Low Risk Chest Pain in the Emergency Department: The RIH CPU Experience

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Case

- 55 year old man presents to ED with atypical chest pain
- PMH: HTN, DM, hyperlipidemia
- ECG: minimal nonspecific ST-T abnormality
Normal SPECT MPI: Stress Perfusion Images

SHORT AXIS

PATIENT INFORMATION
Name: N, D
ID #: 1802169
Date: 11-4-2000
Study A: STRESS-GATED
Study B:

PLANAR

Supine LL  Decub. LL

Supine LL  Decub. LL

VERTICAL LONG AXIS

HORIZONTAL LONG AXIS

C. BAR
Case Continued

• Months later:
  – Presents again with atypical chest pain
  – No diagnostic ECG changes
  – Testing possibilities
    • Repeat stress?
    • Coronary angiography?
Case Continued (March 2008)
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Case Continued

- Cath: 50% stenosis in mid left circumflex
- Medical management continued
- Everybody feels good until:
Case Continued

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- Medical management continued
- Everybody feels good until:

3 months later, presents with inferolateral ST elevation MI!
Post PCI
What do I do with these test results?

• Why did you order the test?
• What are the limitations of the test?
• How do other clinical factors influence medical decision making?
What do I do with these test results?

- Why did you order the test?
- What are the limitations of the test?
- How do other clinical factors influence medical decision making?

*The history, including nature of symptoms and the likelihood of ACS are critical!*
Concept of Functional vs Anatomic Imaging

**Functional**
- Ischemia
- Hemodynamics
- Symptoms

**PROGNOSIS**
- Diagnosis
- Need for revascularization

**Anatomic**
- Angiography
- Calcium Score (CAC)

**Prognosis**
- Diagnosis

**DIAGNOSIS**
- Goals & intensity of medical Rx
ACS: Infarction vs Ischemia

Exclude Infarction
- Resting ECG
- Serum Biomarkers
  - CK-MB
  - Troponins
  - Myoglobin
- Rest Echocardiography
- Rest SPECT Imaging

Exclude Ischemia
- Cardiac Troponin (T, I)
- ST-segment trend monitoring
- Exercise ECG
- Stress Echo
- Stress SPECT imaging
Evaluation of Low Risk Chest Pain in ED:
Definition of “Low Risk”

- Age (< 65 or < 75 yrs)
- No history of CAD
- No ST-segment deviation
- Negative biomarkers
- (?) Risk factors for CAD

Nature of chest pain: Anginal? Frequency?

- Age (< 65 or < 75 yrs)
- No history of CAD
- No ST-segment deviation
- Negative biomarkers
- (? Risk factors for CAD)

*Nature of chest pain: Anginal? Frequency?*
Noninvasive Testing Options

- Stress ECG
- Stress Echo
- Stress MPI
- CT
- No test
Yale Experience: Protocolized

Pharm SPECT

Ex SPECT

Ex ECG

Overall 91% Normal
Abbott et al, Am J Cardiol, 2001

N=2226

64% n=1417

20% n=451

16% n=358

36% required SPECT imaging

Abbott et al, Am J Cardiol, 2001
### CPU Protocol: The Virginia Commonwealth Approach

<table>
<thead>
<tr>
<th>Level 3: probable ACS</th>
<th>Level 4: possible ACS</th>
<th>Level 5: low suspicion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonischemic ECG</td>
<td>Nonischemic ECG</td>
<td>“Clear” documentation of noncardiac etiology</td>
</tr>
<tr>
<td>Typical symptoms &gt; 30’</td>
<td>Typical symptoms &lt; 30'</td>
<td></td>
</tr>
<tr>
<td>No CAD</td>
<td>Or</td>
<td></td>
</tr>
<tr>
<td>Or</td>
<td>Atypical symptoms &gt;30’</td>
<td></td>
</tr>
<tr>
<td>Known CAD</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Level 3: probable ACS**
  - Nonischemic ECG
  - Typical symptoms > 30’
  - No CAD
  - Or
  - Atypical symptoms > 30’
  - Known CAD

- **Level 4: possible ACS**
  - Nonischemic ECG
  - Typical symptoms < 30’
  - Or
  - Atypical symptoms

- **Level 5: low suspicion**
  - “Clear” documentation of noncardiac etiology
CPU Protocol: The Virginia Commonwealth Approach

Level 3
Probable ACS

Serial ECGs
Cardiac markers
or
Rest MPI

+ 
Treat as ACS

Stress *before discharge*

--

Level 4
Possible ACS

Rest MPI

+ 
Treat as ACS

Stress *within 72 hrs*

--
RIH Chest Pain Unit
Patient Population

• Age > 18 yrs
• Chest pain or equivalent
• Negative initial troponin
• No diagnostic ECG changes
• No hx of CAD if age > 75
• No major active acute comorbidities
RIH Chest Pain Unit Protocol

Time 0
- Evaluation by ED Staff
- CPU Admission

0-6 hrs
- Serial ECG, telemetry
- Serial troponin

6-20 hrs
- Cardiology Evaluation
- Disposition
RIH Chest Pain Unit Protocol

**Time 0**
- Evaluation by ED Staff
- CPU Admission

**0-6 hrs**
- Serial ECG, telemetry
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**6-20 hrs**
- Cardiology Evaluation
- Disposition

*Discharge (no testing)*
*Stress ECG*
*Stress Imaging*
RIH Chest Pain Unit
Patient Population (n = 1063, 8 month period)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>53 ± 12 yrs</td>
</tr>
<tr>
<td>Male</td>
<td>49%</td>
</tr>
<tr>
<td>BMI</td>
<td>30 ± 7</td>
</tr>
<tr>
<td>Hypertension</td>
<td>53%</td>
</tr>
<tr>
<td>Hyperlipidemia</td>
<td>38%</td>
</tr>
<tr>
<td>Diabetes</td>
<td>21%</td>
</tr>
<tr>
<td>Smoker</td>
<td>42%</td>
</tr>
<tr>
<td>FHx of CAD</td>
<td>39%</td>
</tr>
</tbody>
</table>

Diamond-Forrester Pre-test likelihood for CAD: 33 ± 25%
ACS: 2.2%
Average stay 17 ± 8 hrs
RIH Chest Pain Unit
Testing

CPU Testing

No testing 49%

MPI 26%

Echo 19%

ETT 3%

Other 3%
RIH Chest Pain Unit
Testing (n = 1063)

- 5.7% positive stress test
- 20.8% positive cardiac cath
- MPI 26%
- Echo 19%
- No testing 49%
- ETT 3%
- Other 3%

CPU Testing

5.7% positive stress test
20.8% positive cardiac cath
5.7% positive stress test

20.8% positive cardiac cath

30 Day MACE (73% F/U): 1/776 (0.1%)
### Comparison with Other Studies
(Studies w/ 30-day AE)

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>Stress (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Rate</td>
</tr>
<tr>
<td>Gomez (1996)</td>
<td>100</td>
<td>94</td>
</tr>
<tr>
<td>Amsterdam (2002)</td>
<td>1000</td>
<td>100</td>
</tr>
<tr>
<td>Chan (2003)</td>
<td>832</td>
<td>21</td>
</tr>
<tr>
<td>Arnold (2007)</td>
<td>1644</td>
<td>66</td>
</tr>
<tr>
<td>Johnson (2008)</td>
<td>800</td>
<td>75</td>
</tr>
<tr>
<td>Kogan (2009)</td>
<td>175</td>
<td>100</td>
</tr>
<tr>
<td>Rahman (2010)</td>
<td>300</td>
<td>85</td>
</tr>
<tr>
<td>Abbott (2001)</td>
<td>2226</td>
<td>100</td>
</tr>
<tr>
<td>RIH</td>
<td>1073</td>
<td>51</td>
</tr>
</tbody>
</table>

*Includes stress imaging*
RIH CPU Experience

- Collaboration between Emergency Medicine and Cardiology
- Low risk patients (2% ACS)
- Cardiac testing is at the discretion of cardiology
- Evaluation within 24 hours (usually <18)
- Low 30 day MACE
RIH CPU Experience

- Collaboration between Emergency Medicine and Cardiology
- Low risk patients (2% ACS)
- Cardiac testing is at the discretion of cardiology
- Half of patients do not have any high cost test
- Evaluation within 24 hours (usually <18)
- Low 30 day MACE

Limitations:
1) Rate-limiting steps: cardiology rounds, stress test availability
2) Limited follow up, low event rates overall
3) Lacking data on downstream impact of stress results
Thank you!