Evaluating Clinical Risk and Guiding management with SPECT Imaging

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(Organization for Economic Cooperation and Development. New Y Times 19/06/2009)
From 1996–2006, the total number of inpatient cardiovascular operations and procedures increased 30% from 5,444,000 to 7,191,000 annually. (AHA computation.)
Heart Disease and Stroke Statistics 2009 Update

(A Report From the American Heart Association Statistics Committee and Stroke Statistics Subcommittee Circulation 2009;119;e21-e181)
PCI in USA

- In 2006 an estimated 1,313,000 PCI
- In 2004 more than 1 million coronary stent procedures
- 85% of all PCI are undertaken electively in pts with stable CAD

- Feldman DN et al Am J Cardiol 2006; 98:1334)
# Outcome as function of early strategy

<table>
<thead>
<tr>
<th>Study</th>
<th>Period</th>
<th>n</th>
<th>conservative</th>
<th>interventional</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIMI IIIb (’89-’92; n=1473)</td>
<td>6 w</td>
<td></td>
<td>7.8%</td>
<td>7.2%</td>
<td>n.s.</td>
</tr>
<tr>
<td></td>
<td>1 y</td>
<td></td>
<td>12.2%</td>
<td>10.8%</td>
<td>n.s.</td>
</tr>
<tr>
<td>VANQWISH (’93-’95; n=920)</td>
<td>1 m</td>
<td></td>
<td>5.6%</td>
<td>10.4%</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>1 y</td>
<td></td>
<td>18.5%</td>
<td>24.0%</td>
<td>0.02</td>
</tr>
<tr>
<td>OASIS (’95-’96; n= 7987)</td>
<td>7 d</td>
<td></td>
<td>4.4%</td>
<td>4.9%</td>
<td>n.s.</td>
</tr>
<tr>
<td></td>
<td>6 m</td>
<td></td>
<td>10.5%</td>
<td>10.8%</td>
<td>n.s.</td>
</tr>
<tr>
<td>FRISH II (’96-’97; n= 2457)</td>
<td>6 mi</td>
<td></td>
<td>12.1%</td>
<td>9.4%</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>1 y</td>
<td></td>
<td>14.1%</td>
<td>10.4%</td>
<td>0.001</td>
</tr>
<tr>
<td>TACTIS TIMI – trial (’97-’99; n=2220)</td>
<td>30 d</td>
<td></td>
<td>7.4%</td>
<td>10.5%</td>
<td>0.009</td>
</tr>
<tr>
<td></td>
<td>6 m</td>
<td></td>
<td>15.9%</td>
<td>19.4%</td>
<td>0.025</td>
</tr>
</tbody>
</table>
Seven-Year Outcome in the RITA 2 Trial: Coronary Angioplasty vs Medical Therapy

(Henderson RA et al JACC 2003; 42: 1161)
Early Invasive versus Ischaemia-guided Strategies in the Management of non-Q wave Myocardial Infarction Patients with and without Prior Myocardial Infarction (Vanqwish trial)

No history of prior MI

Prior MI

A Randomized Trial of Therapies for Type 2 Diabetes and Coronary Artery Disease

(BARI 2D study group N Engl J Med 2009; 360:2503)
COMPARISON OF EARLY INVASIVE AND CONSERVATIVE MANAGEMENT IN PATIENTS WITH UNSTABLE CORONARY SYNDROME WITH THE GLYCOPROTEIN IIb/IIIa INHIBITOR \[\text{...}\]

Christopher P. Cannon, M.D., William S. Weintraub, M.D., Laura A. Demopoulos, Martin J. Frey, M.D., Nasser Lakkis, M.D., Franz-Josef Neumann, M.D., DePaul T. DeLucca, Ph.D., Peter M. DiBattiste, M.D., C. Michael Gibson, M.D.

for the TACTICS-Thrombolysis in Myocardial Infarction 1E Trial Investigators

INTERVENTIONAL CARDIOLOGY AND SURGERY

Interventional versus conservative treatment in acute non-ST elevation coronary syndrome: time course of patient management and disease events over one year in the RITA 3 trial

P A Poole-Wilson, S J Pocock, K A A Fox, R A Henderson, D J Wheatley, D A Chamberlain, T R D Shaw, T C Clayton, for the Randomised Intervention Trial of unstable Angina (RITA) Investigators

Are PCI benefits similar in ACS and in stable CAD?
Optimal Medical therapy with or without PCI for Stable Coronary Disease

From 1999 to 2004
2287 Pts

✓ Stenosis 70% in at least 1 coronary artery + objective evidence of myocardial ischemia (2168 Pts)
✓ Stenosis 80% and classic angina (119 Pts)

EXCLUSION CRITERIA:
- persistent CCS class IV angina
- markedly positive stress test
- heart failure or cardiogenic shock
- EF< 30%
- cor. Anatomy not suitable for PCI
- revascularization procedures within 6 months

( Boden WE et al for the COURAGE Trial research Group NEJM 2007; 356:1503 )
Optimal Medical therapy with or without PCI for Stable Coronary Disease

1149 PCI + medical therapy
1077 PCI + Med. Therapy

Median Follow-up 4.6 y

Primary event rate 19%
Primary event rate 18.5%

(Boden WE et al for the COURAGE Trial research Group NEJM 2007; 356:1503)
Optimal Medical therapy with or without PCI for Stable Coronary Disease

(Boden WE et al for the COURAGE Trial research Group NEJM 2007; 356:1503)
Impact of Optimal Medical Therapy with or without Percutaneous Coronary Intervention on Long-Term Cardiovascular End Points in Patients with Stable Coronary Artery Disease (from the COURAGE Trial)

Tertiary End point: Cardiac Death or MI

P = 0.62

Tertiary End point: Cardiac Death, MI or Hosp. for ACS

P = 0.6

(Boden WE et Am J Cardiol 2009; 104:1)
Effect of PCI on Quality of Life in Patients with Stable Coronary Disease

(Weintraub WS et al for the COURAGE Trial research Group NEJM 2008; 359:677)
Optimal Medical therapy with or without PCI for Stable Coronary Disease

Revascularization during follow-up

PCI + OMT: 21.1%
OMT: 32.6%

(Boden WE et al for the COURAGE Trial research Group NEJM 2007; 356:1503)
Is it possible to better stratify these Patients?
Hierarchy of Evidence for CV Imaging

I Diagnostic Selectivity
- Comparative Accuracy for Detecting CAD

II Symptoms Benefit
- Interaction of Imaging Risk Markers, Presenting Symptoms and Downstream symptom Burden

III Prognostic Utility
- Accuracy in Detecting MACE, Independent Prediction Exceeding Pre-Imaging, Clinical Hx

IV Optimized Test Effectiveness Strategy
- Comparative Effectiveness of Imaging-Driven Strategy in RCT
- Incremental Cost Effectiveness of Imaging-Driven Strategies in RCT

Optimized Test Effectiveness Strategy

Prognostic Utility
Myocardial Perfusion Scintigraphy: the Evidence

# of pts | F.U. yrs | yr event rate | high risk | low risk
---|---|---|---|---
SPECT experience: 10 years [median (25th–75th percentile)]

<table>
<thead>
<tr>
<th>Year</th>
<th>Author</th>
<th>n</th>
<th>Agent</th>
<th>Average follow-up (y)</th>
<th>Annual event rate</th>
<th>High risk</th>
<th>Low risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>Groutars86</td>
<td>597</td>
<td>Tetro</td>
<td>2.0</td>
<td>3.9</td>
<td>5.3</td>
<td>0.7</td>
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<tr>
<td>2001</td>
<td>Calnon87</td>
<td>308</td>
<td>MIBI</td>
<td>1.8</td>
<td>5.8</td>
<td>10.0</td>
<td>2.3</td>
</tr>
<tr>
<td>2001</td>
<td>Galassi57</td>
<td>459</td>
<td>Tetro</td>
<td>3.2</td>
<td>2.5</td>
<td>10.7</td>
<td>0.9</td>
</tr>
<tr>
<td>2001</td>
<td>Cottin88</td>
<td>152</td>
<td>TI-201</td>
<td>3.3</td>
<td>3.2</td>
<td>8.4</td>
<td>0.9</td>
</tr>
<tr>
<td>2001</td>
<td>Diaz50</td>
<td>7,163</td>
<td>TI-201</td>
<td>6.7</td>
<td>1.8</td>
<td>3.6</td>
<td>1.3</td>
</tr>
<tr>
<td>2000</td>
<td>Shaw53</td>
<td>8,411</td>
<td>MIBI/TI-201</td>
<td>2.5</td>
<td>1.2</td>
<td>5.0</td>
<td>0.5</td>
</tr>
<tr>
<td>2000</td>
<td>Kaminek89</td>
<td>70</td>
<td>TI-201/MIBI</td>
<td>2.1</td>
<td>1.4</td>
<td>10.7</td>
<td>1.2</td>
</tr>
<tr>
<td>2000</td>
<td>Amanullah90</td>
<td>633</td>
<td>TI-201/MIBI</td>
<td>1.8</td>
<td>6.0</td>
<td>5.4</td>
<td>0.8</td>
</tr>
</tbody>
</table>

SPECT experience: 69,655* 2.3 (1.8-3.9) yr event rate 3.0 (1.7-4.3) high risk 5.9 (4.6-8.5) low risk 0.85 (0.6-1.2)

MIBI, Tc-99m sestamibi; Tetro, Tc-99m tetrofosmin.

(Shaw LJ, Iskandrian AE. J Nucl Cardiol 2004; 11: 168)
Gated myocardial perfusion single photon emission computed tomography in the clinical outcomes utilizing revascularization and aggressive drug evaluation (COURAGE) trial, Veterans Administration Cooperative study no. 424

PRETREATMENT

• Assessment of pretreatment gSPECT ischemia and its relationship to patient symptoms and angiographic disease burden

POSTTREATMENT

• Role of gSPECT in assessing recurrent chest-pain symptoms after the initial treatment
• Usefulness of gSPECT before and after therapy in assessing treatment effects.

(Shaw LJ et al J Nucl Cardiol 2006; 13: 685)
Risk stratification of patients after myocardial revascularization by stress Tc-99m Tetrofosmin myocardial perfusion tomography.

Optimal Medical Therapy With or Without Percutaneous Coronary intervention to Reduce Ischemic Burden: Results from the Clinical Outcomes Utilizing Revascularization and Aggressive Drug Evaluation (COURAGE) Trial Nuclear Substudy

(Shaw LJ et al Circulation 2008; 117: 1283)
Prediction of Myocardial Infarction versus Cardiac Death by Gated Myocardial Perfusion SPECT: Risk Stratification by the Amount of Stress-Induced Ischemia and the Poststress Ejection Fraction

(Sharir T et al J Nucl Med 2001; 42: 831)
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(Shaw LJ et al Circulation 2008; 117: 1283)
The economic consequences of available diagnostic and prognostic strategies for the evaluation of stable angina patients: an observational assessment of the value of precatheterization ischemia. Economics of Noninvasive Diagnosis (END) Multicenter Study Group.

(Shaw LJ et al J Am Coll Cardiol 1999;33:661)
Outcomes of Patients with Stable Low-Risk Coronary Artery Disease Receiving Medical- and PCI- Preceding Therapies in Japan

(Tanihata S et al Circ J 2006; 70: 365)
Leading causes of death for white females in the U.S. in 2003:

- **Total CVD**: 39.7%
- **Cancer**: 21.5%
- **Chronic Lower Respiratory Disease**: 5.7%
- **Alzheimer's Disease**: 3.9%
- **Accidents**: 3.0%

Percent of total deaths.
Cardiovascular Disease Mortality Trends for Males and Females
United States: 1979-2003

Event Rates as Function of MPI With SPECT Results by Gender

Prognostic value of gated myocardial perfusion SPECT.

(Shaw LJ, Iskandrian AE. J Nucl Cardiol 2004; 11: 168)