Evaluating clinical Risk and Guiding management with SPECT imaging.

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December 2012
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

**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
  
- Greater than or equal to 5 years after CABG
  
- Less than 5 years after CABG
  
- Greater than or equal to 2 years after PCI
  
- Less than 2 years after PCI

**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)
  
- Last stress imaging study done less than 2 years ago
  - Low CHD risk (ATP III risk criteria)

**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
  
- Known CAD on coronary angiography OR prior abnormal stress imaging study
  
- Last stress imaging study done less than 2 years ago

**Risk assessment: within 3 months of an ACS—asymptomatic post-revascularization (PCI or CABG)**

- Evaluation prior to hospital discharge
RAO
Diagnosis

NORMAL!!

But..... Is there more information??
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

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
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

<table>
<thead>
<tr>
<th>Event</th>
<th>Annualised event rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>All-cause mortality</td>
<td>1.1%</td>
</tr>
<tr>
<td>Cardiac mortality</td>
<td>0.3 %</td>
</tr>
<tr>
<td>Cardiac death/MI</td>
<td>0.7 %</td>
</tr>
<tr>
<td>Major cardiac event rate</td>
<td>1.8 %</td>
</tr>
</tbody>
</table>
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

Referral for invasive MX = only independent correlate of CER

P = .0091
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 ± 0.6 years
Comparison of short time survival with Revascularisation v. Medical Therapy

Hachamovitch et al. Circ 6/03

![Bar chart showing comparison of C.D. rate (%) between Medical Rx and Revascularisation based on % Ischaemic myocardium. *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
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-Winkler, 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*
Nuclear sub-study 314 pts

Ischaemia reduction $> 5\%$ reduces risk

Residual ischaemia at 18/12 $> 5\%$ increases risk
## EXERCISE CAPACITY and CER – (n = 9000)

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

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

% CER

- Normal
- Mild
- Severe

Duke Treadmill Score

Low risk  Intermediate  High risk

2200 pts
Rest thallium-201/
Stress Tc99m MIBI

Cath rate -
Very similar data

Hachamovitch et al ... Circ 3/0
Risk-based strategy

Suspected CAD for SPECT

- Normal study
  - Risk factor modification
- Mildly abnormal
  - Medical treatment
- Mod-severely abnormal
  - Cath ± Revascularisation
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!!
• 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

<table>
<thead>
<tr>
<th>Strategies</th>
<th>Cost (Pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All Pts</td>
</tr>
<tr>
<td><strong>Ex ECG → Cath</strong></td>
<td>490</td>
</tr>
<tr>
<td><strong>Ex ECG → MPI → Cath</strong></td>
<td>409</td>
</tr>
<tr>
<td><strong>MPI → Cath</strong></td>
<td>460</td>
</tr>
<tr>
<td><strong>Cath</strong></td>
<td>1253</td>
</tr>
</tbody>
</table>

**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

Cumulative hazard of non-fatal MI

Days

SDS<2

SDS>2

P < .02
Cardiac Prognosis - Gating & Risk

Sharir et al....JNM 6/01

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

Cardiac death % per year

What extra info do we need???
Exercise LVEF with TI-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.
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


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 \((n = 522)\)

<table>
<thead>
<tr>
<th>Condition</th>
<th>(n)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal stress test</td>
<td>409</td>
<td>78.4</td>
</tr>
<tr>
<td>Abnormal stress test</td>
<td>113</td>
<td>21.6</td>
</tr>
<tr>
<td>Abnormal myocardial perfusion</td>
<td>83</td>
<td>15.9</td>
</tr>
<tr>
<td><strong>Reversibility</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ischemia</td>
<td>73</td>
<td>88</td>
</tr>
<tr>
<td>Ischemia and scar</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Scar</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td><strong>Defect size (percent of left ventricle)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small (&lt;5%)</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>Moderate (≥5 and &lt;10%)</td>
<td>29</td>
<td>35</td>
</tr>
<tr>
<td>Large (≥10%)</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Metoprolol (n=4174), n (%)</th>
<th>Placebo (n=4177), n (%)</th>
<th>Hazard ratio</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary composite</td>
<td>243 (5.8)</td>
<td>290 (6.9)</td>
<td>0.83</td>
<td>0.04</td>
</tr>
<tr>
<td>Nonfatal MI</td>
<td>151 (3.6)</td>
<td>215 (5.1)</td>
<td>0.70</td>
<td>0.0007</td>
</tr>
<tr>
<td>Total mortality</td>
<td>129 (3.1)</td>
<td>97 (2.3)</td>
<td>1.33</td>
<td>0.03</td>
</tr>
<tr>
<td>Stroke</td>
<td>41 (1.0)</td>
<td>19 (0.5)</td>
<td>2.17</td>
<td>0.005</td>
</tr>
<tr>
<td>Outcome</td>
<td>Metoprolol (n=4174), n (%)</td>
<td>Placebo (n=4177), n (%)</td>
<td>Hazard ratio</td>
<td>p</td>
</tr>
<tr>
<td>--------------------------</td>
<td>----------------------------</td>
<td>-------------------------</td>
<td>--------------</td>
<td>------------</td>
</tr>
<tr>
<td>Revascularization</td>
<td>11 (0.3)</td>
<td>27 (0.6)</td>
<td>0.41</td>
<td>0.01</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>91 (2.2)</td>
<td>120 (2.9)</td>
<td>0.76</td>
<td>0.04</td>
</tr>
<tr>
<td>Significant hypotension</td>
<td>626 (15.0)</td>
<td>404 (9.7)</td>
<td>1.55</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Significant bradycardia</td>
<td>274 (6.6)</td>
<td>101 (2.4)</td>
<td>2.71</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>
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)

<table>
<thead>
<tr>
<th>MPI study</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>0 %</td>
</tr>
<tr>
<td>Mildly abnormal</td>
<td>7.9 %</td>
</tr>
<tr>
<td>Severely abnormal</td>
<td>11.9 %</td>
</tr>
</tbody>
</table>
RADIATION ISSUES 2012
Typical Effective Doses From Cardiac Imaging Procedures

Einstein, A. J. J Am Coll Cardiol 2012;59:553-565
Cancer risk related to low-dose ionizing radiation from cardiac imaging in patients after acute myocardial infarction.

Eisenberg et al CMAJ 2/11

12,020 cancers in 77% of 82,861 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

<table>
<thead>
<tr>
<th>Adjusted</th>
<th>HR Cancer risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 mSv</td>
<td>1.028 (1.004 – 1.047)</td>
</tr>
<tr>
<td>20 mSv</td>
<td>1.058 (1.036 -1.080)</td>
</tr>
<tr>
<td>30 mSv</td>
<td>1.088 (1.054 – 1.172)</td>
</tr>
<tr>
<td>40 mSv</td>
<td>1.119 (1.073 - 1.166)</td>
</tr>
<tr>
<td>Per mSv</td>
<td>1.003 (1.002 – 1.004)</td>
</tr>
</tbody>
</table>
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
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??
Appropriate use for SPECT MPI
Hendel et al. JACC 1/10
**Table 3**

### Most Frequent Inappropriate Indications

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

*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

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

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
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

Patient referred for MPI

Is study appropriate?

Yes

Is a comparable diagnostic test without radiation available?

No

Contact referring physician.

Is PET available?

Yes

Consider PET

No

Consider alternative test especially in younger patients.

SPECT using lowest dose, ≥2 heads and high sensitivity camera if available

Candidate for stress only?

Yes

Tc-99m stress with AC if available.

No

HF or MI?

Yes

Consider PET, but Tl-201 or dual isotope acceptable

No

Tc-99m, consider stress first

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 !!!

THE UNIVERSITY OF MELBOURNE