Cardiac Spectacular

Gina Hurst, PGY-3
Emergency/Internal Medicine
Question

What is the historical evidence behind current practice pattern with regards to low risk chest pain patients?
Objectives

- Review a brief history of cardiac testing and evaluation
- Explore the establishment of CPUs
- Discuss the ED dispo of chest pain patients
- Examine the current ACC/AHA guidelines for management of low risk chest pain
Chest pain in the ED

- 5.5 million visits to emergency rooms annually are for chest pain (9% of all ER visits)
- Billions of healthcare dollars spent on evaluation
- The percentage of ED visits for chest pain that resulted in a diagnosis in ACS 13.0% in 2007–08
History

- 1902 – First EKG
- 1920 – Vectorcardiography
  - EKG for MI
- 1932 – Precordial leads
- 1940s/50s Exercise testing
Observations made during transient attacks of angina have revealed inversion of the T wave or ST segment of the curve… or high take off in the ST complex. Evidence supports the conception that angina is due to myocardial ischemia.
THE USE OF EPINEPHRINE AS A DIAGNOSTIC TEST FOR ANGINA PECTORIS

WITH OBSERVATIONS ON THE ELECTROCARDIOGRAPHIC CHANGES FOLLOWING INJECTIONS OF EPINEPHRINE INTO NORMAL SUBJECTS AND INTO PATIENTS WITH ANGINA PECTORIS *

SAMUEL A. LEVINE, M.D.

4. It is suggested that the production of anginal pain by the injection of epinephrine may serve as a diagnostic test for angina pectoris. The test would not be applicable when the diagnosis is certain but rather in doubtful cases or when there are other possible explanations for the symptoms, such as gallstones or disease of the stomach or the duodenum.
History

- 1929 – First right heart cath
- 1930s – aortogram/LV press/CO
- 1958 – selective angiography
- 1977 – First angioplasty
- 1980 – Angioplasty in AMI
- 1986 – BMS
- 1988 – Primary angioplasty for infarct
- 2003 – FDA approves first DES
History

The exciting story of cardiac biomarkers: From retrospective detection to gold diagnostic standard for acute myocardial infarction and more

A. Dolci, M. Panteghini

Laboratorio Analisi Chimico Cliniche, Azienda Ospedaliera "Luigi Sacco", Milano, Italy
Cattedra di Biochimica Clinica e Biologia Molecolare Clinica, Dipartimento di Scienze Cliniche "Luigi Sacco", Università degli Studi, Milano, Italy
History

• Bethesda Conference 1960s-80s
  • Suggests CCUs in 60s
  • Created guidelines for pre-hospital care of acute MI
  • “Cardiac catheterization for hemodynamic and angiographic diagnosis is currently a resource of very limited usefulness during the first 6 hours after an acute coronary event” – 1982

• ACC/AHA Task Force Guidelines -1990
  • EKG monitoring from the time of entry
Case

- 48 yo obese white male with PMH of HTN, IDDM, and asthma presents with substernal chest pain, non-radiating that started while shoveling the driveway. It was sharp, stabbing and dissipated as he was driving himself to the ER. He has a 10 pack yr smoking history and a grandfather that had an MI in his 60s.
• EKG within 10 min of arrival
• Cat 1 on monitor
• CXR
• CBC, lytes, and trp x 2
1) Admit to hospital for unstable angina  
   (skip forward 5 slides)
2) Discharge home with PCP f/u  
   (go back 2 slides)
3) Keep in ED for more EKGs/biomarkers  
   (return to last slide)
4) Send immediately to K-2 non-invasive lab for stress testing  
   (Story ended)
• 2-5% of AMIs were being missed\textsuperscript{1}
• 20\% of the malpractice dollars in the ED were associated with the diagnosis and treatment of AMI\textsuperscript{2}

2. Rusnak, RA Litigation against the emergency physician; common features in cases of missed myocardial infarction.\textsuperscript{Ann emerg med} 1989:18:1029-34
patients with a clear cut alternative noncardiac diagnosis and a TIMI risk score of 0 still have 2.9% rate of ACS in 30 days

Even in pts with normal or nondiagnostic EKG, normal biomarkers and low risk for adverse events up to 10 percent may have ACS and 2-4% may have early adverse events

Kline et al, Pretest probability assessment derived from attribute matching
BMC Med Inform Decis Mak. 2005; 5:26

CHEST PAIN PATHWAY
• Of patients admitted to hospital for evaluation of AMI only 5-25% had AMI

• New goal: Who is low risk?

• Possible solutions: chest pain unit vs ED rule out of MI
  • Significant reduction in cost
  • Reduction in patient length of stay
• Candidate for 12 hour rule out if risk <7%
• Data used to determine sensitivity and specificity for detection of AMI
• 304/316 AMIs met clinical criteria in less than 12 hours...314/316 in the first 24 (4% missed... LR of 0.05 vs 0.008 )
Despite r/o of AMI, there were still 210 patients diagnosed with unstable angina.
An Emergency Department-Based Protocol for Rapidly Ruling Out Myocardial Ischemia Reduces Hospital Time and Expense: Results of
Clinicians blinded to troponins

Based on negative markers, normal EKG and no change in clinical status 570 pts would be eligible for discharge

- 10% had reversible ischemia on stress
- 12% had angiograms revealing CAD
Low-risk patients with chest pain and without evidence of myocardial infarction may be safely discharged from emergency department

Safety and Efficiency of a Chest Pain Diagnostic Algorithm With Selective Outpatient Stress Testing for Emergency Department Patients With Potential Ischemic Chest Pain

Frank Xavier Scheuermeyer, MD, MHS, Grant Innes, MD, Eric Grafstein, MD, Marla Kiess, MD, Barb Boychuk, RN, Eugenia Yu, MSc, Daniel Kalla, MD, Jim Christenson, MD

Adverse Cardiac Events in Emergency Department Patients with Chest Pain Six Months after a Negative Inpatient Evaluation for Acute Coronary Syndrome

Alex F. Manini, Michael A. Gisondi, MD, Theresa M. van der Vlugt, MD, MA, Donald H. Schreiber, MDCM
# A Clinical Trial of a Chest-Pain Observation Unit for Patients with Unstable Angina

Michael E. Farkouh, M.D., Peter A. Smars, M.D., Guy S. Reeder, M.D., Alan R. Zinsmeister, Ph.D., Roger W. Evans, Ph.D., Thomas D. Meloy, M.D., Stephen L. Kopecky, M.D., Marvin Allen, M.D., Thomas G. Allison, Ph.D., Raymond J. Gibbons, M.D., and Sherine E. Gabriel, M.D., for the Chest Pain Evaluation in the Emergency Room (CHEER) Investigators

## Table 3. Rates of Initial Primary Outcomes According to Study Group.*

<table>
<thead>
<tr>
<th>Time of Event</th>
<th>Hospital Admission (N=212)</th>
<th>Chest-Pain Unit (N=212)</th>
<th>P Value</th>
<th>Odds or Hazard Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>no. (%)</td>
<td>no. (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early events</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>During hospital stay</td>
<td>15 (7.1)†</td>
<td>7 (3.3)‡</td>
<td>0.15</td>
<td>0.50 (0.19–1.29)</td>
</tr>
<tr>
<td>Within 30 days after discharge from hospital</td>
<td>2 (0.9)§</td>
<td>1 (0.5)†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total within 30 days</td>
<td>17 (8.0)</td>
<td>8 (3.8)</td>
<td>0.13</td>
<td>0.50 (0.20–1.24)</td>
</tr>
<tr>
<td>Late events (after 30 days and within 6 mo)</td>
<td></td>
<td>1 (0.5)**</td>
<td>6 (2.8)††</td>
<td></td>
</tr>
<tr>
<td>Total events</td>
<td>18 (8.5)</td>
<td>14 (6.6)</td>
<td>0.94</td>
<td>0.98 (0.48–1.95)</td>
</tr>
</tbody>
</table>
A Rapid Diagnostic and Treatment Center for Patients With Chest Pain in the Emergency Department

Table 2.
Outcome data for 1,010 patients evaluated in the Heart ER Program.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>No. of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Released home from ED</td>
<td>829</td>
</tr>
<tr>
<td>Released AMA from ED</td>
<td>28</td>
</tr>
<tr>
<td>Admitted to hospital for further evaluation</td>
<td>153</td>
</tr>
<tr>
<td>Cardiac disease</td>
<td>52/153 (34.0%)</td>
</tr>
<tr>
<td>Ischemic cardiac diagnoses</td>
<td></td>
</tr>
<tr>
<td>AMI</td>
<td>12</td>
</tr>
<tr>
<td>PTCA</td>
<td>7</td>
</tr>
<tr>
<td>CABG</td>
<td>1</td>
</tr>
<tr>
<td>Angina/unstable angina</td>
<td>31</td>
</tr>
<tr>
<td>PTCA</td>
<td>5</td>
</tr>
<tr>
<td>Nonischemic cardiac diagnoses</td>
<td></td>
</tr>
<tr>
<td>Dilated cardiomyopathy</td>
<td>2</td>
</tr>
<tr>
<td>Hypertrophic cardiomyopathy</td>
<td>2</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>3</td>
</tr>
<tr>
<td>Mitral valve prolapse</td>
<td>1</td>
</tr>
<tr>
<td>Pericardial effusion</td>
<td>1</td>
</tr>
</tbody>
</table>

AMA, against medical advice; AMI, acute myocardial infarction; PTCA, percutaneous transluminal coronary angioplasty; CABG, coronary artery bypass grafting.
• Half of patients stressed while in CPU, other half discharged home with scheduled follow up ... claimed that 3.3% of positive stress tests were missed due to lack of follow up

| TABLE 2. Extrapolation of Stress Testing to Potential Outpatient Compliance |
|---------------------------------|---------------------------------|---------------------------------|
| Observation Unit Stress Tests   | Outpatient Stress Tests Completed (Extrapolated) | Outpatient Missed Stress Tests (Extrapolated) |
| 353 stress tests                | 247 stress tests completed       | 106 missed stress tests         |
| 11% positive stress tests       | 7.7% positive stress tests       | 3.3% missed positive stress tests |
• “It has been shown that CPOUs are practical and safe. They are economical when treating patients with chest pain and a low-risk profile. This is also one way to help with overcrowding in inpatient hospital cardiac units”
Consensus?

• Agency for Health Care Policy and Research ’94
  • “Patients with unstable angina that are judged to be at low risk for adverse outcomes, can in many cases be safely evaluated as outpatients”
  • Recommendation to perform non-invasive testing within 72 hours of presentation*
Current ACC/AHA Guidelines for Management of Unstable Angina and NSTEMI
<table>
<thead>
<tr>
<th>LEVEL A</th>
<th>LEVEL B</th>
<th>LEVEL C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple (3-5) population risk strata evaluated*</td>
<td>Limited (2-3) population risk strata evaluated*</td>
<td>Very limited (1-2) population risk strata evaluated*</td>
</tr>
<tr>
<td>General consistency of direction and magnitude of effect</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CLASS I</th>
<th>CLASS IIa</th>
<th>CLASS IIb</th>
<th>CLASS III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benefit &gt;&gt; Risk</td>
<td>Benefit &gt;&gt; Risk</td>
<td>Benefit ≥ Risk</td>
<td>Risk ≥ Benefit</td>
</tr>
<tr>
<td>Procedure/Treatment SHOULD be performed/administered</td>
<td>Additional studies with focused objectives needed</td>
<td>Additional studies with broad objectives needed; additional registry data would be helpful</td>
<td>No additional studies needed</td>
</tr>
<tr>
<td></td>
<td>IT IS REASONABLE to perform procedure/administer treatment</td>
<td>Procedure/Treatment MAY BE CONSIDERED</td>
<td>Procedure/Treatment should NOT be performed/administered SINCE IT IS NOT HELPFUL AND MAY BE HARMFUL</td>
</tr>
</tbody>
</table>

- Recommendation that procedure or treatment is useful/effective
- Sufficient evidence from multiple randomized trials or meta-analyses
- Recommendation in favor of treatment or procedure being useful/effective
- Some conflicting evidence from multiple randomized trials or meta-analyses
- Recommendation’s usefulness/efficacy less well established
- Greater conflicting evidence from multiple randomized trials or meta-analyses
- Recommendation that procedure or treatment is not useful/effective and may be harmful
- Sufficient evidence from multiple randomized trials or meta-analyses
- Recommendation that procedure or treatment is not useful/effective and may be harmful
- Limited evidence from single randomized trial or nonrandomized studies
- Recommendation that procedure or treatment is not useful/effective and may be harmful
- Only expert opinion, case studies, or standard-of-care
- Only diverging expert opinion, case studies, or standard-of-care
Current ACC/AHA guidelines – Risk Stratification

Patients who present with chest discomfort or other ischemic symptoms should undergo early risk stratification for the risk of cardiovascular events (e.g., history, including anginal symptoms and findings). A 12-lead ECG should be performed and shown to an experienced emergency physician as soon as possible after ED arrival. Patients with negative cardiac biomarkers within 6 h of the onset of symptoms consistent with ACS should have biomarkers remeasured in the time frame of 8 to 12 h after symptom onset. (The exact timing of serum marker measurement should take into account the uncertainties often present with the exact timing of onset of pain and the sensitivity, precision, and institutional norms of the assay being utilized as well as the release kinetics of the marker being measured.) (Level of Evidence: B)
Current ACC/AHA guidelines – Immediate Management

Patients with probable or possible ACS but whose initial 12-lead ECG and cardiac biomarkers are normal should be observed in a facility or hospital telemetry unit.

In patients with suspected ACS in whom ischemic heart disease is present or suspected, if the follow-up 12-lead ECG and cardiac biomarkers measurements are normal, a stress testing (see above), precautionary appropriate pharmacotherapy (e.g., ASA, sublingual NTG, and/or beta blockers) should be given while awaiting results of the stress test. (Level of Evidence: C)

In patients with suspected ACS with a low or intermediate probability of CAD, in whom the follow-up 12-lead ECG and cardiac biomarkers measurements are normal, performance of a noninvasive coronary imaging test (i.e., CCTA) is reasonable as an alternative to stress testing. (Level of Evidence: B)
Scientific Evidence Underlying the ACC/AHA Clinical Practice Guidelines

- Unstable Angina
  - I-A 19.1  I-B 27.5  I-C 15.8
  - II-A 1.7  II-B 17.4  II-C 8.4
  - III-A 2.7  III-B 1.7  III-C 5.4
- Exercise testing Class II with no level of evidence
References Available on Request