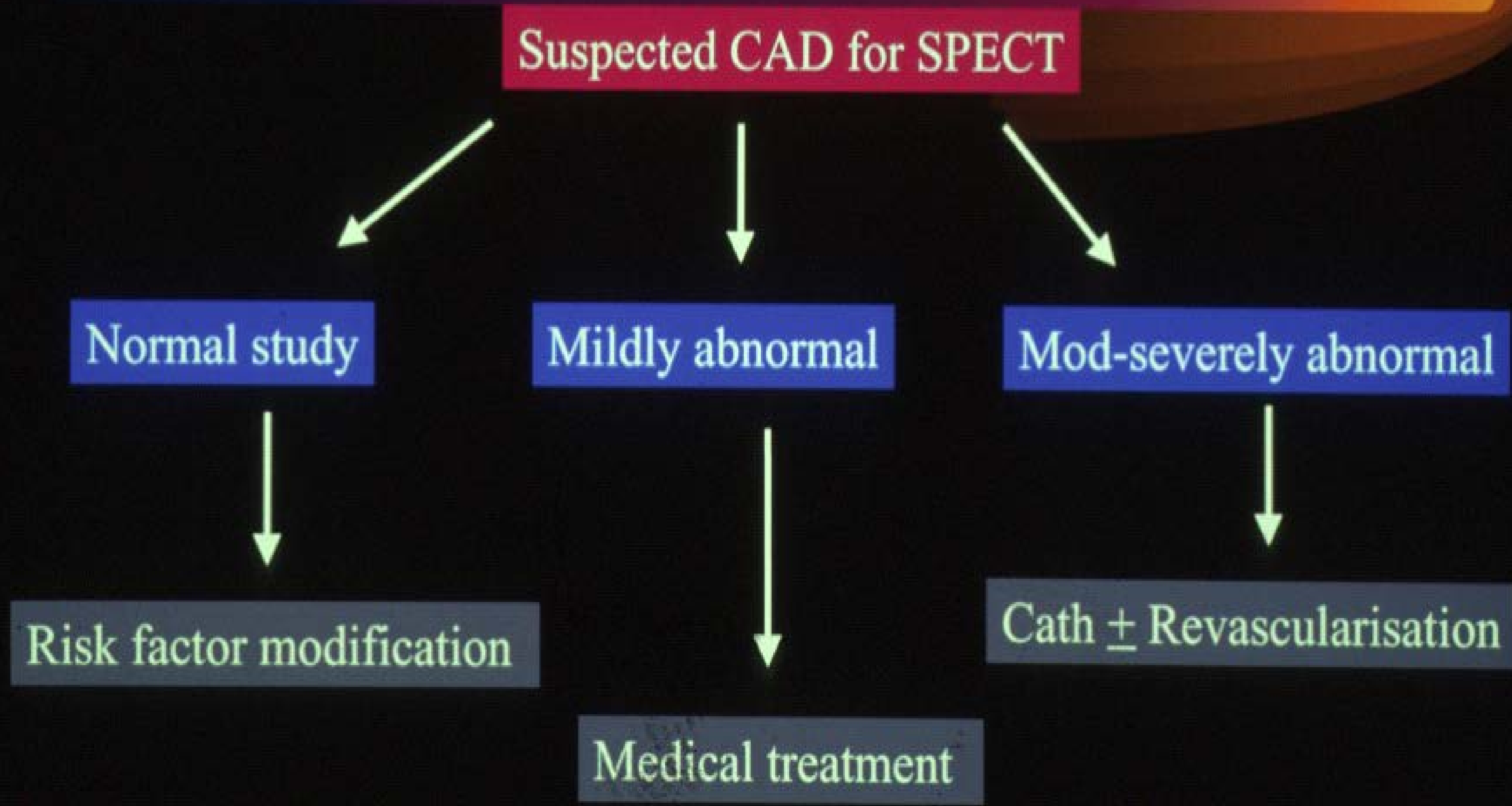
2200 pts
Rest thallium-201/
Stress Tc99m MIBI

Cath rate -
Very similar data

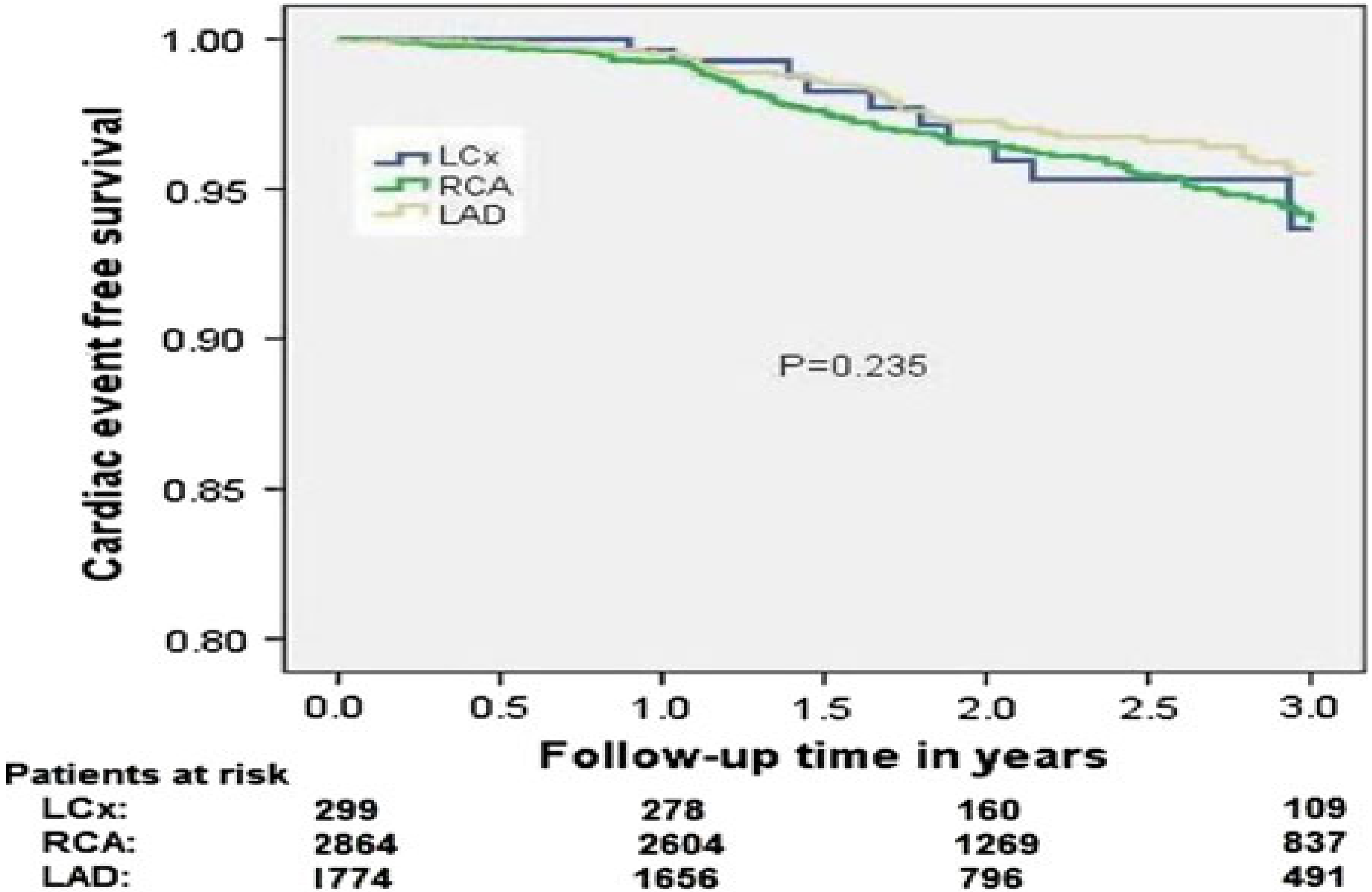
Hachamovitch et al …Circ 3/9

Risk-based strategy

R.Hachamovitch JNC……2/98



Does location matter? Prognostic value of single-photon emission computed tomography myocardial perfusion imaging by vascular territory… **Slim et al JNC 2/12**



n = 21,294. Conclusion – location makes no difference!!

ANY MORE INFORMATION

- Transient ischaemic dilatation
- Lung uptake Choi et al… JNC 2001
- ECG
  - normal persantin SPECT with marked ECG changes – 8 % CER / yr (Wackers..JNC 2/03)
- Haemodynamics

EMPIRE study

Underwood et al…….. EHJ 1/99

396 patients retrospectively

Strategies	Cost (Pounds)	
	All Pts	CAD Pts
Ex ECG → Cath	490	4453
Ex ECG → MPI → Cath	409	3842
MPI → Cath	460	3768
Cath	1253	5599

Conclusion - Cheapest strategies include MPI

Does Gating help assess risk?

Cardiac Prognosis - Gating & Risk

Sharir et al….JNM 6/01

2686 pts over approx 3 years

Rest thallium-201/stress Tc-99m MIBI

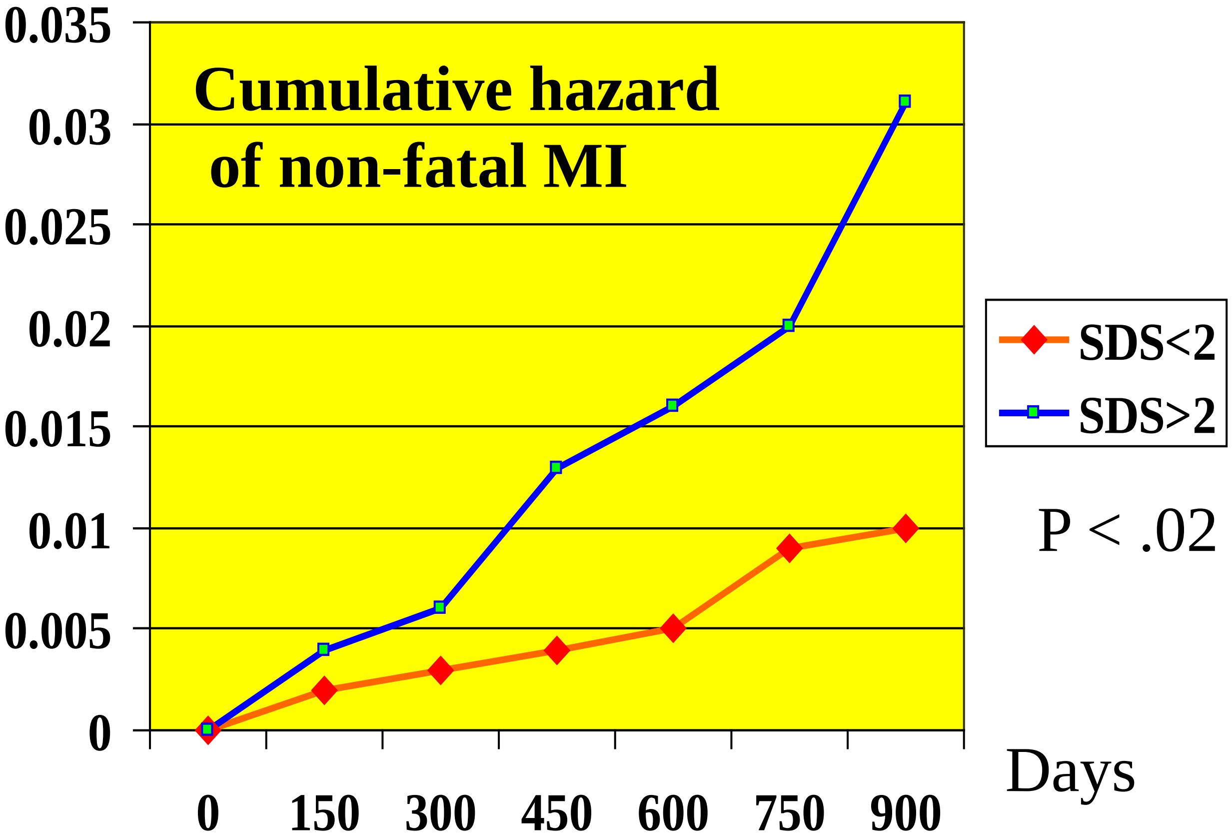
Quantitative perfusion - SSS, SRS and SDS

Automated post-stress LVEF

? Cardiac death and MI rate

Cardiac Prognosis - Gating & Risk

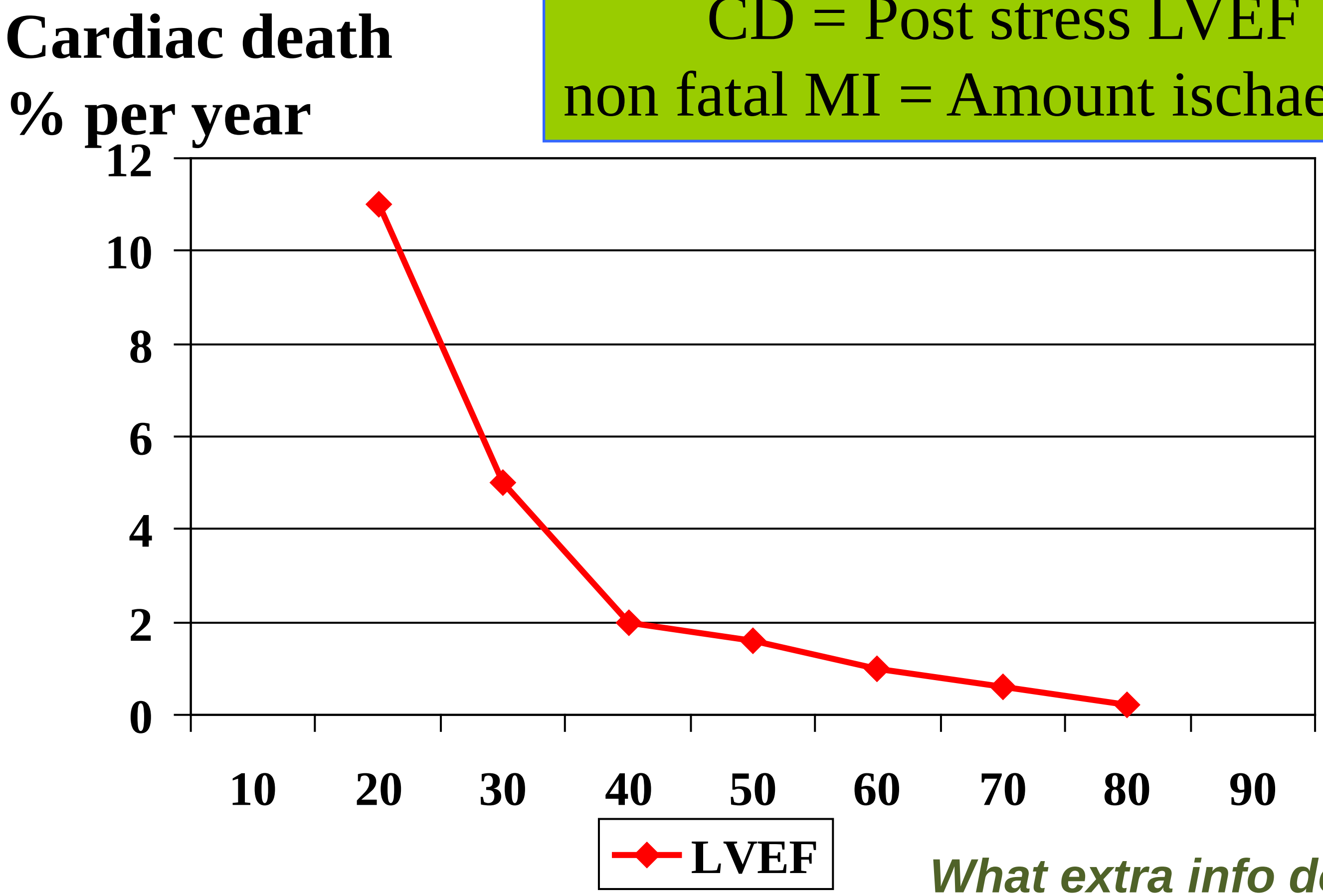
Sharir et al….JNM 6/01



Cardiac Prognosis - Gating & Risk

Sharir et al….JNM 6/01

Best predictor of
CD = Post stress LVEF
non fatal MI = Amount ischaemia



What extra info do we need???

Exercise LVEF with Tl-201 Yamagishi et al JNM 1/02

182 pts.

26.9% (18/67) with MVD had multiple defects

Adding exercise LVEF or rest LVEF -

no difference

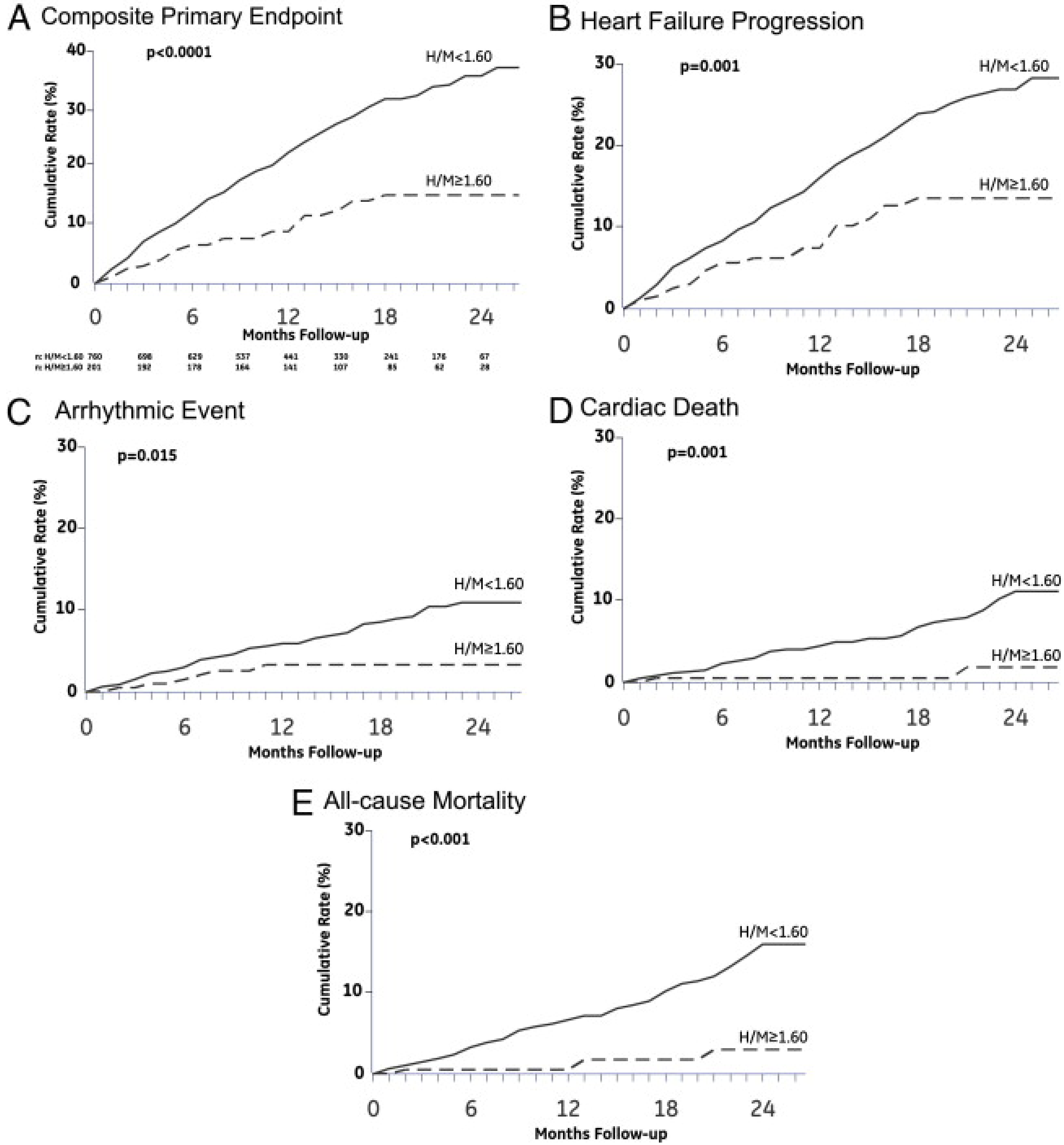
Adding worsening of LVEF by > 5.6% -

43.3 % sensitivity ($p<.05$) +

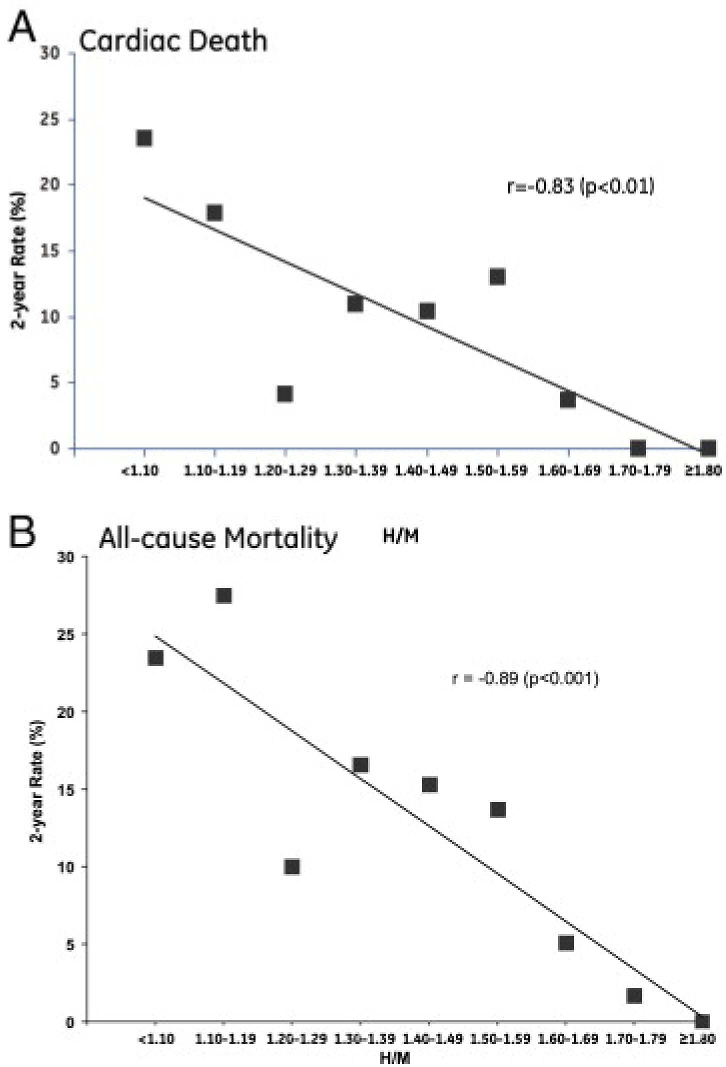
90.4 % specificity

ADMIRE – HF Jacobson et al.JACC 4/10

- n = 961 over 2 years
- LVEF < 35 %
- I-123 MIBG. Cardiac uptake quantitated.
- 237 pts had events
- Change in NYHA class, cardiac death or serious arrhythmia.



A Composite Primary Endpoint
p<0.0001
H/M<1.60
H/M≥1.60
Cumulative Rate (%)
0
10
20
30
40
0
6
12
18
24
Months Follow-up
n: H/M<1.60 760 698 629 537 441 330 241 176 67
n: H/M≥1.60 201 192 178 164 141 107 85 62 28
B Heart Failure Progression
p=0.001
H/M<1.60
H/M≥1.60
Cumulative Rate (%)
0
10
20
30
0
6
12
18
24
Months Follow-up
C Arrhythmic Event
p=0.015
H/M<1.60
H/M≥1.60
Cumulative Rate (%)
0
10
20
30
0
6
12
18
24
Months Follow-up
D Cardiac Death
p=0.001
H/M<1.60
H/M≥1.60
Cumulative Rate (%)
0
10
20
30
0
6
12
18
24
Months Follow-up
E All-cause Mortality
p<0.001
H/M<1.60
H/M≥1.60
Cumulative Rate (%)
0
10
20
30
0
6
12
18
24
Months Follow-up


A
Cardiac Death
r=-0.83 (p<0.01)
2-year Rate (%)
30
25
20
15
10
5
0
<1.10
1.10-1.19
1.20-1.29
1.30-1.39
1.40-1.49
1.50-1.59
1.60-1.69
1.70-1.79
≥1.80
H/M
B
All-cause Mortality
r = -0.89 (p<0.001)
2-year Rate (%)
30
25
20
15
10
5
0
<1.10
1.10-1.19
1.20-1.29
1.30-1.39
1.40-1.49
1.50-1.59
1.60-1.69
1.70-1.79
≥1.80
H/M

Selective improvement in Seattle Heart Failure Model risk stratification using iodine-123 meta-iodobenzylguanidine imaging

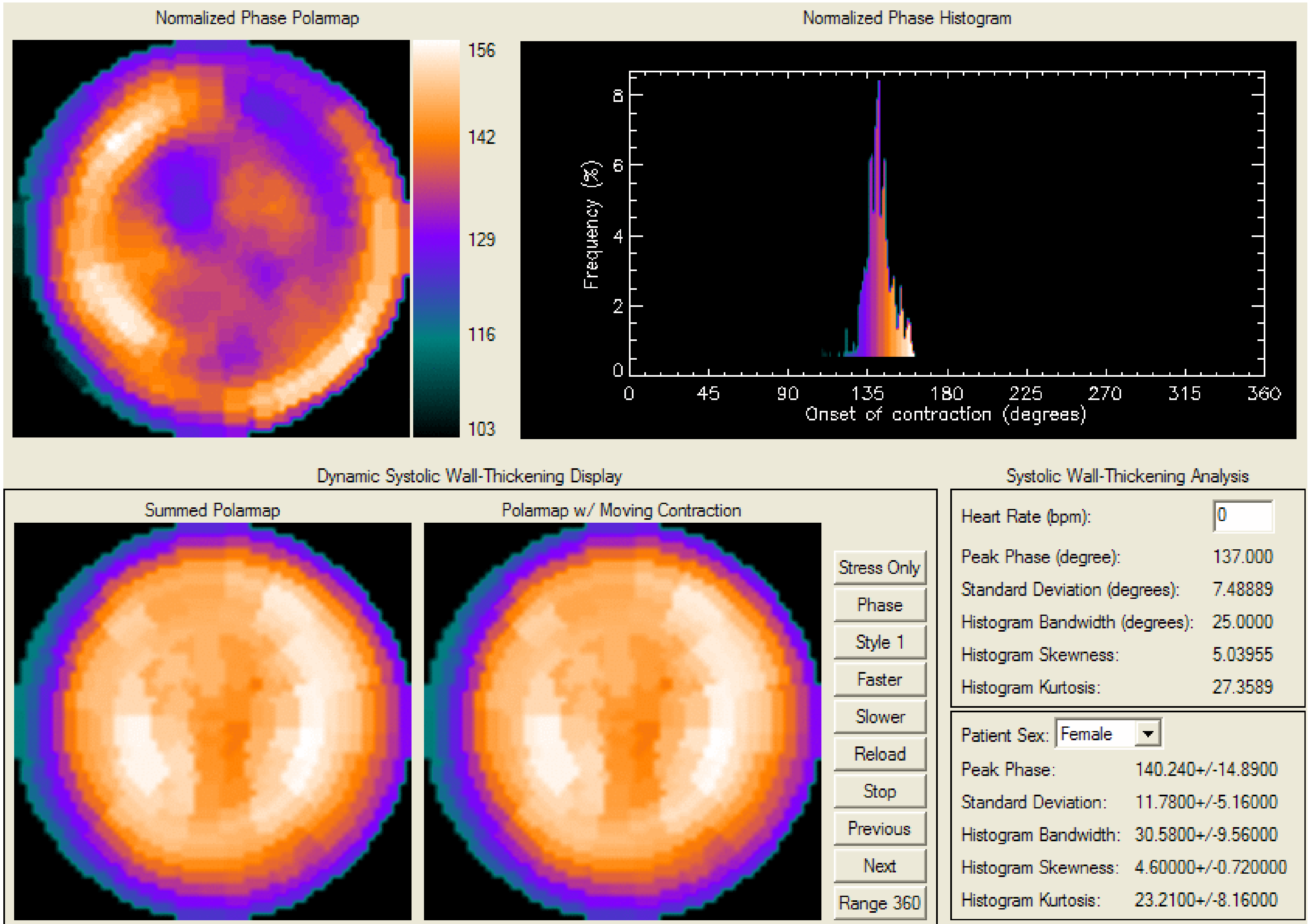
Eric S. Ketchum MD, MS, Arnold F. Jacobson MD, PhD, James H. Caldwell MD, Roxy Senior MD, Manuel D. Cerqueira MD, Gregory S. Thomas MD, MPH, Denis Agostini MD, PhD, Jagat Narula MD, PhD, Wayne C. Levy MD

JNC ……. October 2012

Net reclassification improvement was **22.7%** (*P* < .001), with **14.9%** of subjects who died reclassified into a higher risk category than suggested by SHFM score alone (*P* = .01) and **7.9%** of subjects who survived reclassified into a lower risk category (*P* < .0001).

Measuring LV Systolic Dyssynchrony using Phase Analysis of Gated MPI . *Courtesy E.Ficaro and E.Garcia 10/12*

Chen et al, J Nucl Cardiol 2005;12:687-95



Predictors and incremental prognostic value of left ventricular mechanical dyssynchrony response during stress-gated positron emission tomography in patients with ischemic cardiomyopathy

Wael AlJaroudi MD, FACC, M. Chadi Alraies MD, FACP, Venu Menon MD, FACC, Richard C. Brunken MD, FACC, Manuel D. Cerqueira MD, FACC, Wael A. Jaber MD, FACC JNC … 10/12

n = 489 Ischaemic CM
LVEF < 35 %
123 died over 2 years

After multivariate analysis, left ventricular mechanical dyssynchrony response (LVMDR) was an independent predictor of all-cause mortality (HR 1.19 [1.01;1.38]) (p=.04)

- ***Subgroups where the amount of ischaemia helps predict risk!!!!***

Diabetics – DIAD trial v. Wiersma et al JNC 10/09

The elderly. Perrone-Fillardi et al JNC 4/10

Renal failure. Hakeem et al Circ 2008

Chronic total occlusions. Galassi et al J Int Cardiol 3/10

Non-Cardiac Surgery – High risk Sx, Intermediate risk pt.
POISE trial 2008 – beta-blockers for all ?
Post MI – ICTUS trial 5 year F/U JACC 3/10

Detection of Ischaemia in asymptomatic diabetics.

Wackers et al Diabetes Care 8/04

- n= 1127
- 5 year follow-up
- Adenosine MIBI + F/U v. F/U alone

Adenosine-sestamibi SPECT results (*n* = 522)

	n	Percentage
Normal stress test	409	78.4
Abnormal stress test	113	21.6
Abnormal myocardial perfusion	83	15.9
Reversibility		
Ischemia	73	88
Ischemia and scar	7	8
Scar	3	4
Defect size (percent of left ventricle)		
Small (<5%)	50	60
Moderate (≥5 and <10%)	29	35
Large (≥10%)	4	5

JAMA 2009 – No difference with outcome

But what if there are symptoms?

- Wiersma et al JNC 10/09

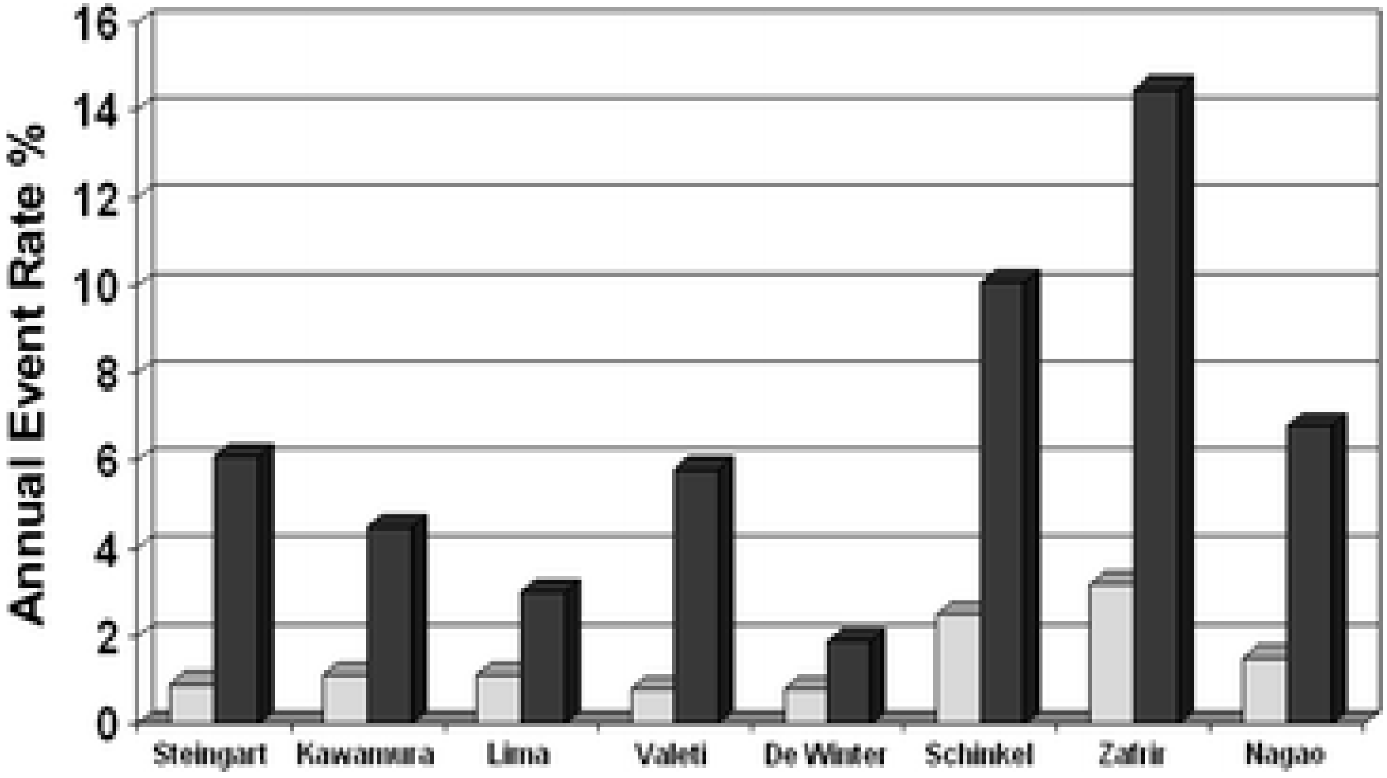
- If no – mod ischaemia 0.8 % CER

- If severe ischaemia 5.8 % CER (1 year)

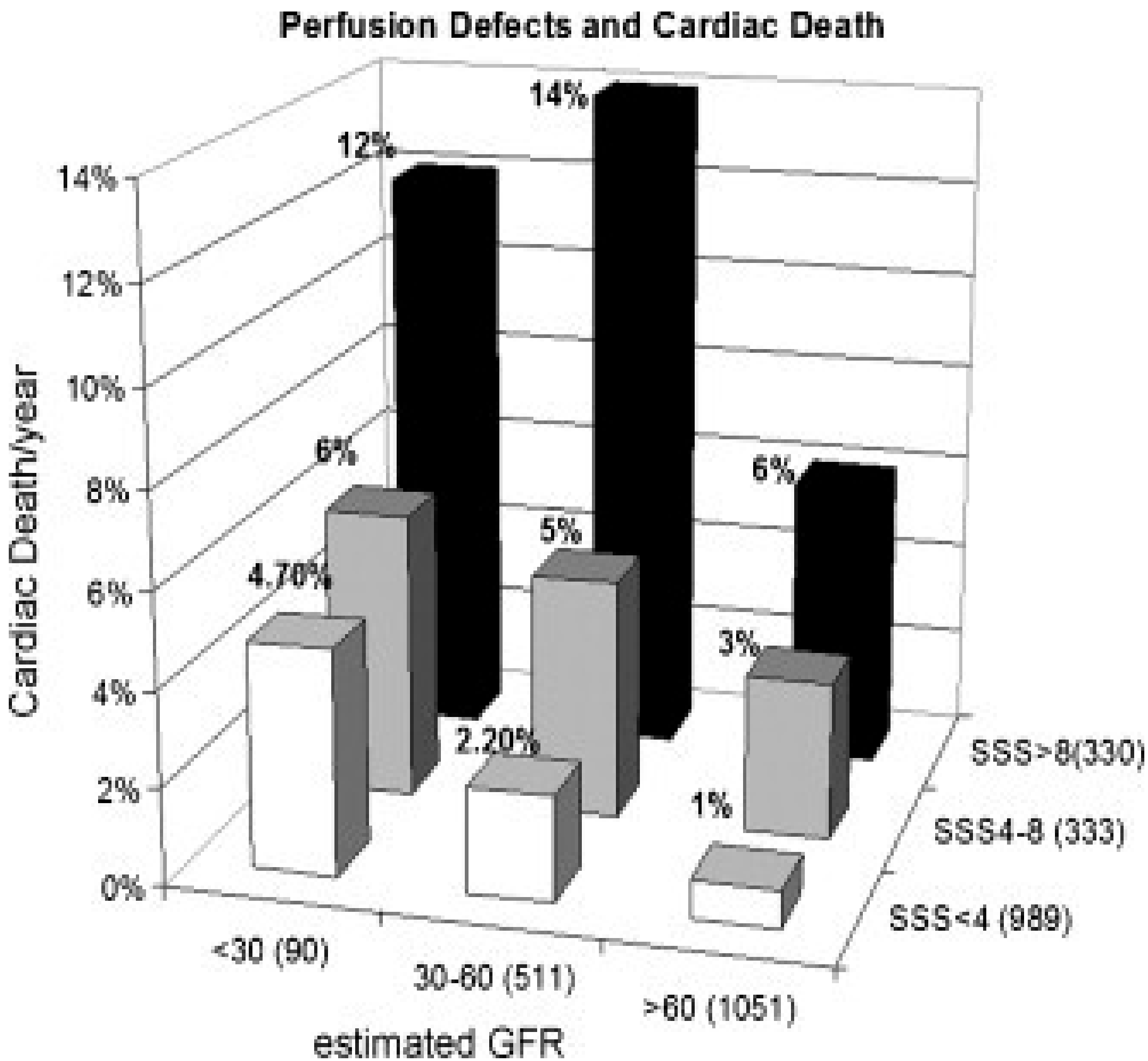
- For asymptomatic high risk pts, CER = 1.6% (normal scan) v. 4.0% (high risk scan)

Cardiac Prognosis and the elderly.

Perrone-Fillardi et al JNC 4/10



White bar = low risk, Black bar =high risk (on SPECT)



n = 1652
F/U 2.15 years

Hakeem et al.. Circ 2008

NON-CARDIAC SURGERY

- Intermediate risk patients
- High risk Surgery
- Vascular surgery / Radical Prostate / Renal and liver transplant
- ? Beta-blockers for all….NO. (POISE AHA 11/07)
    - Further data AHA 11/08

Primary outcome and major secondary outcomes – POISE 11/07 AHA

Outcome	Metoprolol (n=4174), n (%)	Placebo (n=4177), n (%)	Hazard ratio	p
Primary composite	243 (5.8)	290 (6.9)	0.83	0.04
Nonfatal MI	151 (3.6)	215 (5.1)	0.70	0.0007
Total mortality	129 (3.1)	97 (2.3)	1.33	0.03
Stroke	41 (1.0)	19 (0.5)	2.17	0.005

Secondary outcomes – POISE 11/07

Outcome	Metoprolol (n=4174), n (%)	Placebo (n=4177), n (%)	Hazard ratio	p
Revascularization	11 (0.3)	27 (0.6)	0.41	0.01
Atrial fibrillation	91 (2.2)	120 (2.9)	0.76	0.04
Significant hypotension	626 (15.0)	404 (9.7)	1.55	<0.0001
Significant bradycardia	274 (6.6)	101 (2.4)	2.71	<0.0001

Chronic total occlusions.

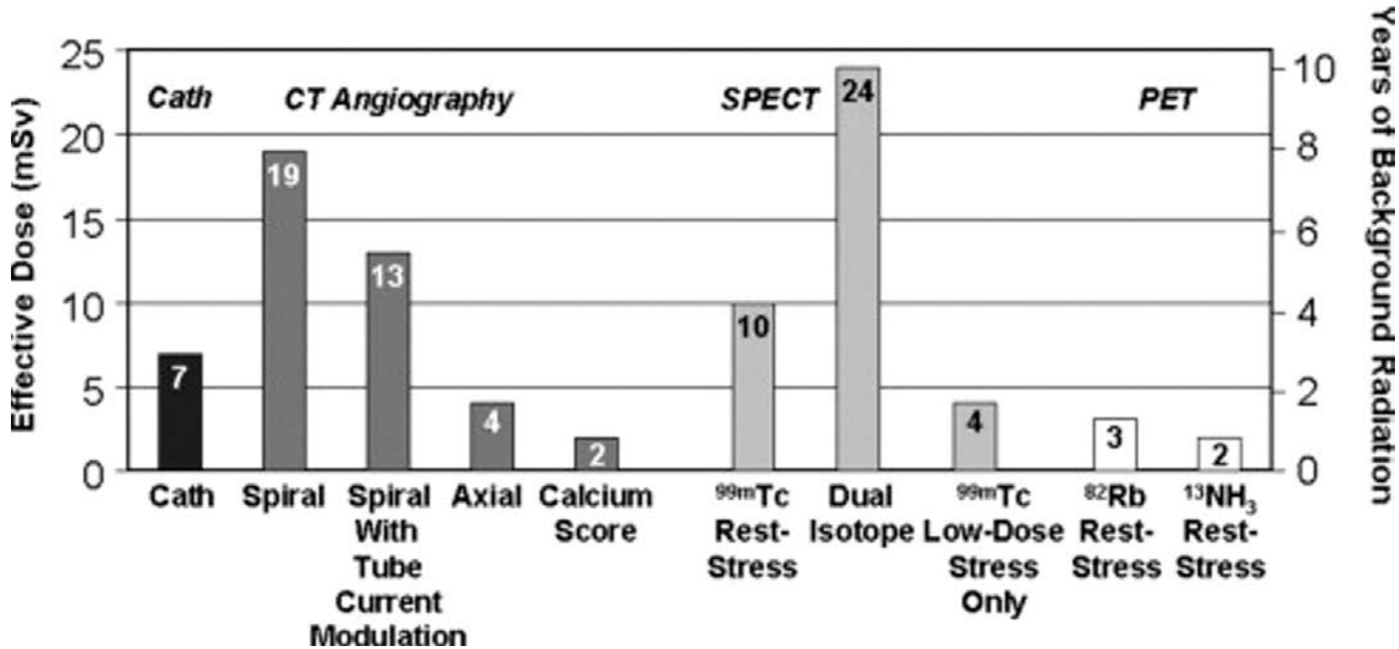
Galassi et al J Int Cardiol 3/10

- n = 126 with CTO and MPI study
- Death/MI - n = 6, all abnormal MPI
- Soft events (UAP/Revasc)

MPI study	SE
Normal	0 %
Mildly abnormal	7.9 %
Severely abnormal	11.9 %

RADIATION ISSUES 2012

Typical Effective Doses From Cardiac Imaging Procedures



Einstein, A. J. J Am Coll Cardiol 2012;59:553-565

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Cancer risk related to low-dose ionizing radiation from cardiac imaging in patients after acute myocardial infarction..

Eisenberg et al CMAJ 2/11

12020 cancers in 77 % of 82861 pts undergoing cardiac procedures over 10y period (1996-2006) post-MI.

5 year follow-up.

Adjusted for age, sex and non-cardiac radiation imaging.

23.6 % cath, 40.3% PCI and 29.9% MPI

Cancer risk related to low-dose ionizing radiation from cardiac imaging in patients after acute myocardial infarction..

Eisenberg et al CMAJ 2/11

Adjusted	HR Cancer risk
10 mSv	1.028 (1.004 – 1.047)
20 mSv	1.058 (1.036 -1.080)
30 mSv	1.088 (1.054 – 1.172)
40 mSv	1.119 (1.073 - 1.166)
Per mSv	**1.003 (1.002 – 1.004)**

Recommendations to reduce doses

Tracers

- Use radionuclides with shorter half-life such as

Tc-99m and PET tracers.

- Perform stress-only testing.
- Use weight-based dosing.

AC dose is “negligible” – use is desirable if stress-only imaging is used.

ASNC guidelines 2010. Cerqueira et al

Appropriateness criteria

- Avoid categories 1 – 3 / 9
- See ASNC guidelines 2009

RADIATION REDUCTION 1

Low pretest probability of CAD I(3)

ECG interpretable AND able to exercise

Detection of CAD: Symptomatic acute chest pain

10 Define ACS* I(1)

Detection of CAD/risk assessment without ischemic equivalent: Asymptomatic

12 Low CHD Risk (ATP III Risk Criteria) I(1)

13 Intermediate CHD risk (ATP III Risk Criteria) I(3)

ECG interpretable

Detection of CAD/risk assessment without ischemic equivalent: Syncope

20 Low CHD risk (ATP III Risk Criteria) I(3)

Risk assessment with prior test results and/or known chronic stable CAD, asymptomatic OR stable symptoms, normal prior stress imaging study

23 Low CHD risk (ATP III Risk Criteria) I(1)

Last stress imaging study done less than 2 years ago

24 Intermediate to high CHD risk (ATP III Risk Criteria) I(3)

Last stress imaging study done less than 2 years ago

25 Low CHD risk (ATP III Risk Criteria) I(3)

Last stress imaging study done more than or equal to 2 years ago

Risk assessment with prior test results and/or known chronic stable CAD, asymptomatic OR stable symptoms, abnormal coronary angiography OR abnormal prior stress imaging study, no prior revascularization

27 Known CAD on coronary angiography OR prior abnormal stress imaging study I(3)

Last stress imaging study done less than 2 years ago

Risk assessment with prior test results and/or known chronic stable CAD, asymptomatic, prior coronary calcium Agatston score

33 Agatston score less than 100 I(2)

Risk assessment with prior test results and/or known chronic stable CAD, Duke treadmill score

37 Low-risk Duke treadmill score I(2)

Radiation reduction 2

Risk assessment: Preoperative evaluation for non-cardiac surgery without active cardiac conditions, low-risk surgery

40 Preoperative evaluation for non-cardiac surgery risk assessment I(1)

Risk assessment: Preoperative evaluation for non-cardiac surgery without active cardiac conditions, intermediate-risk surgery

41 Moderate to good functional capacity (greater than or equal to 4 METs) I(3)

42 No clinical risk factors I(2)

44 Asymptomatic up to 1 year post normal catheterization, non-invasive test, or previous revascularization

I(2)

Risk assessment: Preoperative evaluation for non-cardiac surgery without active cardiac conditions, vascular surgery

45 Moderate to good functional capacity (greater than or equal to 4 METs) I(3)

46 No clinical risk factors I(2)

48 Asymptomatic up to 1 year post normal catheterization, non-invasive test, or previous revascularization

I(2)

Risk assessment: Within 3 months of an acute coronary syndrome, STEMI

49 Primary PCI with complete revascularization I(2)

51 Hemodynamically unstable, signs of cardiogenic shock, or mechanical complications I(1)

Risk assessment: Within 3/12 of an acute coronary syndrome, ACS-asymptomatic post-revascularization (PCI or CABG)

53 Evaluation prior to hospital discharge I(1)

- It’s all very well to do this but are we doing it appropriately??

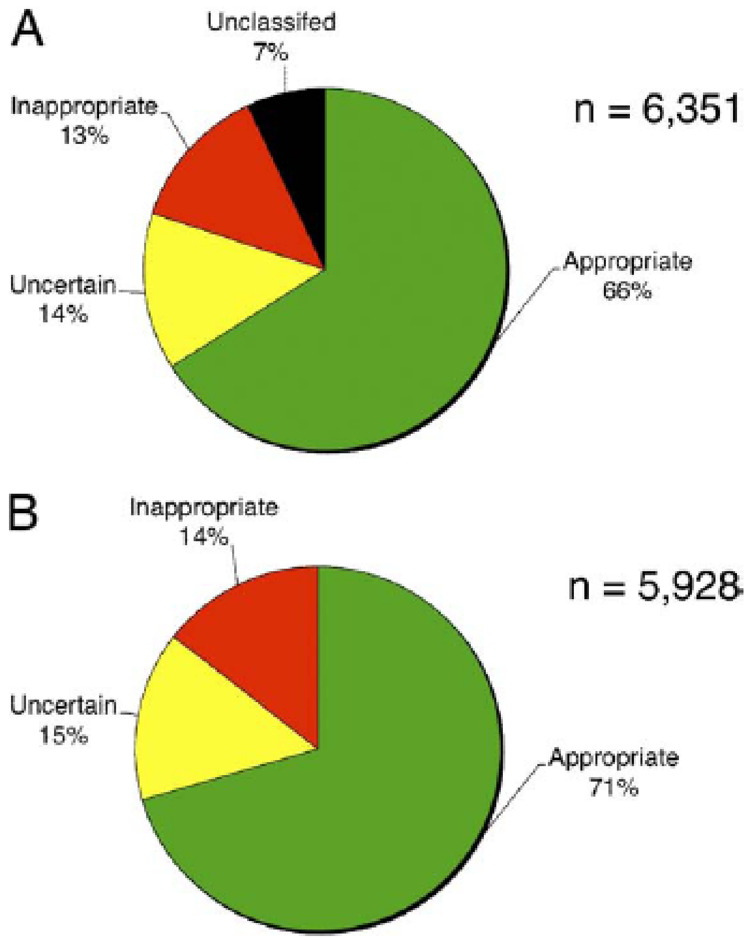


Figure 1 **Assignment of Levels of Appropriate Use From Patients Collected During the Entire Enrollment Period**

(A) All enrolled patients; **(B)** in evaluable patients.

Appropriate use for SPECT MPI
Hendel et al..JACC 1/10

AHA/ACC review 2005, updated 2009.

Appropriate use for SPECT MPI

Hendel et al..JACC 1/10

Table 3 **Most Frequent Inappropriate Indications**

Indication	Inappropriate Studies, %	% of Total Studies
Detection of CAD Asymptomatic, low CHD risk*	44.5	6.4
Asymptomatic, post-revascularization <2 yrs after PCI, symptoms before PCI	23.8	3.4
Evaluation of chest pain, low probability Interpretable ECG and able to exercise	16.1	2.3
Asymptomatic/stable symptoms, known CAD <1 yr after catheterization or abnormal prior SPECT	3.9	0.6
Pre-operative assessment Low-risk surgery	3.7	0.5
Total†	92.0	13.2

*CHD risk was determined by the Framingham Risk score (19). †The remaining 8% of inappropriate studies are contained among the remaining inappropriate indications.
ECG = electrocardiogram; other abbreviations as in Tables 1 and 2.

Evaluation of the American College of Cardiology Foundation/American Society of Nuclear Cardiology appropriateness criteria for SPECT myocardial perfusion imaging in an Asian tertiary cardiac center. Koh et al 4/11

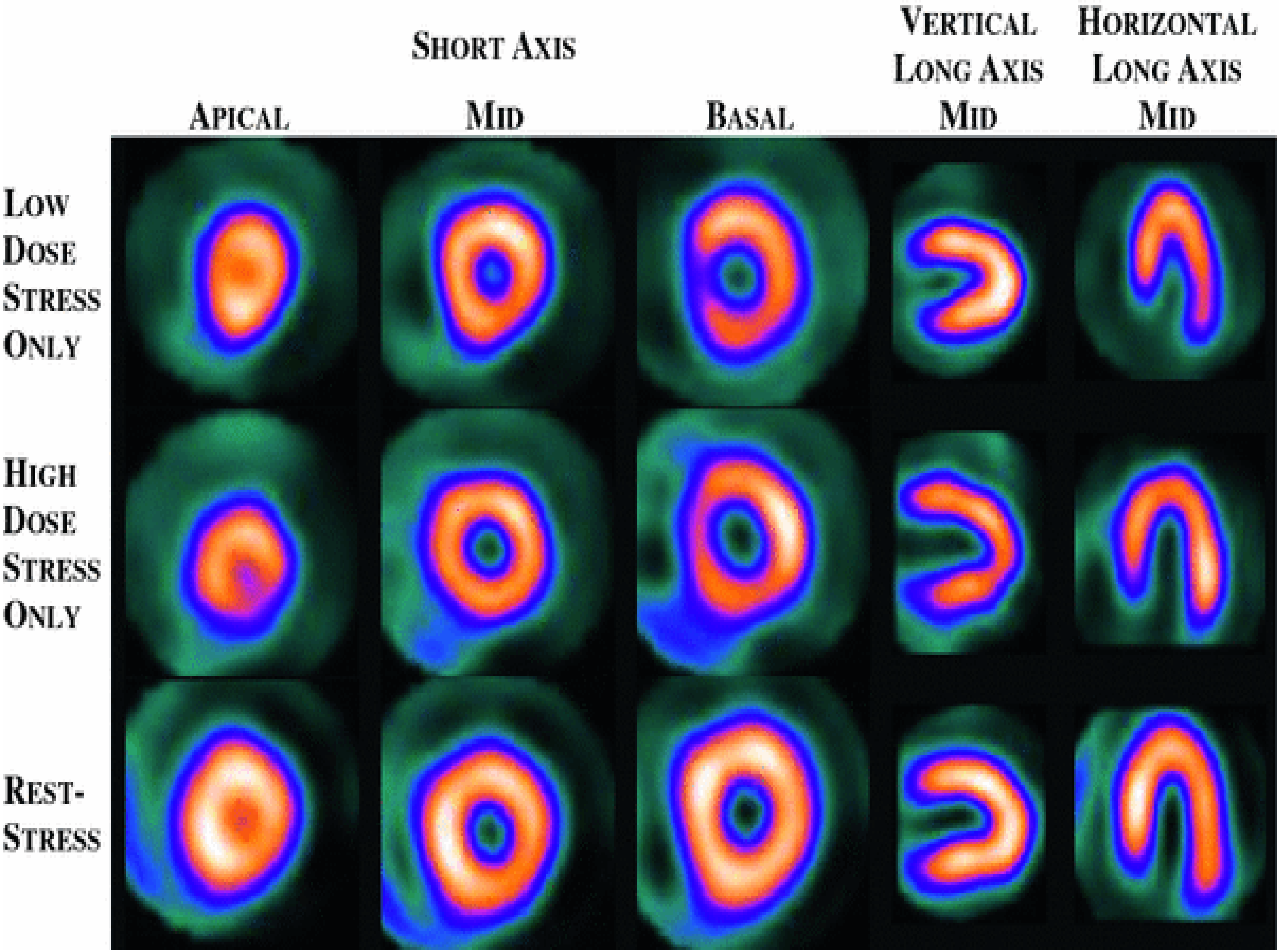
Indication	*Number (%) with studies graded as inappropriate*	*Number (%) with abnormal MPI results within each group**
Preoperative evaluation for non-cardiac surgery	*95 (59)*	*38 (40)*
Evaluation of ischemic equivalent (non-acute): low probability, interpretable ECG, able to exercise	*34 (21)*	*3 (9)*
Detection of CAD without ischemic equivalent: low risk, interpretable ECG	*18 (11)*	*3 (17)*
Risk assessment with prior test results: asymptomatic or stable symptoms with normal prior stress imaging study	*5 (3)*	*3 (60)*
Risk assessment post-revascularization: asymptomatic, less than 2 years after PCI	*3 (2)*	*2 (67)*
Total†	*155 (96)*	

Singapore - 27 % inappropriate

CZT cameras (GE). Low-dose scans

Duvall et al JNC 12/10

- N = 717. 50.5 % female. 58.9 % ex. 27.9 BMI
- Std rest-stress v Low dose (12.5 mCi) stress only 5 minutes v High dose (25-36 mCi) stress only 3 minutes.
- Similar image quality with 57 % dose reduction



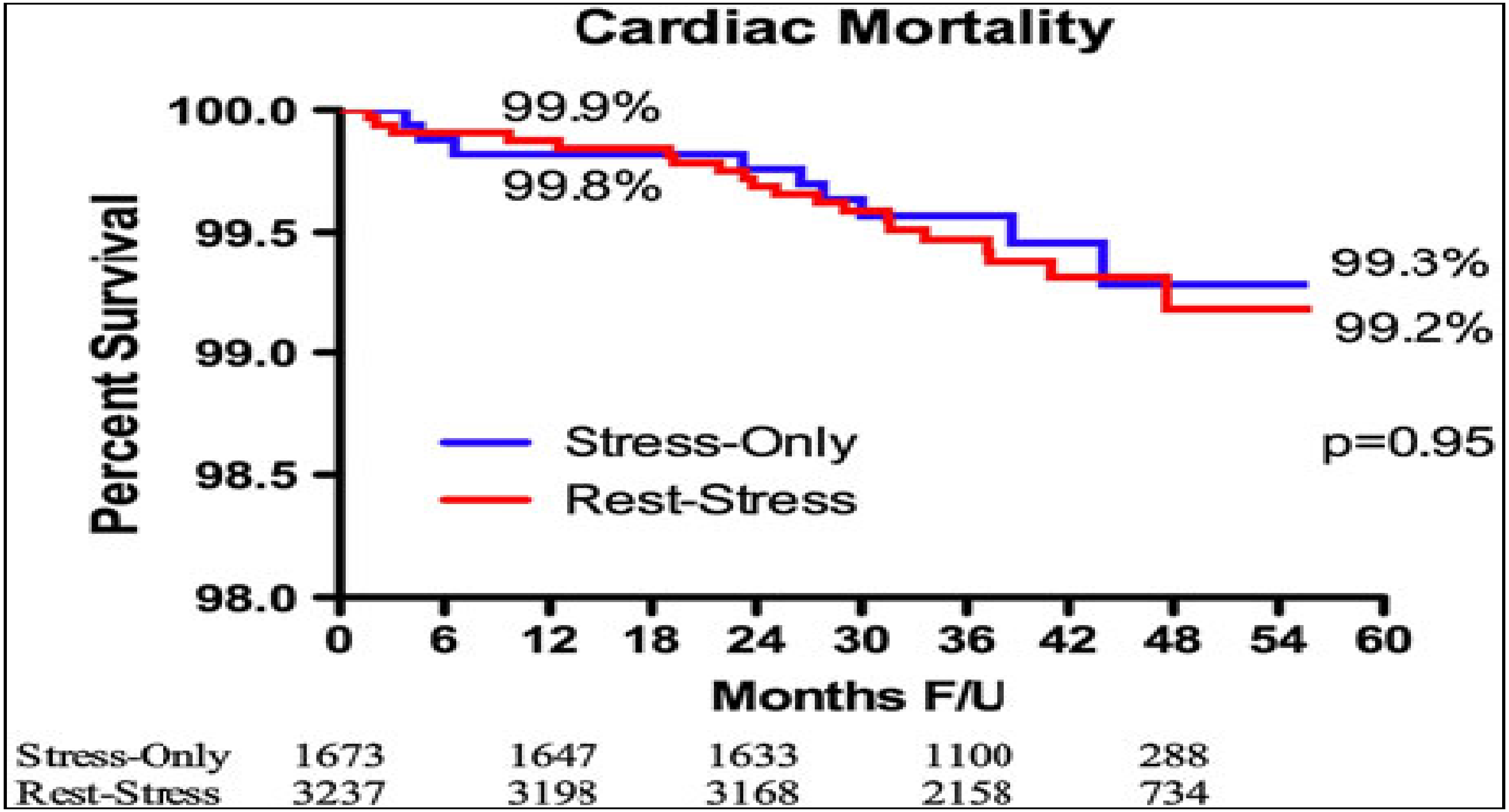
SHORT AXIS
VERTICAL LONG AXIS
HORIZONTAL LONG AXIS
APICAL
MID
BASAL
MID
MID
LOW DOSE STRESS ONLY
HIGH DOSE STRESS ONLY
REST-STRESS

Software

- Wide beam reconstruction – half time/half dose
- Resolution recovery
- FLASH 3D
- Astonish

Normal stress only imaging.

Duvall et al, JNC 6/10



Very low-activity stress/high-activity rest, single-day myocardial perfusion SPECT with a conventional sodium iodide camera and wide beam reconstruction processing

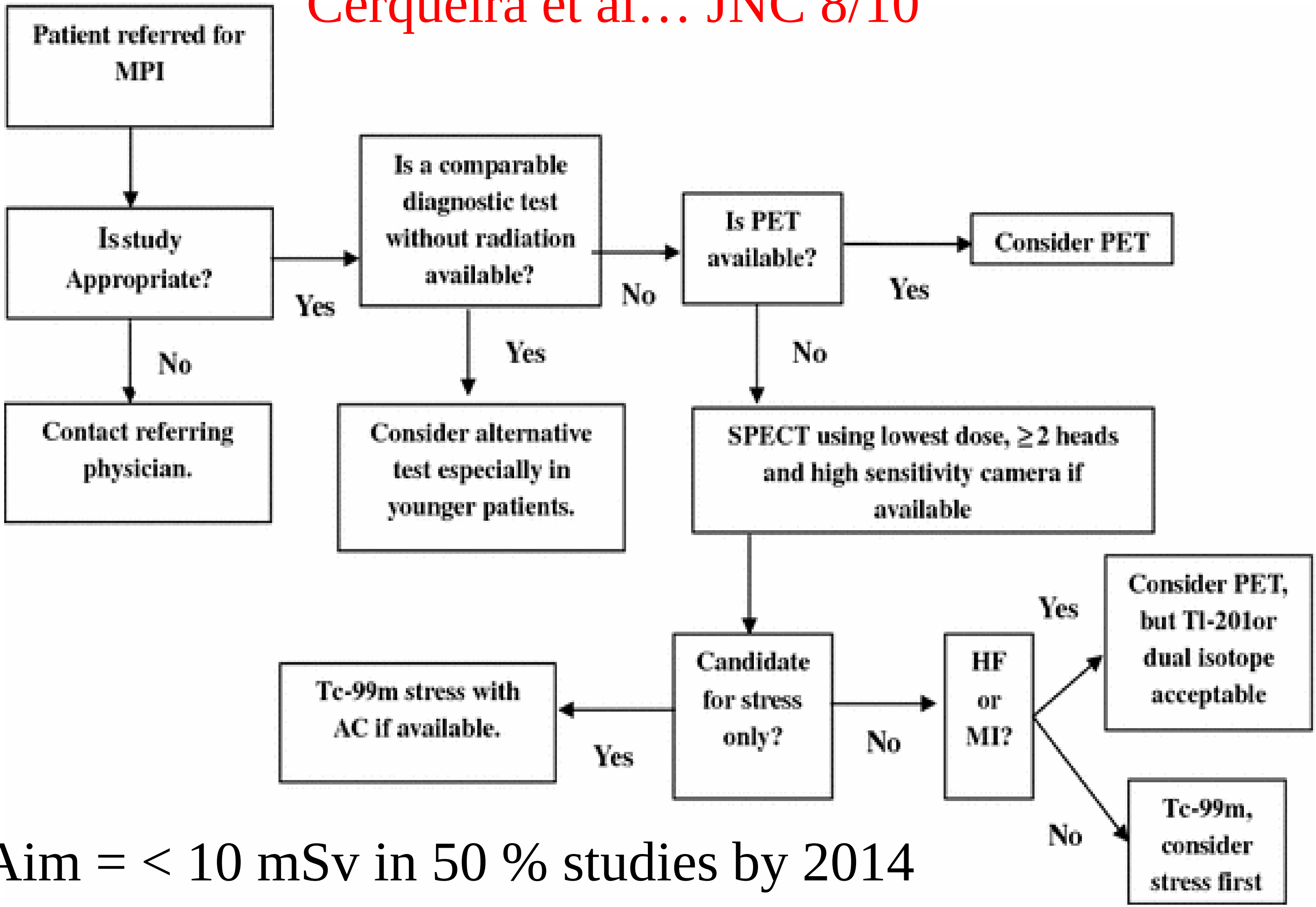
E. Gordon DePuey MD, Pashmina Ata MD, Rick Wray MD, Marvin Friedman PhD

JNC 10/12

Combining new software and stress only imaging, can get dose approx 1.4 mSv

Algorithm to reduce radiation exposure

Cerqueira et al… JNC 8/10



Aim = < 10 mSv in 50 % studies by 2014

Boy Genius – *Not* an Australian registrar!!!!!

CONCLUSION

1. Nuclear Cardiology continues to grow, but differently.
2. There are choices
3. Appropriate Use – Right test for the right pt
4. Use Radiation Reduction techniques
5. Cardiac CT – it’s here. ? Hybrid imaging
6. Gatekeeping in 2012 – we love to be “hot” in cardiology!!!

My Home !!!

POSTERA CRESCAM LAUDE

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