Chest Pain that Gives You Heartburn

Risk Stratification of Low Risk Chest Pain

E Larson
Incidence

- 6-8 million visits per year
- 2nd most common complaint
- 1-2 million will have disease
- <5% STEMI
- Mortality for ACS
  - 8% admitted
  - 30% discharged
AHA Guidelines 2010

- **History**
  - Diaphoresis
  - 2-10 minutes

- **Physical Exam**
  - Alternative cause

- **EKG**

- **Biomarkers**

- **Chest Pain units**
  - ADP’s and confirmatory studies
Low Risk

- **Stable**
  - No hemodynamic abnormalities
  - No arrhythmia

- **Normal or near normal EKG**

- **Negative initial biomarkers**

- **Amal Mattu’s**
  - Absence of pressure, radiation to arm, nausea or diaphoresis
  - No cardiac risk factors
  - Completely normal EKG
  - Good, likely alternative for CP
Cardiac Risk Factors

- Male
- Family History
- Age
- Hypertension
- Tobacco
- Diabetes
- Lipids
- Obesity
Chest Pain Continuum

- I. STEMI
- II. NSTEMI, UA, EKG changes
- III. Very concerning history
- IV. This lecture
- V. No risk to very low risk
Chest Pain

SYMPTOMS SUGGESTIVE OF ACUTE CORONARY SYMPTOMS (ACS)

- Noncardiac diagnosis
  - Treatment as indicated by alternative diagnosis
- Chronic stable angina
  - See ACC/AHA Guidelines for Chronic Stable Angina
- Possible ACS
  - See ACC/AHA Guidelines for Non-ST Elevation ACS
- Definite ACS
  - See ACC/AHA Guidelines for ST Elevation Acute Myocardial Infarction

Nondiagnostic ECG
- Normal initial cardiac markers
  - Observe
    - Serial ECGs, cardiac markers
      - If positive
        - Study to provoke ischemia or detect anatomic CAD
          - If positive
            - Admit to hospital
          - If negative
            - Outpatient follow-up
          - If negative
            - Consider MPI to identify rest ischemia
              - If positive
                - Study to provoke ischemia or detect anatomic CAD
                  - If positive
                    - Admit to hospital
                  - If negative
                    - Outpatient follow-up
                - If negative
                  - Outpatient follow-up
Cardiac Risk Factors

- Prospective cohort study of 804 CP patients in ED
- Documented presence or absence of cardiac risk factors at arrival and at 12 hours
Absence of cardiac risk factors had negative LR of 0.61 for diagnosis of AMI
  – 12.2% of patients with NO risk factors had AMI
  – 21.3% with 4-5 risk factors had AMI

Conclusion: risk factors not helpful for confirmation or exclusion of AMI in the ED
Better for long term risk of atherosclerosis & CAD
EKG

- Obtain within 10 minutes
- Normal and no h/o CAD- MI 2%
- Normal and h/o CAD- MI 4%
- Repeat EKG’s are valuable- evolution
EKG

- ST elevation EKG’s
- Normal EKG’s
- Nonspecific EKG’s
  - Compare to old EKG if possible
  - Risk of ACS dramatically increases with ST depression of only 0.5mm & any TWI, especially deep, symmetric TWI
  - Degree of ST depression directly related to adverse prognosis
Biomarkers

- **Troponins:** Evaluate for myocardial infarction
  - Other reasons for non-ischemic troponin elevation
- Required turnaround <60min in the lab
  - If not feasible -> use POC
- Rise 1 value above 99th percentile of Upper limit ref range PLUS at least 1:
  - Symptoms of ischemia
  - EKG changes
  - Imaging with new regional wall motion abnormality
Troponins

- Early presentation (within 6 hrs of symptoms)
  - Repeat test 6-8 hrs after symptom onset

- Late presentation (>8 hrs)
  - May only need 1 negative troponin to rule out

- Troponins do NOT rule out ACS, ischemia or presence of cardiac disease

- Provocative test/confirmatory study is endpoint
Stratify

- Using
  - History
  - Physical
  - EKG
  - Biomarkers
    - Troponin

- 5 Levels
  - 1
  - 2
  - 3
  - 4
  - 5
Chest Pain Units

- Accelerated diagnostic protocol
  - Negative
  - Confirmatory study
    - Immediate
    - outpatient

- Accelerated diagnostic protocol
  - Positive EKG or biomarkers
    - Admit
TIMI Risk Score

- Age > 64
- > 2 risk factors
- Known CAD
- ASA use in past 72 hours
- Severe angina (2 episodes within 24 hours)
- ST changes 0.5mm or more
- Positive cardiac markers
Accelerated Diagnostic Protocols

- **2 hour protocol**
  - Southeast Asia, 3582 patients presenting to the ED with CP
    - 10% (352) were “low risk”
      - Negative biomarkers at time 0 and 2 hr, non-ischemic EKG’s, TIMI 0
  - 30 day f/u for adverse cardiac events: MI, death, revascularization, V. tach
  - Out of 3582- 12% had major cardiac event
  - Out of 352 “low risk”- 0.9% had major cardiac event
2 Hour Protocols

- Analysis of the New Zealand component of the ASPECT study.
- Also incorporated POC trop and highly sensitive trop's
- TIMI 0-1

Conclusions:
- POC trop and highly sensitive trop's comparable to the 3 marker strategy used in ASPECT
- TIMI 0-1 identified more patients suitable for DC, but increase of false negative (0.8 -> 3%) & sensitivity ↓ 99 -> 97%
2 Hour Protocols

- Prospective observational study
- 1975 patients with CP from Australia and New Zealand- 14 sites
- Troponin sole biomarker, also TIMI 0
- Same 30days f/u endpoints

- Of the 1975 patients-15.3% had major cardiac event
- 392 classified “low risk” -0.25% had major cardiac event
- Sensitivity 99.7%
Confirmatory Studies

- Exercise Stress Test
- Stress Imaging
  - Myocardial Perfusion Imaging (MPI)
  - Stress Echo
Exercise Treadmill Test

- Selection criteria:
  - Able to exercise
  - Normal baseline EKG – no LVH, repolarization abnormalities
  - No arrhythmia
  - Negative biomarkers
Exercise Treadmill Test

- Criteria for positive test
  - >0.1mV horizontal or down-sloping ST depression
  - OR
  - >0.1mV ST elevation
  - Angina or arrhythmia induced by exercise
Cost-effectiveness of ETT

- RCT hospital admission vs CPU with ETT

*length of stay ↓ by 50%
*$624 less per patient
Exercise Treadmill Test

- 3000 patients underwent ETT after <12 hours in CPU
- Outcomes at 6 months: no difference from control group managed with hospital admission
- 1-17 month f/u:
  - 1 reported cardiac death
  - 0-2% incidence of nonfatal cardiac event (mostly MI and revascularization)
- Sensitivity 75-80%
Outpatient Stress Testing

- 24/7 ETT availability?
- Criteria for discharge after negative ADP:
  - Chest pain free
  - Normal serial EKG’s
  - Normal serial biomarkers
- The outpatient ETT should be performed within 24-72 hrs
Outpatient ETT

- Prospective study, 979 patient with CP, stratified to low risk
- 6 hr ADP
- 92% discharged for outpatient ETT
- Results: during follow up, 3 MI’s- nonfatal
Myocardial Perfusion Imaging

- Rest or stress
- Cites ↑ sensitivity & specificity (87%, 73%) compared to ETT
- NPV comparable
Resting MPI

- Algorithm suggests early rest MPI
  - Class 1 indication
- Technetium 99m radiopharmaceuticals
- Snapshot of perfusion at time of injection
- Normal perfusion = very low clinical risk
Resting MPI

- Multiple studies cited, no RCT
- Hospitalization rate, cost per patient
- OK for use in cocaine CP
- Advantage: LV function, location/extent of ischemia, ok if abnormal EKG, great if can’t do ETT (stress or rest MPI)

- Limitations:
  - new vs old MI
  - Availability
Coronary CT Angiography

CCTA Stenosis Severity

70-99%

100%

70-99%

100%
Coronary CT Angiography

- 64-slice multi-detector
- Provides anatomic information
  - Not functional
Coronary CT Angiography

**Pros:**
- ↓ time to diagnosis (15 v 3.4hrs)
- ↓ # of repeat evaluations for CP
- Can exclude/work up alternative diagnoses
- ↓ Cost overall ??
  - Medicare data

**Cons:**
- Breath holding
- Slow HR
- Contrast load/allergy
- Radiation (250-500x CXR)
- Obesity limits
- Elderly- high calcium load obscures view
- 25-50% patients not candidates
Coronary CT Angiography

- Meta-analysis
- 386 studies reviewed (2005-2009), 9 included: prospective, > 1 month follow up, CTA in the ED, >30 patients/study
CCTA Meta-analysis

- 50-54 yo, 51% male, low to intermediate pretest probability
- Positive CTA >50% stenosis
- 64 slice CT
- Non diagnostic scans: obesity, calcium, motion
CCTA Meta-analysis

- Results: ACS diagnosed in 10%, no 30 days deaths or additional MI’s
  - Sensitivity of CTA 95%
  - Specificity 87%
  - NLR 0.06
ROMICAT II

- Rule Out Myocardial Ischemia/Infarction using Computer Assisted Tomography
- RCT multicenter study- 9 US centers

Study design
Acute CP (low to intermediate risk) -
> CT or standard evaluation - >
Admit or Discharge - > 48-72 hour phone call - > 28 days phone interview
Inclusion criteria:
- 40-74 yo
- >5min of CP in prior 24hours
- Able to hold breath for at least 10s
- Sinus rhythm

CT arm- 501

Standard arm- 499
ROMICAT II

- Exclusion criteria
  - Elevated biomarker, ischemic EKG
  - >6h since presentation to ED
  - Reported or documented h/o CAD
  - BMI>40
  - Renal disease
  - HD instability
  - Cocaine in last 48h
  - CT contraindications
ROMICAT II

- **Endpoints:**
  - LOS- CT 23hr vs 31hr
    (Final diagnosis not ACS 17 vs. 27 hr)
    \((p<0.0001)\)
  - ED discharge- CT 47% vs 12% \((p 0.001)\)
  - Time to diagnosis- CT 10h vs 19 \((p 0.0001)\)
  - Safety- missed ACS 0% for both
    (Missed ACS at 28d f/u CT 0.4% vs 1%)
ROMICAT II Costs

- ED -19% for CT (p<0.0001)

- Hospital +50% for CT (p 0.17)
  - Why?

- Total +5% for CT
Conclusions

- Low risk chest pain: listen to the history, clinical judgment
- Low risk not equal to no risk
- Follow up is key
- When applicable CTA is a useful and safe tool to disposition and workup
- Know what is available at your institution