Chest Pain in the Observation Unit

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  - NIH: Heart Lung and Blood Institute

- Author for Up-to-Date

- No conflict of interest

- No commercial bias: No products or devices will be discussed
Introduction:
- Heart disease & Chest Pain
- Role of Observation Units for patients with chest pain

Observation Unit Chest Pain Care
- Overview
- Inclusion/Exclusion Criteria
- Protocols and Testing Strategies
#1 cause of death in the US

Chest pain is a top cause of US ED visits
- Emergency providers care for patients with chest pain on virtually every shift
- 8-10 million patients annually
Providers are tasked with determining if the patient’s pain is cardiac or non-cardiac.

High stakes decision for providers and patients:

- Patients: high risk for morbidity and mortality from an incorrect diagnosis
- Providers: high risk for a medical malpractice claim
Risk shapes our Management of Chest Pain

Medical malpractice

• Chest pain is the highest per claim payout for emergency physicians

ACC/AHA guidelines:

• If there is concern for ischemic chest pain, patients should receive comprehensive evaluation: serial troponins followed by stress testing or angiography
Most patients with chest pain receive comprehensive hospital-based testing

- Annual cost $10-13 Billion
- ~2-5% of patients with AMI are inappropriately discharged from the ED every year.
  - Patients discharged with AMI have an 11-25% risk of death
Variability Among Providers

- Significant variability among providers in their chest pain care
- Pines et al. AJEM 2010;
  - Measured providers risk aversion using a risk taking scale (RTS)
  - The most risk-averse quartile of providers had higher admission rates compared to the least risk-averse quartile. (P < 0.001)
Chest Pain Observation Units

- Mitigate risk and reduce care variability
  - Protocol-driven care
  - Comprehensive chest pain evaluations
- Potential answer to inefficiency
  - Avoids inpatient admissions
  - Safe and decreases length of stay and costs relative to an inpatient strategy.*

OU care: Improving Value of Care

- Improved rate of diagnosis of ACS in hospitals with OU - Graff et al

- Physicians without access to OU may have difficulties completing a rapid cardiac protocol - Ellrodt et al
  - 34% of low risk chest pain patients were not discharged at 3 days

- Approximately half the cost as Inpatient care - shown in multiple clinical trials
ACC/AHA:
Class I recommendation to manage patients with possible ACS in OUs

Institute of Medicine (2006):
“...clinical decision units reduce boarding and diversion, avoid expensive hospitalization, and appear to contribute to improved management of common ambulatory-care sensitive conditions.”
Risk Stratification in the Obs Unit

Two Questions:

- What is the likelihood that presenting symptoms represent ACS?
  - Serial troponins and ECGs
    - Class I recommendation ACC/AHA Guidelines

- What is the likelihood of an ACS event occurring in the near future?
  - Stress testing or CT coronary angiography
    - Class I recommendation ACC/AHA Guidelines
Primary / Secondary evaluations

**Primary evaluation**

<table>
<thead>
<tr>
<th>Emergency Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>History</td>
</tr>
<tr>
<td>Physical Exam</td>
</tr>
<tr>
<td>Electrocardiogram</td>
</tr>
<tr>
<td>First set of cardiac markers</td>
</tr>
<tr>
<td>(may not be needed for clearly non-cardiac chest pain)</td>
</tr>
</tbody>
</table>

- Chest pain not from ACS

**Secondary evaluation**

<table>
<thead>
<tr>
<th>Observation unit or inpatient</th>
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<tbody>
<tr>
<td>Serial ECGs</td>
</tr>
<tr>
<td>Serial Cardiac Markers</td>
</tr>
<tr>
<td>(Excludes AMI)</td>
</tr>
<tr>
<td>Objective cardiac testing</td>
</tr>
<tr>
<td>(Excludes UA)</td>
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</tbody>
</table>

- Chest pain not from ACS

**Secondary evaluation**

- Definite ACS or High risk features

**Primary evaluation**

- Possible ACS

**Secondary evaluation**

- Treatment to coronary care unit or revascularization

**Secondary evaluation**

- Treatment alternative diagnosis

- What framework do we use to determine who is appropriate for OU care?

- Treat alternative diagnosis
Successful utilization of an OU chest pain pathway requires adequate patient selection
- Are they absolutely non-cardiac? Send them home.
- Do they need a cath (positive biomarkers, ECG changes, hemodynamically unstable)? Admit
HEART Score/Pathway

- Evaluates a patient’s:
  - History
  - EKG
  - Age
  - Risk factors
  - Troponin

- Validated in >6,000 patients
- Observation Care
  - HEART Score (4-6)
  - Alternative: TIMI (0-2)

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<table>
<thead>
<tr>
<th>HEART Score</th>
<th>Points</th>
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<tbody>
<tr>
<td>History</td>
<td></td>
</tr>
<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>EKG</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>
</tr>
<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>
</tr>
<tr>
<td>Total</td>
<td></td>
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**HEART Pathway: Algorithm**

- Low Risk → Early discharge
  - Discharged from ED with follow up with a primary care physician
  - No stress testing or cardiac imaging

- High Risk → Further evaluation
  - Observation Unit or inpatient ward
  - Patients identified for stress testing or cardiac imaging
Wake Forest Exclusion and Admission Criteria

**Exclusion criteria**
- Troponin > 99th percentile
- New EKG changes
- High risk (Known CAD)
- Disruptive behavior
- Hemodynamic instability
- Active CHF
- New or uncontrolled dysrhythmias
- Contraindications to stress testing or coronary CT

**Admission criteria**
- Recurrent chest pain
- EKG or biomarker changes
- Positive stress test
- Hemodynamic instability
The best observation patient...

- Has a single medical issue
- No acute psychiatric issues
  - Including intoxication
- Chronic pain patients do not do well in OU
Cocaine

- Good evidence that cocaine chest pain can be observed without stress testing – chemical/ECG rule out suffices
- Hemodynamically stable, ECG non-diagnostic, initial troponin negative, and chest pain free
Serial troponins and ECGs

- ACC/AHA Guidelines Class I Recommendation

- “Patients with definite or possible ACS but whose initial 12-lead ECG and cardiac marker levels are normal should be observed in a facility with cardiac monitoring (eg, chest pain unit), and a repeat ECG and cardiac marker measurement should be obtained…”

- (Level of Evidence: B)
Goal of serial markers is to detect those who have already infarcted - “Evolving MI”

- 4% of ED patients with possible ACS will have an EMI and an ECG that is not consistent with MI / ischemia
What serial ECGs and Troponins rule out

And/or Positive Troponin
Stress tests

- ACC/AHA Guidelines Class I Recommendation

  “If the follow-up 12-lead ECG and cardiac marker measurements are normal, a stress test (exercise or pharmacological) to provoke ischemia may be performed in the ED, in a chest pain unit, or on an outpatient basis shortly after discharge. Low-risk patients with a negative stress test can be managed as outpatients.”

- (Level of Evidence: C)
What stress tests detect

- Fixed obstructions causing inducible ischemia
  - UA
    - Risk of near-term MI and cardiac death
### Accuracy of stress testing

<table>
<thead>
<tr>
<th>Test</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stress ECG (1-3)</td>
<td>68% for significant CAD</td>
<td>77% for significant CAD</td>
</tr>
<tr>
<td>Stress echo (4)</td>
<td>80% for significant CAD</td>
<td>84% for significant CAD</td>
</tr>
<tr>
<td>Stress nuclear imaging (5-6)</td>
<td>86-97% for short-term cardiac events</td>
<td>88-90% for short-term cardiac events</td>
</tr>
</tbody>
</table>

Negative predictive value for adverse cardiac events >98%
Class IIa recommendation:

“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)
1-year event rate following a normal CCTA = 0.17%
- Stress echo = 0.54%; stress nuclear = 0.45%

CCTA and cost

CTA less costly than hospital admission or stress testing

Chang et al. (Acad Emerg med 2008)
CCTA: Proper patient selection

- Risk factors for poor image quality:
  - High heart rate
  - Diabetes
  - Hypertension
  - Older age
  - History of CAD

Highly dependent on the imaging team
- Earlier techniques were routinely 10-20 mSv
  - 2007 median 12 mSv*
- 10 mSv common using dose reduction techniques**
- Now some scans being obtained with <1 mSv†

*Hausleiter J et al. JAMA 2009
** Raff et al. JAMA 2009
† Heilbron and Leipsic, Can J Cariol, 2010
>4,000 patients with chest pain present to ED annually
>600 patients per year with chest pain managed in OU
Most receive stress echocardiography
ACS rates very low 1-2%
Admit rate ~12%
Staffing
- Nurse -24 hours
- Mid-level coverage 8a-Mn
- ED physician always available, rounds @ 8a
Wake Forest Chest Pain Protocol

- Telemetry
- Q 4 vitals
- Oxygen
- NPO at midnight
- Troponins @ 0, 4, 6 hours
# Wake Forest Chest Pain Protocol

## IMAGING

- **Stress test**
  - or
  - **Coronary CT**

- **Serial ECGS**
- **IV access**
- **Meds**
  - ACS
  - Pain & nausea

## OTHER TESTS

- **EKG 12 Lead On Arrival to Floor Done by Unit - Adults**
  - STAT

- **12 Lead EKG 2nd EKG with 2nd Troponin Done by Unit - Adults**
  - STAT

- **12 Lead EKG 3rd EKG with 3rd Troponin Done by Unit - Adults**
  - Perform

- **EKG instructions**
  - Until discontinued

## IV FLUIDS

- **Saline lock IV**
  - 0 of 2 selected

## MEDICATIONS

- **Antiplatelets / Nitrates**
  - 0 of 2 selected

- **Beta-blockers**
  - 0 of 2 selected

- **Analgesics**
  - 0 of 2 selected

- **Sleep**
  - 0 of 1 selected

- **Nausea/Vomiting/Indigestion**
  - 0 of 3 selected

__Note__

Only order pharmacologic stress (dobutamine) for those patients who will physically be unable to exercise on the treadmill.
Serial ECGs and troponins (0, 4, 6)

Objective cardiac testing availability:
- Stress Echo 7 days / week
- Coronary CT weekdays
- Cardiac MRI weekdays
Key points

- OU provides high value care for patients with chest pain
  - Safe, efficient, lower cost
- Patient selection for OU is key
  - Lower-risk patients, but not very-low-risk
  - Single medical issue
- OU protocol should involve:
  - Serial troponins and ECGs
    - Rule out evolving MI/acute ACS event
  - Stress testing or coronary CT
    - Prediction of near-term ACS risk