

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

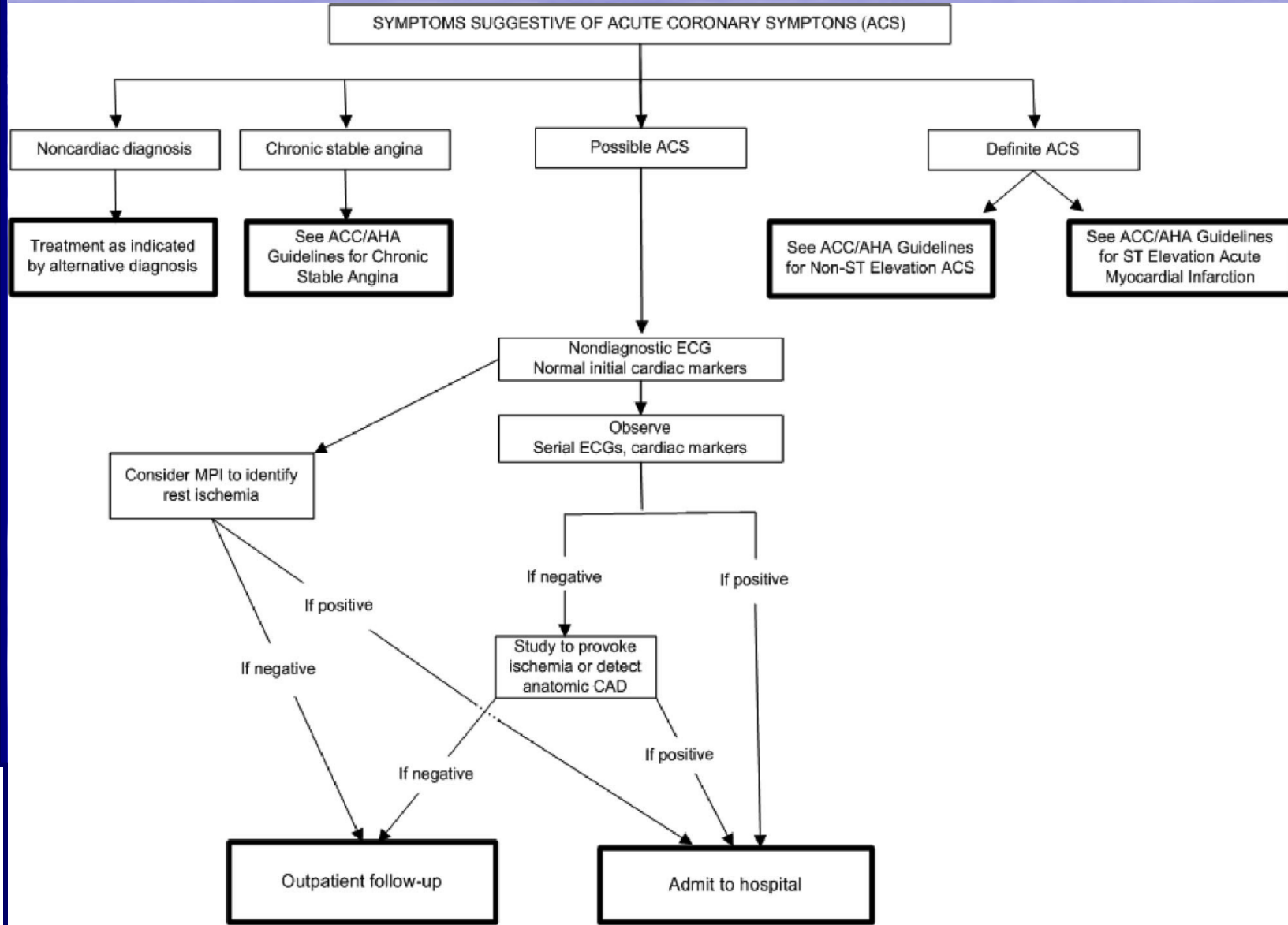


Chest Pain Continuum

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



Chest Pain



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



Cardiac Risk Factors

- 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 troponins and highly sensitive troponins
- TIMI 0-1
- Conclusions:
 - POC troponin and highly sensitive troponins comparable to the 3 marker strategy used in ASPECT
 - TIMI 0-1 identified more patients suitable for DCS, 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
 - $>0.1\text{mV}$ horizontal or down-sloping ST depression
- OR
- $>0.1\text{mV}$ 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

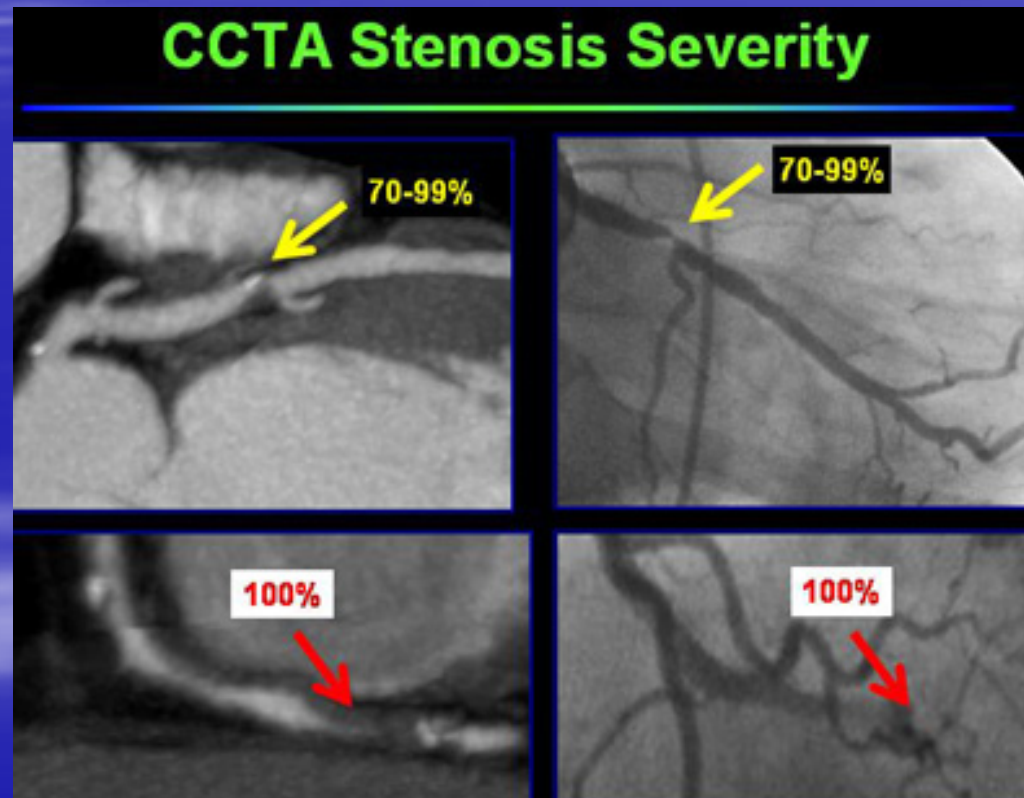


Resting MPI

- 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



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->48-72hour phone
call-> 28 days phone interview



ROMICAT II

- 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

