Five Errors to Avoid in Chest Pain Patients
High Risk Emergency Medicine 2017
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ED Chest Pain in USA
- 8-10 million ED visits for CP
- 10 – 12 billion dollars spent on CP evals
- Best evaluation method unknown
- Most CP patients do NOT have CASHD

We underestimate risk of ACS

Missing AMI and ACS is usually the single biggest category for total malpractice claims payouts in Emergency Medicine

Missed AMI
- Groups repetitively cited for missed ACS:
  - The “wrong” age (< 45 or > 65-70)
  - Atypical symptoms
  - Less symptoms
  - No prior angina/CASHD hx
  - WNL or Nonspecific ECG
  - Female
  - Minority
Classic Ischemic Chest Pain

• Crushing Substernal
• Radiating to the left arm and/or jaw
• Associated with:
  – Nausea
  – Weakness
  – Diaphoresis
• Lasting 15-30 minutes
• Made better by rest, worse by exertion
• Relieved by Nitroglycerin

Chest Pain Is The Hallmark Of AMI

• May be absent
• May be fleeting
• May be different than substernal
• May be:
  – Pleuritic, stabbing or even palpable

Value and Limitations of Chest Pain History in the Evaluation of Patients With Suspected Acute Coronary Syndromes

- Medline and OVID searched 1970-2005
- 88 sources reviewed
- Up to 11,000 patients per characteristic
- Objectively evaluates ability of clinicians to Rule-In or Rule-Out ACS

<table>
<thead>
<tr>
<th>Increased Likelihood of AMI (+LR)</th>
<th>Decreased Likelihood of AMI (-LR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiation to R arm or shoulder</td>
<td>Pleuritic</td>
</tr>
<tr>
<td>4.7</td>
<td>0.2</td>
</tr>
<tr>
<td>Radiation to both arms or shoulder</td>
<td>Positional</td>
</tr>
<tr>
<td>4.1</td>
<td>0.3</td>
</tr>
<tr>
<td>Associated with exertion</td>
<td>Sharp</td>
</tr>
<tr>
<td>2.4</td>
<td>0.3</td>
</tr>
<tr>
<td>Radiation to L arm</td>
<td>Reproducible palpation</td>
</tr>
<tr>
<td>2.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Diaphoresis</td>
<td>Inframammary</td>
</tr>
<tr>
<td>2.0</td>
<td>0.8</td>
</tr>
<tr>
<td>Nausea or vomiting</td>
<td>Not associated with exertion</td>
</tr>
<tr>
<td>1.9</td>
<td>0.8</td>
</tr>
<tr>
<td>Worse than prior angina or AMI</td>
<td>Described as pressure</td>
</tr>
<tr>
<td>1.8</td>
<td>1.5</td>
</tr>
</tbody>
</table>

“No single element of the Chest Pain History is a powerful enough predictor of non-ACS or non-AMI to allow clinicians to make decisions according to it alone”

Mistake #1: Not appreciating that...

Atypical is Typical
Atypical Stuff - Probability of AMI in 6000 Patients

NEJM 1994; Chest 1992

- C. P. greater than 48 hours
  - New ST: 20%
  - No New ST: 1%
- Pain reproduced by palpation: 1%
- Stabbing Pain: 3%
- Age less than 40: 2%
- Radiation to back, legs, abdomen: 1%

Grace Study

The 8.4% Without Chest Pain

Chest 2004; 126:461-469

- 20,881 patients with ultimately suspected ACS
- 8.4% (1,783 pts.) had no chest pain, only “atypical symptoms”
- ¼ of patients without C.P. didn’t have ACS initially suspected
- Mortality much higher if no C.P.: 13% vs. 4.3% (p < 0.0001)

Grace Study

The 8.4% Without Chest Pain

Chest 2004; 126:461-469

- 434,877 AMIs (NRMI-2)
- 1/3 of patients had no C.P. at presentation
- No C.P. doubled mortality
- No C.P. if DM, female, older

The Big 5
No CP AMIs

*Acute Onset of:*

- Shortness of breath
- Diaphoresis
- GI sx: vague pain, N/V
- Acutely weak, loss of energy
- Neuro sx; dizzy, pre-syncope, AMS

Mistake #2: Not appreciating that...

The Elderly are Different
“Atypical” Presentations in the Elderly

- 777 AMI’s, ages 65-100
- Chest pain was seen in only 66%
- Frequency of C.P. decreases with age (75% age 70; 50% age 80)
- Infrequent above age 85 (38% above age 85)
- Beware “Atypical” presentation

Mistake #3: Not appreciating that...

No one is too young for ACS

Mistake #4:

Trying to read all 12 ECG leads at the same time

Atypical” Presentations in the Elderly

- Dyspnea 40%
- Syncope 14%
- AMS 7%
- Weakness 7%
- Giddiness 5%
- Stroke 4.5%

Up to 10% of all AMIs occur in patients under age 40
Reading the ECG for AMI

- Misreads are single biggest cause of missing AMI
- Must be as good as anyone in reading ECGs
- Must specifically look for all 5 AMI patterns
- Beware NSSTW Δs…
- Repeat ECGs!!

Read 2-3 leads at a time!

Reading for AMI
3 at a Time, Not 12

<table>
<thead>
<tr>
<th>2, 3, F</th>
<th>Inferior</th>
</tr>
</thead>
<tbody>
<tr>
<td>V₁, V₂, V₃</td>
<td>Anteroseptal</td>
</tr>
<tr>
<td>V₄, V₅, V₆</td>
<td>Anterolateral</td>
</tr>
<tr>
<td>I, L</td>
<td>Lateral</td>
</tr>
</tbody>
</table>

↑ AvR, V₁↓, V₂↓ Left Main, RV, Posterior

- “50% of all misses due to suboptimal ECG reading skills”
- 70% of missed AMIs had abnormal ECGs
- 12% of high risk changes missed; 18% ST depression missed, 8% of STEMI missed

Wellen’s Warning

A patient presents with chest pain and diffuse ST depression. What is so significant about this ECG?
ST in AVR > 1 mm
80% Sensitive and 93% Specific
For Left Main Disease when seen in conjunction with diffuse ST depression in other leads

If ST ↑ in AVR > V₁ think left main or left main equivalent
Are all abnormal ECG changes equal in risk?

- 2,349 CP patients from Australia
- Evaluated six different ECG changes
- Measured 30 d STEMI, N-STEMI, PCI, Death
- Overall: 6.3 STEMI, 2.5% N-STEMI rates

**ECG Changes and 30 Day Risk**

<table>
<thead>
<tr>
<th>ECG Type</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>5%</td>
</tr>
<tr>
<td>Non Specific</td>
<td>13.6%</td>
</tr>
<tr>
<td>Abnormal, non diagnostic</td>
<td>13%</td>
</tr>
<tr>
<td>Ischemia known old</td>
<td>24.7%</td>
</tr>
<tr>
<td>Ischemia not known old</td>
<td>55.3%</td>
</tr>
<tr>
<td>AMI</td>
<td>66.7%</td>
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**ECGs in CP Patients**

- Any abnormality increases risk
- Read ECGs carefully

**Mistake #5:**

- Not using a scoring system that includes repeating the 12-Lead ECG and Troponin

**The HEART Pathway Randomized Trial**

- Pathway for early ED D/C
- Troponins at 0 and 3 hours
- Used HEART Score
282 patients; 141 HEART Pathway
• HEART Pathway vs Regular Care
• 30 d follow-up
• Average age 53 yo
• Low-risk patients discharged

Simplicity of the HEART Score

It is safe to discharge patients if their HEART Score is 3 or less (≤ 3)

Patients with HEART Scores above 3 (≥ 4) should undergo stress testing and/or admission

The HEART Score

H History
E ECG
A Age
R Risk Factors
T Troponin

HEART Score Risk Factors

• No risk factors 0 points
• 1-2 risk factors 1 point
• ≥ 3 risk factors 2 points

*Risk factors for atherosclerotic disease:
- Hypercholesterolemia
- Cigarette Smoking
- Hypertension
- Positive family history
- Diabetes Mellitus
- Obesity
CASHD Risk Factors
Are there more?

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Additional Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>Family history</td>
</tr>
<tr>
<td>Hyperlipidemia</td>
<td>Metabolic Syndrome</td>
</tr>
<tr>
<td>Hyperglycemia (DM)</td>
<td>HIV antiretrovirals</td>
</tr>
<tr>
<td>Chronic RF</td>
<td>SLE, RA, CVD</td>
</tr>
<tr>
<td>Chronic Cocaine</td>
<td>Mediastinal irradiation</td>
</tr>
<tr>
<td>Chronic ETOH</td>
<td></td>
</tr>
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</table>

The Deadly Quartet

- Abdominal obesity (40 inch M; 35 inch F)
- Hypertension
- Diabetes
- Hyperlipidemia

Caution if HEART Score < 3

- Do not use Troponin in HEART as a very positive troponin scores only 2 points and could allow a discharge of an NSTEMI

A 44 yo man has crushing SSCP radiating to both arms and SOB. His ECG has non specific ST and T wave changes.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>+2</td>
</tr>
<tr>
<td>E</td>
<td>+1</td>
</tr>
<tr>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>R</td>
<td>0</td>
</tr>
<tr>
<td>T</td>
<td>0</td>
</tr>
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Caution if HEART Score ≤ 3

- Can include highly suggestive history (2 points) plus non-specific repolarization patterns on ECG (1 point)

A 40 yo man had a single-episode of SSCP while mowing the lawn. It lasted 2 minutes and did not reoccur as he finished mowing. He has no risk factors, is on no meds, is physically active and his two troponins spaced 3 hours apart are undetectable

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<th>Score</th>
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<tbody>
<tr>
<td>H</td>
<td>+1</td>
</tr>
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<td>E</td>
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<tr>
<td>A</td>
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<td>R</td>
<td>0</td>
</tr>
<tr>
<td>T</td>
<td>0</td>
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Diffuse ST Depression

Can also equal significant ST depression (2 points) and a moderately suspicious history (1 point)

Caution if HEART Score ≤ 3

Stop Using HEART Score

If Troponin is positive
If history is highly suggestive
If ECG shows significant ischemic ST changes

Modifies HEART Score to be more sensitive

- repeat ECG
- 2 hour delta troponin
- male sex

Increases importance to
- probable ischemic CP
- Ischemic ST depression

Objective and Subjective

The HEART Score provides an objective number to risk stratify CP patients

But please remember its based on subjective data:
- The patient’s knowledge of risk factors
- Your assessment of the patient’s CP history
- The ECG interpretation

Do ED physicians and cardiologists agree on HEART Scores?

- ED physicians and cardiologists disagreed 70% of time
- Cardiologists assigned a lower score to patient’s history in more than ½ of patients (58%)
5 Ways to Diagnose an AMI on ECG

- 1 mm of ST elevation in 2 or more anatomically contiguous leads
- Reciprocal ST Depression
- Q Waves
- Compared to prior ECGs
- Compare to next ECG

If the patient’s ECG is in any way abnormal - make every effort to obtain an old ECG…even if it has to be faxed

ONE ECG BEGETS ANOTHER

Repeat ECGs increase the likelihood of diagnosing an AMI by up to 16% in high risk patients

Repeat an ECG before the patient leaves and/or if the patient re-develops CP or new symptoms

Can a HEART Score ≤ 3 and a 0 and 1 hour delta high-sensitivity troponin be used in an effective rapid rule out ACS protocol? TRAPID-AMI trial

- 12 center, 1,040 ED pts, used Roche hs TnT
- Compared HS ≤ 3 vs HS ≥ 3
- Did both a 0 and Δ 1 hr R/O protocol
- And a 0, 1, 2, 4-14 hr R/O protocol

Key Finding

- A HEART score ≤ 3
  +
  - 0 hour troponin < 14
    +
    - 1 hour Δ troponin < 3

Equates to a 30 day Death / AMI risk of 0.2%
4 different Troponin testing protocols

Level of detection vs abnormal vs 2 delta protocols

A single Troponin can miss up to 6% of AMIs if CP began within 2 hours of ED arrival

An undetectable Troponin I level (LOD < 2 ng/L) in patients with CP for at least 2-3 hours rules out AMI with 100% sensitivity

High-STEACS study of 1,218 pts.

ARCHITECT hs Trop I limit of detection is 1.2 ng/L

Compares European guidelines to high STEACS < 99th percentile at 0 and at 3h or 6h (16 ng/L Female and 34 ng/L Male)

STEACS: < 5 ng/L at 0 hrs and 3 hr ∆↑ < 3 ng/L

• The lower the Troponin value used for abnormal, the more sensitive your rule out will be
• Using the 99th percentile increases missed AMIs by 90% compared to a lower cut-off value (18 acute misses vs 2)
• Using lower value is 99.5% sensitive

Take Homes on High Sensitivity Troponins

• Undetectable at 0-1 or 0-3 rules out AMI
• Delta testing excludes evolving AMI
• Early AMI presenters need values over time
• Using the 99th percentile may not be optimal
• hS Troponin testing with Objective Scoring is synergistic

At the current time there is no universally accepted high sensitivity Troponin protocol and objective scoring system that is “proven” to be optimal
All important decisions are made on incomplete information…

Yet we are responsible for every decision we make.

Sheldon Kopp 1972

Be sure to recommend follow up in 3 days until ACC-AHA makes a new recommendation

Expert Cardiac Evaluation in 5 Steps

- Perform a Careful History and Physical
- Perform at least two ECGs
- Perform at least two troponins
- Use modified HEART Score
- Involve patient in shared decision making

In Summary

- Atypical is Typical
- The Elderly are Different
- No one is too young for ACS
- Don’t try to read all 12 ECG leads
- Scoring System with Repeat ECGs and Troponins

Responsibility is a Heavy Responsibility

Cheech of Cheech and Chong