Definitions: Acute Myocardial Ischemia

- Unstable Angina
- Non-ST-Elevation MI (NSTEMI)
- ST-Elevation MI (STEMI)
Acute Coronary Syndrome

No ST Elevation
- NSTE MI
- Unstable Angina

ST Elevation
- Myocardial Infarction
- NQMI
- QwMI
ACS

- **Pathophysiology**: acute change/destabilization/rupture of coronary arterial plaque with inflammation and acute thrombus formation.
ACS

Evaluation

- History
- Physical
- EKG

Serum cardiac markers/enzymes

* R/O requires 8-12 hrs after sx onset
ACS

History

- Age

- Symptoms: Chest pain
  - Quality
  - Onset
  - Duration
  - But...1/3 present with symptoms other than chest pain (older, women, hx. of CHF, diabetes)

- Past Cardiac History

- Coronary Risk Factors
ACS

Physical Exam

- **General**: signs of hypoperfusion (cool, clammy, ashen)
- **Vital Signs**: hypertensive, hypotensive, tachycardic
- **JVP**: elevated ?
- **Lungs**: rales ?
- **Heart**: murmur (new?), S₃
- **Neuro.**: signs of prior CVA
ACS

EKG: cornerstone of treatment decision

- **ST Elevation**: acute reperfusion recommended
  - > 0.1mV in 2 contiguous leads
  - new LBBB
  - acute true posterior MI (ST ↓ V1-4 with tall R-waves right precordial leads and upright T-waves)

- **Non-ST-Elevation**: lytics not indicated
  - ST- depression
  - T-wave inversion
  - “normal”
ACS

Serum Cardiac Markers: should not delay treatment

- **CK - MB**: 6 hrs to 1-3 days
  - Specificity and sensitivity decreased vs. Troponin
  - Value = re-infarct, peri-procedural MI
  - Isolated ↑ = no value

- **Troponin (I, T)**: 6 hrs to 1-2 weeks
  - preferred biomarker to diagnose myocardial injury
  - specificity and sensitivity increased vs. CK-MB

- **Myoglobin**: 2 hrs to <24 hrs
  - sensitivity increased: early * high negative
  - Not cardiac specific > predictive value
ACS

STEMI

- Reperfusion strategy
  - Thrombolytic therapy
  - “Primary” PCI (angioplasty)
  - “Rescue” PCI (post-lytics)
  - “Non-emergent” PCI (post-lytics)
- Infarct related artery patency = predictor of survival
- GREATEST BENEFIT = 1\textsuperscript{st} 2-3 HRS
ACS

STEMI

Thrombolytics: FMC-device time > 120 mins
Door-needle time <= 30 mins

- Alteplase (TPA), Reteplase (rPA), Tenecteplase (TNK)
- 90-min patency rate = 75%-85%
- TIMI-3 Flow = 50-60%
- ↓efficacy in patients presenting with CHF or shock
- ACC/AHA: patients with cardiogenic shock or severe heart failure (Killip 3 or 4) should be transferred immediately to a hospital with a cath lab and PCI/CABG capabilities.
ACS

STEMI

Primary Angioplasty:

- Patency and TIMI-3 flow rate: $\geq 90\%$
- Logistics
- The greater the risk = the greater the benefit
  (ie. anterior MI, heart failure, shock)

FMC-device time

$\leq 90$ mins (PCI hosp)

$\leq 120$ mins (non-PCI hosp)
Antiplatelet Therapy

- ASA load: 160-325mg (uncoated)
- Clopidogrel: 75 mg daily
  * load = 300 mg (lytic tx & < 75 yo)
  * load = 600 mg (PCI)
  * newer = prasugrel (60 mg), ticagrelor (180 mg)
    - [avoid prasugrel if hx CVA / TIA]
ACS - STEMI

Anticoagulant Therapy

- **Primary PCI:**
  - UFH
  - or...Bivalirudin

- **Lytics:**
  - UFH (48 hrs)
  - or...LMWH (duration of hosp)
  - or...Fondaparinux (duration of hosp)
ACS
STEMI
Summary

PCI hosp
  ↓
Primary PCI
  ↓
FMC-device time \(\leq 90\) mins

Non-PCI hosp
  ↓
Transfer for PCI if FMC-device time \(\leq 120\) mins
    ↓
[DIDO \(\leq 30\) mins]
  or…
Lytics if FMC-device time > 120 mins… then transfer for cath
Rescue Angioplasty

- def.: emergent PCI after failed fibrinolysis
  (determined by sx, EKG, hemodynamics)

- Recommendations:
  - Cardiogenic Shock
  - Severe heart failure
  - Ongoing ischemia = CP, ST↑ @ 90 min
Delayed Invasive Management:

Routine early cath (3-24 hrs) after lytic tx in all patients (class IIa) !!!
ACS
NSTEMI

Treatment

- “Lytics” not indicated
- Angioplasty = “Invasive strategy”
- Medical therapy = “Conservative strategy”
  * non-high risk patients
ACS

NSTEMI

Medical Therapy

Conservative: ischemia-driven strategy

ASA

Plus … Clopidogrel or Ticagrelor

Plus … Anticoagulant

Invasive Strategy: urgent/immediate or within 24-72 hrs

ASA

Plus … Clopidogrel or Ticagrelor

Plus … Anticoagulant

? Plus… IIb/IIIa (high risk patients)
ACS
NSTEMI

Medical Therapy

- **Anti-Coagulant**
  - Low Molecular Weight Heparin
  - Unfractionated Heparin (UFH)
  - Fondaparinux
  - Bivalirudin (invasive strategy, omit GP 2b/3a)

- **Anti-Platelet / IIb-IIIa inhib (parenteral)**
  - Abciximab (Reopro): option with PCI (GUSTO-IV ACS)
  - Tirofiban (Aggrastat): with/without PCI (Prism Plus)
  - Eptifibatide (Integrelin): with/without PCI (Pursuit)

- **Anti-Platelet (enteral)**
  - Clopidigrel (CURE)
Risk Stratification

- Historical
- Current: onset → post-discharge
- Predict event risk:
  - recurrent ischemia
  - (re) MI
  - Death
ACS
NSTE MI

Risk Stratification

- Early invasive strategy: ? All
- TIMI score, GRACE, PURSUIT
- Hemodynamic or electrical instability
- Elevated cardiac markers
  - Troponin
  - ? BNP
- Acute EKG changes: ST-depression, new BBB
- Prior MI, CABG, PCI (in 6 mos)
- Age (> 75)
- Multiple coronary risk factors
ACS
Adjunctive Medical Therapy

Oxygen
ASA

Nitrates = SL +/- IV

*Caution: recent ED med use, RVMI, low BP, tachy, brady

Morphine:

* STEMI = class 1

* UA/NSTEMI = class IIb
ACS
Adjunctive Medical Therapy

■ Beta Blockers:
  Oral = 1st 24 hrs
  IV = avoid unless HTN or tachyarrhythmia
  * COMMIT = ↑ risk cardiogenic shock (day 0-1)
  ↓ risk re-infarct & VFib (> day 1)

  * Avoid: CHF, PR >240 ms, 2nd or 3rd degree AVB, asthma
  * Caution - risk markers for shock:
    age >70yo, BP< 120, HR >110 or <60, late presentation
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Adjunctive Medical Therapy

- ACE inhibitors: within 24 hours, oral dosing
  * Ant MI, or EF $\leq 40\%$, or CHF (class I)
  * All STEMI patients (class IIa)

- Aldosterone antagonist:
  * LVEF $\leq 40\%$ and CHF or diabetes (class I)

- Statin = high dose
ACS
Adjunctive Medical Therapy

NSAID’s

All are contraindicated during hospitalization for AMI = except Aspirin

*↑ risk of death, reinfarct, HTN, CHF, cardiac rupture.
ACS

Complications

- Electrical instability
- Hemodynamic instability / Shock
- CHF
- Depressed LV function (EF<40%)
- Recurrent ischemia
ACS

Complications

- CHF/shock: stabilize transfer
  - Diagnosis: Echo
  - Treatment: Meds., IABP, Cath / revascularization
ACS

Mechanical Complications

- “Pump” failure: right, left, both: reperfusion
- Acute MR
- Acute Septal rupture ("VSD")
- Free wall rupture

} echo surgery
Right Ventricular Infarction - Complications

- **Diagnosis**
  - inferior MI = ~ 1/3 of patients
  - ST↑ V1, V4-R
  - Triad = Hypotension, JVD, “Clear” lungs
  - Echocardiogram

- **Treatment** - Volume, Catecholamines, maintain A-V synchrony, early reperfusion

- **Prognosis** - ↓
ACS

Electrical Complications

- Brady-arrhythmia
- Tachy-arrhythmia
  - SVT
  - sinus tach
  - other
- VT
Electrical Indications for Pacing

- Prognosis: extent of myocardial necrosis
- Indications (transvenous or transcutaneous)
  - Symptomatic bradycardia
  - $2^0$ AVB - Mobitz II
  - $3^0$ AVB
  - RBBB plus fascicular block
  - New BBB
  - Asystole
  - Alternating BBB
Ventricular Arrhythmias

- VT/VF: ACLS guidelines
- Non-sustained VT, PVC’s, idioventricular rhythm: no anti-arrhythmic
- VT/VF: electrophysiology evaluation for ICD
- NSVT: LVEF evaluation; electrophysiology evaluation
- Prophylaxis: ICD for recovered (> 6-13 wks) EF < 30 (NYHA I) -35% (NYHA II-III)
ACS

Risk Stratification - Re-visited

- **LVEF**: Echo, Nuclear
- **Ischemia**: Stress testing
  - Submaximal: pre-discharge
  - Symptom limited: early post-discharge
- **Risk**: ischemia, ↓ EF (<40%), hemodynamic instability/CHF, ventricular electrical instability, diabetes, prior revascularization
ACS

Secondary Prevention

- Statin: atorvastatin 80 mg daily or rosuvastatin 20-40 mg daily
- ASA lifelong: 75-162mg (lifelong)
- ACE inhibitor: maybe all
- Beta-blocker: long term
- Aldosterone antagonist: impaired LV (EF<40%)… w/ CHF or DM (EPHESUS trial)
- Warfarin anticoagulation: thrombus, atrial fibrillation, ? extensive regional wall motion abnormality (eg: anterior MI) = but CAUTION with dual anti-plt tx.
- Clopidogrel: ASA intolerant, post-stent, USA, NSTEMI, STEMI… All ACS ~ 1yr
- Cardiac Rehab