Acute coronary syndrome

István Lőrincz MD
Division of Emergency Medicine, Institute of Internal Medicine, University of Debrecen
Terminology used in acute coronary syndromes

- Entry
- Working diagnosis
- ECG
- Biomarker of necrosis
- Final diagnosis

Acute coronary syndrome
- ST-elevation
  - Positive
  - Negative
- No ST-elevation
  - Positive
  - Negative

Acute myocardial infarction
Unstable angina
Differential Dx
Acute Coronary Syndrome (ACS)

- **ACS = AMI or Unstable Angina**
  - AMI - 15%
  - UA - 25-30%
Differential Dx ACS

- Pain in pts myocardial ischemia:
  - Retrosternal, diffuse, heaviness, or pressure
  - Radiation to neck or arm
  - Usually persistent pain >20 min, severe
  - Associated Sx: Dyspnea, Diaphoresis, Nausea
  - May even be Reproducible
Differential Dx ACS

- **Exertional Angina:**
  - Episodic pain, <10 min
  - Onset **with** exertion
  - **Resolves** with rest, sublingual NTG
  - Response to exertion and rest follows **same** pattern
Differential Dx ACS

• Atypical Angina:
  - Occurs at rest
  - Coronary spasm
  - Pattern of episodes same
Differential Dx ACS

• Pain in pts unstable angina (UA):
  - Change in the pattern of angina
    • New Onset
    • More frequent, severe, easily provoked
    • More difficult to relieve
    • Occurs at rest, lasting >20 min
    • High risk of AMI
Differential Dx ACS

- **Pulmonary embolism:**
  - Atypical, presenting with any combination of:
    - Chest Pain, Dyspnea, Syncope, Shock, Hypoxia
    - Fever, cough, hemoptosis
  - Pain is often pleural
    - Reproducible with breathing, palpation
  - Classic presentation:
    - Sharp pain, Dyspnea
    - Tachypnea, tachycardia, hypoxemia
Differential Dx ACS

- **Aortic Dissection:**
  - Risk Factors - Atherosclerosis, HTN (uncontrolled), Coarctation of Aorta, Bicuspid Aortic Valve, Aortic Stenosis, Marfan Syn, Ehlers-Danlos Syn, Pregnancy
  - Pain - midline Substernal CP, tearing, ripping, searing, radiating to interscapular area
  - Pain above **and** below diaphragm
  - Often assoc. with stroke, AMI, limb ischemia
Differential Dx ACS

**Spontaneous Pneumothorax:**

- **Risks:**
  - Sudden Change in barometric pressure
  - Smokers, COPD
- **Pain:**
  - sudden, sharp, pleuritic chest pain, and dyspnea
- **Dx:**
  - Absence of breath sounds ipsilaterally
  - Hyper resonance to percussion
  - CXR - Dx simple pneumothorax
Differential Dx ACS

- **Esophageal Rupture (Boerhaave Syn):**
  - Life-threatening
  - Substernal, sharp chest pain
  - Sudden onset after forceful vomiting
  - **Dyspneic, diaphoretic, and ill-appearing**
  - **CXR:** Normal, Pleural Effusions, Pneumothorax, pneumoperitoneum, pneumomediastinum
  - Water Soluble Contrast Study
Differential Dx ACS

- **Acute Pericarditis:**
  - Acute, sharp, severe, constant, substernal CP
  - Radiation to back, neck, shoulders
  - **Worse** with lying down and inspiration
  - **Relief** with leaning forward
  - FRICITION RUB
  - **EKG:** ST segment elev., T wave inversion, or PR depression
Differential Dx ACS

- **Pneumonia:**
  - Sharp and Pleuritic
  - Fever, cough, hypoxia
  - Rales, decreased breath sounds, etc.
  - CXR
Differential Dx ACS

• **Mitral Valve Prolapse:**
  - Women > Men
  - Discomfort at rest
  - Assoc. Sx:
    • Dizziness, Hyperventilation, Anxiety, Depression, Palpitations, Fatigue, SVT, Ventricular Dysrhythmia
  - **Tx:** Beta-Adrenergic Blockers
  - **Dx:** Echo
Differential Dx ACS

• Musculoskeletal/Chest Wall Disorders:
  - LOCALIZED, Sharp, positional CP
  - Reproducible
  - Types -
    • Costochondritis, Tietze Syndrome
    • Xiphodynia
Differential Dx ACS

- GI Disorders: GERD/dyspepsia
  - Burning,
  - Acidic taste
  - Recumbent position increases pain
  - Relief per antacids
    - CAREFUL, can also help in ACS
Differential Dx ACS

- **Esophageal Spasm:**
  - Sudden onset, dull, tight, gripping
  - Hot or cold liquids
  - Large food bolus
  - Responds to NTG
Differential Dx ACS

- Peptic Ulcer Disease:
  - Gastric:
    - Postprandial, dull, boring pain
    - Mid-epigastric, may awake pt.
  - Duodenal Ulcer:
    - Relieved after eating
  - Symptomatic Tx: antacids
  - DDx: Pancreatitis and Biliary tract Dz
Differential Dx ACS

• **Panic Disorder:**
  - Recurrent, Unexpected panic
  - **Including at least 4 SX:**
    • Palpitations, diaphoresis, tremor, dyspnea, choking, CP, nausea, dizziness, derealization, or depersonalization, fear of losing control or dying, paresthesias, chills, hot flashes
  - **Rule out substance abuse**
Terminology used in acute coronary syndromes.
Reproduced with permission from Hamm et al. Lancet 2001; 358: 1533-1538

Within 10 min
Testing for ACS - EKG

• AHA Guidelines:
  - Any pt with Ischemic type pain is to have an EKG done within 10 minutes of arrival.
  - This is to be handed directly to the physician.
ACS with persistent ST-segment elevation

Adapted from Michael Davies

Troponin elevated

ESC Guidelines for the Management of NSTE-ACS (16)

ACS without persistent ST-segment elevation

Adapted from Michael Davies

Troponins elevated or not
Testing for ACS - EKG

• AMI PT EKGs:
  - 50% = ST elevation >1mm in 2 contiguous leads
  - 20-30% = new ST segment changes or T wave inversion
  - 10-20% = ST depression and T wave inversions Similar to previous EKGs
  - 10% nonspecific changes
  - 1-5% will have NORMAL initial EKG
Testing for ACS - EKG

- Positive predictive values:
  - New ST elevation = AMI 80%
  - New ST depression & T wave inversion = AMI 20%, 14-43% UA
  - Acute CP, preexisting ST depression & T wave inv. = AMI 4%, 21-48% UA
Testing for ACS - Troponins

- Main regulatory protein of thin filament of myofibrils that regulate the Ca++ dependent ATP hydrolysis of actinomysin

- **3 Subunits:**
  - Trop I = Inhibitory Subunit
    - Myocardial Specific
    - Elevation indicated worse prognosis
  - Trop T = tropomyosin-binding subunit
  - Trop C = calcium-binding subunit
Testing for ACS - Troponins

- AMI: Cardiac Troponin I (cTnI) and cTnT
  - Elevates in 6 hrs
  - Peaks in 12 h
  - Remain elevated for 7 to 10 days
  - Higher specificity than CK-MB
- Controversy = Troponins are found to be elevated in Renal Failure pts without proof of ACS/AMI
Troponin elevations have been reported in a variety of clinical scenarios other than ACS in the absence of a thrombotic occlusion of the coronary artery:

- Tachy- or bradyarrhythmias, or heart block
- Critically ill pts, especially with diabetes, respiratory failure or sepsis
- Hypertrophic cardiomyopathy
- Coronary vasospasm
- Acute neurological disease, including stroke or SAH
- Cardiac contusion/trauma - surgery, ablation, pacing, ICD shocks, cardioversion, endomyocardial biopsy, cardiac surgery, etc.
- Rhabdomyolysis with cardiac injury
- Congestive heart failure - acute and chronic
- Pulmonary embolism, severe pulmonary hypertension
Troponin elevations have been reported in a variety of clinical scenarios other than ACS in the absence of a thrombotic occlusion of the coronary artery:

- Renal failure
- Aortic dissection
- Aortic valve disease
- Infiltrative diseases (ie, amyloidosis, hemochromatosis, sarcoidosis, scleroderma)
- Inflammatory diseases (ie, myocarditis/endo-/pericarditis, Kawasaki disease)
- Drug toxicity or toxins (ie, adriamycin, 5-flurouracil, etc.)
- Burns, especially if affecting >25 percent of body surface area
- Extreme exertion
- Transplant vasculopathy
Testing for ACS - Serum Markers

• *Creatine Kinase*, an intracellular enzyme involved in transferring phosphate grps from ATP to creatine in Cardiac & skeletal muscle and brain

• CK-BB = brain

• CK-MM = skeletal

• CK-MB = cardiac
Testing for ACS - Serum Markers

• CK
  - Elevates 4-8 hours after coronary Art. Occlusion
  - Peaks = 12 to 24 hours
  - Nml = 3 to 4 days

• CK-MB
  - Detectable 4-8 hrs
  - Peak = before 24 hrs
  - Nml = in 48hrs

• CK-MB normally can be 5% of total CK (Rapid Index)
Testing for ACS - Serum Markers

Common Causes of CK-MB Elevation:

- UA, ACS
- Inflammatory Heart Dz
- Cardiomyopathies
- Shock
- Cardiac Surgery/Trauma
- Trauma
- Dermatomyositis
- Myopathic Disorders
- Muscular Dystrophy
- Extreme Exercise
- Malignant Hyperthermia
- Reyes Syndrome
- Rhabdomyolysis
- Delerium Tremens
- Ethanol Poisoning, chronic
Testing for ACS - Serum Markers

**Myoglobin**: Abnormal in 80 – 100% AMI pts

- Small protein in striated and cardiac muscle, released in cell disruption
  - In AMI
    - Rises within 3 hours
    - Peak at 4 to 9 hours
    - Baseline at 24 hours
  - Except in trauma pts, renal pts, and cocaine users myoglobin can be as sensitive as CK-MB and Troponins
Testing for ACS - Serum Markers

- New Bedside cardiac marker tests are now available with results in less than 20 minutes

- Overall value of this remains to be determined
Testing for ACS
Prognosis Categorization Strategy

1. AMI = Immediate Revascularization candidate
2. Probable acute Ischemia: 

(Any of the following)
- Clinical Instability (HF, shock, etc)
- Ongoing pain
- Pain at rest with ischemic EKG changes
- Positive cardiac marker(s)
- Positive perfusion imaging study
3. **Possible acute Ischemia:** **Intermed. Risk:**

*Hx suggestive of ischemia with...*

- Rest pain, now resolved
- New onset of pain
- Crescendo pattern of pain
- Ischemic pattern on EKG without CP
Testing for ACS

Prognosis Categorization Strategy

4.A. Probably NOT Ischemia: **low risk**

*Requires all of following*

- Hx not strong for ischemia
- EKG normal, unchanged from previous, or nonspecific changes
- Negative markers
Testing for ACS
Prognosis Categorization Strategy

4.B. Stable Angina Pectoris: low risk Px
Requires all the following

> 2wk unchanged Sx pattern, Longstanding Sx with only mild change in exertional pain threshold
EKG normal, unchanged, nonspecific changes
Negative initial myocardial markers
Testing for ACS
Prognosis Categorization Strategy

5. Definitely not ischemia: very low risk for adverse events

Requires All

- Clear objective evidence of nonischemic Sx etiology
- ECG normal, unchanged, nonspecific
- Negative Initial Markers
ACS ED Observations

- **Chest Pain Units** have shown to be able to discharge 82% of pts after set observation
  - Serial Enzymes at 0, 3, 6, 9 hrs
  - Serial EKG’s
  - Followed by Echo and Stress test to rule out ACS
Disposition

- Miss rate of AMI = 2%

- Chest Pain units, serial markers, imaging studies and stress testing help reduce this %

- Collect adequate information before making judgment
Disposition

• **Safely Discharge:**
  - Sharp, well localized, reproducible by position, breathing, palpation and no prior diagnosis of angina or AMI

• **Keepers:**
  - Unexplained visceral pain
    • Unless ancillary testing excludes ACS

• **Close follow up!**
Therapy

• In the algorhythm
Algorithm for management of pts with suspected AMI in the ED
Algorithm for management of pts with suspected AMI in the ED
Chest pain pattern suggesting an acute coronary syndrome

Goal = 10 minutes

- Triage for rapid care
- Aspirin 160-325 mg chewed
- SL nitroglycerin 0.4 mg every 5 minutes for three doses
- Morphine sulfate 2 to 4 mg IV initially, then 2 to 8 mg IV every 5 to 15 minutes
- Establish intravenous access
- Obtain blood for initial laboratory work including serum biomarkers *
- Institute continuous ECG monitoring
- Initiate supplemental oxygen therapy
- Obtain focused history and examination

Initial 12 lead ECG; if not diagnostic, repeat at 5 to 10 minute intervals

- ST elevation or new or presumably new LBBB
- Strong suspicion for ischemia, but no persistent ST elevation
- Normal or nondiagnostic ECG and normal cardiac enzymes
ST elevation or new or presumably new LBBB

Beta blocker if not contraindicated
IV nitroglycerin if persistent chest pain
Intravenous heparin
Most use GP IIb/IIIa inhibitor if primary PCI
Clopidogrel

Primary PCI, if available, with goal less than 90 minutes
OR thrombolysis with goal of 30 minutes

Normal or nondiagnostic ECG and normal cardiac enzymes

Continue evaluation and treatment in ED or monitored bed
Repeat ECG and cardiac enzymes at 6 to 12 hours

Strong suspicion for ischemia, but no persistent ST elevation

Enoxaparin or unfractionated heparin
Beta blocker if not contraindicated
IV nitroglycerin if persistent chest pain
Clopidogrel but, if PCI is planned, some wait until coronary angiography to see if CABG is required

Look for high-risk features:
ST depression
Elevated cardiac enzymes
Persistent chest pain
Hemodynamic instability
TIMI risk score ≥3

Evidence of ischemia/infarction

No
Perform stress test

Yes
Treat for non-ST elevation acute coronary syndrome
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