Chest Pain Wave I

What Defines Quality in Chest Pain? - Metrics, Outliers, and Actions
Presenters

Jim McCord, MD, Cardiology

Chris Pergrem, MD, Emergency Medicine

Josh Baugh, MD, MPP, Emergency Medicine
Disclosures

Jim McCord:
• Research Support: Roche, Siemens, Abbott
• Consultant: Roche, Siemens

Chris Pergrem:
• I currently am employed by, and own stock in Envision Physician Services
Mike’s question:

- We have covered so many great topics related to low risk chest pain patients in the ED – troponin, decision tools, observation units, cardiac imaging.

- This naturally leads us to the next question:
  - How do you define quality of care for ED low risk chest pain patients?
Quality of Care in Low Risk Chest Pain in ED

James McCord MD
Henry Ford Heart & Vascular Institute
Dec 2017
Quality Issues in Chest Pain Evaluation

1. Missed AMI or death within 30 days
2. Cost Issues (time/money) for patients and Hospitals: markers, stress test, CTA
3. Avoiding harm: radiation, invasive procedures
MISSED DIAGNOSIS OF ACUTE CARDIAC ISCHEMIA IN THE EMERGENCY DEPARTMENT

RESULTS

- 1,855 with ACS
  - 889 AMI
  - 966 USA

- Missed Diagnosis
  - AMI 19 (2.1%) (0-11%)
  - USA 22(2.3%) (0-4.3%)
MISSED ACS in the ED

- 8-13 million/yr evaluated for possible ACS
- ~ 20% have ACS
- ~ 2% are missed in the ED
- 32,000 – 52,000 missed ACS/year in USA

Blomkalns, *Cardiology Clinics, 2005*
Medical-Legal Issues

- 25% of all money paid in malpractice claims relates to missed ACS in the USA
AHA/ACC Testing Strategy

3.5.1. Discharge From the ED or Chest Pain Unit: Recommendations

Class IIa

1. It is reasonable to observe patients with symptoms consistent with ACS without objective evidence of myocardial ischemia (nonischemic initial ECG and normal cardiac troponin) in a chest pain unit or telemetry unit with serial ECGs and cardiac troponin at 3- to 6-hour intervals.¹⁹⁶,¹⁹⁷,¹⁹⁹–²⁰¹ (Level of Evidence: B)

2. It is reasonable for patients with possible ACS who have normal serial ECGs and cardiac troponins to have a treadmill ECG²⁰⁰–²⁰² (Level of Evidence: A), stress myocardial perfusion imaging,²⁰⁰ or stress echocardiography²⁰³,²⁰⁴ before discharge or within 72 hours after discharge. (Level of Evidence: B)

AHA/ACC Guidelines for the Management of Patients with Non ST-Elevation ACS
Circ 2014; 130:2354-2394 (Endorsed by ACEP)
COSTS

- Estimations are that $10-12$ billion spent annually in the US to evaluate patients in the ED with possible ACS
- Do not over test; do not keep the patient longer than is necessary!
Time: Rapid Rule-Out AMI Strategies

1. 1-hr delta protocol
2. Below LOD (level of detection) at presentation
3. These protocols involve high sensitivity troponin assays
One-Hour Rule-out and Rule-in of Acute Myocardial Infarction Using High-Sensitivity Cardiac Troponin T

Tobias Reichlin, MD; Christian Schindler, PhD; Beatrice Drexler, MD; Raphael Twerenbold, MD; Miriam Reiter, MD; Christa Zellweger, MD; Berit Moehring, MD; Ronny Ziller, MD; Rebeca Hoeller, MD; Maria Rubini Gimenez, MD; Philip Haaf, MD; Mihael Potocki, MD; Karin Wildi, MD; Cathrin Balmelli, MD; Michael Freese, RN; Claudia Stelzig, MSc; Heike Freidank, MD; Stefan Osswald, MD; Christian Mueller, MD, FESC
Diagnostic Algorithm: hs-cTnT

- 436 Patients with chest pain—validation cohort
  - Oh < 12 and Delta 1h < 3
    - Rule-out
      - 259 Patients (60%)
        - Sensitivity: 100%
        - NPV: 100%
  - Others
    - Observational zone
      - 101 Patients (23%)
        - Prevalence of AMI: 8%
  - Oh ≥52 or Delta 1h ≥5
    - Rule-in
      - 76 Patients (17%)
        - Specificity: 97%
        - PPV: 84%
1-Hr Delta Trop Studies

- Sensitivity: 93.3-100%
- NPV: 98.6-100%
- # Pts that rule-out: 40-64%
0 h/1 h rule-in and rule-out algorithms using high-sensitivity cardiac troponins (hs-cTn) assays

<table>
<thead>
<tr>
<th>Suspected NSTEMI</th>
<th>Rule-out</th>
<th>Observe</th>
<th>Rule-in</th>
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<tbody>
<tr>
<td>0h &lt; A ng/l or Δ0-1h &lt; C ng/l</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>0h ≥ D ng/l or Δ0-1h ≥ E ng/l</td>
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<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
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<tr>
<td>hs-cTnT (Elecsys)</td>
<td>5</td>
<td>12</td>
<td>3</td>
<td>52</td>
<td>5</td>
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<tr>
<td>hs-cTnI (Architect)</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>52</td>
<td>6</td>
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<tr>
<td>hs-cTnI (Dimension Vista)</td>
<td>0.5</td>
<td>5</td>
<td>2</td>
<td>107</td>
<td>19</td>
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2014 AHA/ACC Guideline for the Management of Patients With Non-ST-Elevation Acute Coronary Syndromes

A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines

Developed in Collaboration With the Society for Cardiovascular Angiography and Interventions and Society of Thoracic Surgeons

Endorsed by the American Association for Clinical Chemistry

CLASS III: NO BENEFIT

1. With contemporary troponin assays, creatine kinase myocardial isoenzyme (CK-MB) and myoglobin are not useful for diagnosis of ACS (158-164). (Level of Evidence: A)
US Trends in Biomarker Protocols

![Graph showing trends in biomarker usage from 2009 to 2014. The graph compares the usage of Troponin alone, Troponin I/T & CKMB, Trop I/T + CKMB + Myo, and Trop I/T + Myo across the years.](image)

J Am Heart Assoc 2017 Sept 22 6(9)
Cut-Points for Troponin

- Abnormal value exceeds the 99\(^{th}\) % of a normal reference control group
- Major quality issue: use recommended cut-point!
Mike’s question . . .

- Jim you raise some excellent points regarding missed MIs, cost, and ED troponin protocols.

- What about the really big issue – potential overuse of advanced cardiac imaging and the associated risks? Does that have a place in quality definitions?
Multi-Center Randomized Trials: CTA in ED

1. CT-STAT JACC 2011: 699 pts
2. ACRIN NEJM 2012: 1,370 pts
3. ROMICAT-II NEJM 2012: 1,000 pts
**ACRIN STUDY: 1,370 Pts**

<table>
<thead>
<tr>
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<th>CTA</th>
<th>SOC</th>
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<tr>
<td>Revascularization</td>
<td>23(3%)</td>
<td>4(1%)</td>
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<table>
<thead>
<tr>
<th>Variable</th>
<th>Index Visit</th>
<th></th>
<th>P Value</th>
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<tr>
<td>Diagnostic testing — no. of patients (%) †</td>
<td></td>
<td>&lt;0.001</td>
<td></td>
<td>&lt;0.001</td>
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<tr>
<td>No testing:‡</td>
<td>9 (2)</td>
<td>109 (22)</td>
<td></td>
<td>9 (2)</td>
<td>89 (18)</td>
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<tr>
<td>1 test</td>
<td>376 (75)</td>
<td>337 (68)</td>
<td></td>
<td>359 (72)</td>
<td>350 (70)</td>
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<tr>
<td>≥2 tests</td>
<td>116 (23)</td>
<td>53 (11)</td>
<td>133 (27)</td>
<td>60 (12)</td>
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<tr>
<td>Functional testing — no. (%) ‡</td>
<td></td>
<td>&lt;0.001</td>
<td></td>
<td>&lt;0.001</td>
<td></td>
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<tr>
<td>SPECT</td>
<td>50 (10)</td>
<td>124 (25)</td>
<td>58 (12)</td>
<td>133 (27)</td>
<td></td>
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<tr>
<td>Stress echocardiography</td>
<td>20 (4)</td>
<td>102 (20)</td>
<td>20 (4)</td>
<td>102 (20)</td>
<td></td>
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<tr>
<td>ETT</td>
<td>12 (2)</td>
<td>147 (29)</td>
<td>22 (4)</td>
<td>162 (32)</td>
<td></td>
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<tr>
<td>Invasive coronary angiography — no. (%)</td>
<td>54 (11)</td>
<td>36 (7)</td>
<td>59 (12)</td>
<td>40 (8)</td>
<td>0.06</td>
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<td>Intervention — no. (%)</td>
<td></td>
<td></td>
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<tr>
<td>PCI</td>
<td>24 (5)</td>
<td>14 (3)</td>
<td>0.14</td>
<td>27 (5)</td>
<td>17 (3)</td>
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<tr>
<td>CABG</td>
<td>5 (1)</td>
<td>4 (1)</td>
<td>0.99</td>
<td>5 (1)</td>
<td>4 (1)</td>
</tr>
<tr>
<td>Cumulative radiation exposure — mSv/patient ¶</td>
<td>13.9±10.4</td>
<td>4.7±8.4</td>
<td>&lt;0.001</td>
<td>14.3±10.9</td>
<td>5.3±9.6</td>
</tr>
<tr>
<td>Costs of care — U.S. dollars ¶</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
ROMICAT-II Costs - 30 Days

- CTA: $4,289
- Standard: $4,060
CT Scan utilization

Figure 2. Estimated Number of CT Scans Performed Annually in the United States.

The most recent estimate of 62 million CT scans in 2006 is from an IMV CT Market Summary Report.³

Radiation from CT Scans

- Estimated that CT scans done in the US in 2007 resulted in 29,000 new cancers
- ~ 2% of all cancer in the US are from medical radiation
RISK SCORES:
Should be Using One!
CP Risk Scores in the ED

- TIMI Risk Score
- Heart Score
- Sanchis
- Modified Grace
- EDACS
# Traditional HEART Score

<table>
<thead>
<tr>
<th>HEART SCORE</th>
<th>Points</th>
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<tr>
<td>History</td>
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<tr>
<td>Highly Suspicious</td>
<td>2</td>
</tr>
<tr>
<td>Moderately Suspicious</td>
<td>1</td>
</tr>
<tr>
<td>Slightly Suspicious</td>
<td>0</td>
</tr>
<tr>
<td>ECG</td>
<td></td>
</tr>
<tr>
<td>Significant ST-depression</td>
<td>2</td>
</tr>
<tr>
<td>Non-specific repolarization abnormality</td>
<td>1</td>
</tr>
<tr>
<td>Normal</td>
<td>0</td>
</tr>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>≥ 65</td>
<td>2</td>
</tr>
<tr>
<td>45-65</td>
<td>1</td>
</tr>
<tr>
<td>≤ 45</td>
<td>0</td>
</tr>
<tr>
<td>Risk factors</td>
<td></td>
</tr>
<tr>
<td>3 or more risk factors</td>
<td>2</td>
</tr>
<tr>
<td>1-2 risk factors</td>
<td>1</td>
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<tr>
<td>No risk factors</td>
<td>0</td>
</tr>
<tr>
<td>Troponin</td>
<td></td>
</tr>
<tr>
<td>≥ 3x normal limit</td>
<td>2</td>
</tr>
<tr>
<td>1-3x normal limit</td>
<td>1</td>
</tr>
<tr>
<td>≤ normal limit</td>
<td>0</td>
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<tr>
<td>Total</td>
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</table>
Traditional HEART Score

- Designed to risk stratify patients in the ED evaluated for possible ACS.
- Studied in >20,000 patients.
- Adverse Event at 30 days with HS ≤ 3 (0.6-3.6 %)

Marcoon, et al, Crit Path Cardiol, 2013
Backus, et al., Int J Cardiol, 2013
Six, et al., Crit Path Cardiol, 2013

Low Risk ≤ 3
TRAPID STUDY

- 1,282 pts evaluated for possible AMI
- 213 (17%) AMIs
- 1-hr delta algorithm missed 7 AMIs
- Sens AMI 96.7%
- Modified HEART Score: apply hs-cTnT to HS
Prognostic Utility of a Modified HEART Score in Chest Pain Patients in the Emergency Department

James McCord, MD; Rafael Cabrera, MD; Bertil Lindahl, MD; Evangelos Giannitsis, MD; Kaleigh Evans, MD; Richard Nowak, MD; Tiberio Frisoli, MD; Richard Body, PhD; Michael Christ, MD; Christopher R. deFilippi, MD; Robert H. Christenson, PhD; Gordon Jacobsen, MS; Aitor Alquezar, MD, PhD; Mauro Panteghini, MD; Dina Melki, MD, PhD; Mario Plebani, MD; Franck Verschuren, PhD; John French, PhD; Garnet Bendig, PhD; Silvia Weiser, PhD; Christian Mueller, MD; for the TRAPID-AMI Investigators*
Death/acute myocardial infarction (AMI) at 30 days based on modified HEART score (m-HS) and high-sensitivity cardiac troponin-T (hs-cTnT) <12 ng/L at 0 hour and delta 1 hour <3 ng/L.

Heart Score & 1-hr Algorithm

- 515/1282 (40 %) ruled-out by the 1-hr protocol and had HS ≤ 3
- These patients likely can be discharged directly from the ED
QUALITY CONCLUSIONS

1. Time: do not keep patient longer than needed. Rapid rule-out AMI (0 or 1 hr).
2. Cardiac Markers: only use cTn (no CK-MB).
3. Use correct cut-point for cTn
4. Apply Risk Score and send home.
5. Avoid radiation (nuclear and CTA).
6. “Less is more”
Mike’s point . . .

- Jim that was really excellent!

- With that frame of reference, the next question is - how on earth do you measure quality? If you can’t measure it, then it becomes really hard to make meaningful changes.

- For this question, let’s turn to Chris Pergrem. Chris what do you think?
Measuring Quality of Care
In low risk chest pain patients

Christopher Pergrem, MD, FACEP
ACEP eQUAL
What is “Quality”

- the degree of excellence of something
- the standard of something measured against similar things

In healthcare
- good outcome
- low complication rate
- improvement of disease or condition
Measuring quality

- Track use of a decision tool
  - HEARTscore, EDACS
- Track patients that had tool utilized appropriately
  - Percentage of LRCP patients that were not “admissions”
- Review and track disposition and outcomes
  - Discharge, observation, admission, return rates
- Track advanced interventions and outcomes
  - Stress testing, cCTA, Echo, MRI, Catheterization, None
We have data, now what?

- SHARE! Create a dashboard
  - Disposition rates
  - Advanced testing rates
  - Complication rates
  - Inpatient days (potential avoidable cost)
  - Observation days (potential avoidable cost)
Share with whom?

- Physicians (ED, hospitalists, cardiologist, primary care)
- Advance practice providers
- Hospital administration
- Group administration
- Quality committee
- Case managers
- Patients
Possible pitfalls of sharing

- Medicolegal - More to come....
- Termination of providers?
- Insurance companies excluding providers?
- Public reporting/opinion?
- Incentivizing care?
Mike’s question:

1. Definition
2. Metrics
3. Action...

- Chris that was outstanding! Thanks!
- ...Now that we’ve talked about collecting all of this quality data, what can we do to use it most effectively?
- Now let’s turn to Josh Baugh for a little quality intervention consult. Josh, what can you tell us?
Sharing data and anticipating obstacles to change
Sharing Data

- Provide an initial snapshot
- Create active group dashboard
- Provide individual data
What to report

- % disposition of chest pain/LRCP pts
  - Obs, admit, discharge

- % advanced testing rate for chest pain/LRCP pts

- % of admitted and observed pts who rule in for ACS
  - # of ACS pts discharged from ED in past 7 days

- Hospital bed days – actual, goal, avoidable days/cost
  - Observed and admitted patients
Mike’s question:

- ...Hmmm.
- So it seems like this way of presenting and sharing data would work well if the project goes as planned, but what if the metrics in the data aren't changing as expected?
- How might you think about troubleshooting an ED pathway if behavior around chest pain care isn't improving as we would hope?
Changing Behavior

Information Interventions (Rider)
Motivation (Elephant)

- Facilitating accurate self-assessments
- Helping physicians resolve dissonance

Motivation (Elephant)

- Choosing the right incentives
  - Personal pride
  - Shaming 🐘
  - Public lauding
  - Finances $$
Decreasing Friction (Path)

- Creating a Good EMR Pathway

- Greasing Dispo Pathways
Summary

- Share data with dashboard and individual reports
- Consider three components of behavior change:
  - Knowledge of what to do
  - Motivation to do it
  - A clear path to get it done
Mike’s wrap up questions

- So, for low risk chest pain patients in the ED we now have an idea of what quality looks like, how we can measure it, and then how to create meaningful changes in our practice using this information.

- This is a big step forward in our quality journey. Do you guys have anything that you would like to add? Any final suggestions?
Questions? Contact the E-QUAL team at equal@acep.org