EMC 370 Introduction to Medical Emergencies

Acute Coronary Syndrome 1

23 A

David Trigg, MD

Outcomes

At the completion of this lecture, the learner will be able to:

- Integrate pathophysiology, assessment, and treatment for patient with angina (5-2.70-71) or MI. (5-2.75-2.84)
- Discuss possible myocardial infarction and ischemia prehospital complications and treatment principles and examples of these complications.
- Review the pitfalls of misinterpretation of the presenting signs and symptoms of the various types of non cardiac chest pain.
- Discuss the rationale for prehospital disposition and triage of ACS.
- Discuss the components of the prehospital ACS triage data base.

Assessment and Stabilization

- ABC's / CO_2M_3EBIG
- Risks
  - sudden death
  - worsening myocardial ischemia / infarct

Clinical Presentations and Risk Factors

In prehospital and ED management

- Classical CV risk factor assessment (FH…) : not real helpful in the initial management.
- Prognosis-based stratification and risk-based decision making will determine:
  - which facility is the most appropriate
  - which initial reperfusion intervention is more appropriate
    - fibrinolysis
    - Primary **PCI** (Percutaneous Coronary Intervention) , or "percutaneous intervention(PCI)," or percutaneous coronary angioplasty (PTCA)

Classical ACS Presentation

Substernal chest pressure

- if present
  - helpful for prehospital disposition and triage of ACS
- if absent (~ 20% of all MIs)
  - use other prehospital ACS triage data

"Atypical" Presentations

"Silent" MI

- Vague complaints
  - Suspect atypical / silent MI
- Risk Factors
  - Diabetes
  - Female
  - Elderly
  - Alcoholism
  - Hypertension

Classical Risk Factors Used For Risk-Stratification

- Male sex
- Increasing age
- Tobacco
- Hypertension
- **Diabetes** mellitus
- Hypercholesterolemia
- Obesity
- **Prior history of ACS**
- Family history of ACS

Prehospital Risk Factors Used For Risk-Stratification

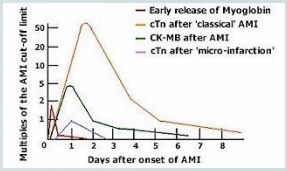
- History
  - **positive**: definite ischemic symptoms
- EKG- 12 lead
  - **abnormal**: definite ischemic changes
  - dynamic EKG / changing with Sx and Tx
- ST-segment changes
  - elevation
  - depression
- Marked precordial T-wave changes

Risk-Stratification and Clinical Variables

- History
  - **Unrelieved** chest pain
- PE (deteriorating patient)
  - Pulmonary edema
  - Shock
- 12 lead EKG :
  - Changing ST-segment elevation in precordial and limb leads
- Troponin I
  - Elevation is not immediate

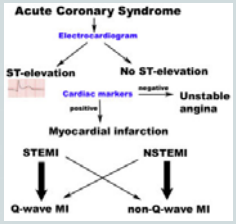
Definitive Diagnosis

- A patient can still have an MI and / or ischemic complications
  - with ***no*** chest pain
  - with a ***normal*** EKG
  - with normal initial markers [AKA "enzymes"]



Criteria for Diagnosis of MI

- ST segment elevation MI (or STEMI) and
- non ST segment elevation (or NSTEMI)



EKG Criteria for MI

- ST segment elevation in 2 or more anatomically contiguous leads
- Precordial leads : contiguous leads
  - (e.g., V_2 and V_3 : anterior septal)
- ≥ 1 mm of elevation in contiguous precordial leads [or posterior V_{7-9} - LCx]
- ≥ 1 mm of elevation in limb leads in an anatomical locations [the arterial supply]
- Chest pain when accompanied by ST segment elevation
  - yields 90% probability of ACS

Chest Pain Algorithm

- Chest Pain, Possible MI
- $CO_2M_3B_4I_2G$
  - M_3 -- cardiac monitor and 12 lead EKG
  - B_4 -- blood draw of 4 tubes: red, green, purple, blue tops
  - I_2 -- start 2 lines if you think the patient is probable for MI
- While initiating procedures, if time permits start
  - Assessing history
  - Risk stratification
  - Thrombolytic questionnaire
- O_2 4 L/min by NC (*Circulation* 2000; 102: I-95)
- Aspirin 160 mg PO, chewed and swallowed
- Treat complications

Treatment Principles and Examples of Complications

- Sample algorithm - in fair detail
- Without every assessment detail (such as specifics of history, PE, EKG, and thrombolytic questionnaire)
- Some examples (common + uncommon)
- No without the lengthy VF, PEA, and asystole algorithms

Chest Pain

- Nitroglycerin (NTG)
- 0.4 mg (1/150) SL
- repeat NTG q 5-10 minutes x 3 if no relief and systolic BP > 100.
- Nitrol ointment 1/2 - 2" may then be used after initial NTG, to maintain a therapeutic level
- IV NTG starting at 10 mic / min (6mL / hr)
- contraindicated in RV infarct

Nitroglycerin Caution

- Viagra (Sildenafil)
- Do ***NOT*** give nitroglycerin
  - If patient has taken Viagra within 24 hours
  - patient can develop refractory hypotension
- If a patient does develop hypotension because of inadvertent Viagra / NTG combination
  - initially treat with volume expansion

Nitroglycerin Caution

- Cialis (tadalafil)
- Similar to Viagra
- Effects may last up to 36 hours
- If patient has taken Cialis
  - Do not administer NTG

Pain Control

Morphine Sulfate

- 2 - 4 mg IV initially
- then 2-4 mg IV q 5 min PRN for pain

Pain and Sinus Tachycardia

- Metoprolol 5 mg IV
- If no contraindications:
  - severe asthma
  - CHF
  - shock

Symptomatic Bradycardia

- Heart rate < 60 and CP / shock / CHF / ALOC
- Atropine
  - 0.5 mg IV q 5 min until SBP > 90 and HR > 60
  - maximum dose of 3 mg (old: 0.04 mg/kg)
  - Use only the lower dose of 0.5 mg in CP ; high dose can cause tachycardia and cardiac irritability.

Symptomatic Bradycardia

External pacemaker

- Sedate with midazolam (Versed) 0.1 mg/kg IV
- and/or MS 2-15 mg PRN analgesia.

Dopamine

- Start at 6 µg/kg/min, and titrate

Treatment Principles

- Prehospital phase
  - Period associated with highest incidence of dysrhythmias.
  - Treatment is indicated if the dysrhythmia exacerbates myocardial ischemia, or could potentially deteriorate into cardiac arrest.
- Stable tachyarrhythmias
  - Specific new treatment guidelines have not yet been determined for all prehospital settings.
- Unstable tachyarrhythmias
  - Treatment guidelines remain
  - Cardioversion

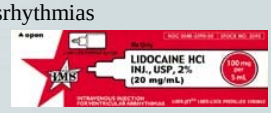
Stable Tachydysrhythmias

- Regional treatment guidelines often **NOT** consistent for prehospital management
- Controversy continues over ***amiodarone**** vs. lidocaine (and others)
- Originally: only ***ONE**** randomized double-blind comparisons cited - - no mention of long term survival, only of resuscitation
- cost-benefit analysis
- sinus tachycardia
- atrial fibrillation
- ventricular tachycardia

* *# 109 Kentsh M. Intensivmedizin 1988;25:70-74*

Prophylactic Lidocaine

- No longer administered to decrease the incidence of ventricular ectopy and primary ventricular fibrillation associated with acute MI.
- Lidocaine may be particularly harmful in the setting of
  - acute inferior wall MI
  - bradydysrhythmias



Stable Tachydysrhythmias

Treatment

- Sinus tachycardia
  - Metoprolol 5 mg IV, slowly over 5 min
    - repeat q 5 min with max of 15 mg
- Atrial fibrillation (with RVR)
  - rate control
  - Diltiazem 0.25 mg/kg
    - repeat dose : 0.35 mg/kg

Stable Ventricular Tachycardia

Monomorphic V-Tach

- Amiodarone: 150 mg IV over 10 min

  or
- Lidocaine: 0.5 - 0.75 mg/kg q 3-5 min

  max : 3mg/kg

Right Ventricular Infarct

- Incidence
  - 30+/- % of IMI patients may have RV Infarct
- Mortality
  - significantly increased (30%)
- PE
  - Lungs clear
  - Shock with NVD (sometimes after NTG)
- EKG
  - ST elevation in II, III, AVF, V_4R

RV Infarct Treatment

- Avoid NTG
- Morphine for pain
- If NTG already started and hypotension with bradycardia develop, stop NTG
- Elevate legs / lower head
- Substantial fluid challenge (NS 500 mL / 10 min)
  - RV infarct pt's are preload or VOLUME dependent
- NS 500 mL / 10 min (up to 2000 mL !!)
- Consider Dobutamine
- Reperfusion / angioplasty

Left Ventricular Failure

CHF, pulmonary edema, cardiogenic shock

- Acute MI $\rightarrow$ impaired contractility of the left ventricle
- impairment of $\geq$ 25% of the LV $\rightarrow$ CHF
- impairment of $\geq$ 40% of the LV $\rightarrow$ cardiogenic shock
- Treatment
  - CPAP / PEEP
  - reduce
    - preload
    - afterload

Treatment of LVF

- Conscious patient
  - positive end-expiratory pressure (PEEP)
  - applied with a tight fitting mask
  - method: "continuous positive airway pressure" (CPAP)
- Unconscious or obtunded patient
  - PEEP is applied via endotracheal tube

Treatment of LVF

Nitroglycerin (if systolic BP > 100mmHg)

- Acts primarily to decrease preload
- Provides better collateral flow to the ischemic heart than nitroprusside, and therefore is the ***vasodilator*** *of* ***choice*** in the presence of an acute MI.
- Administration
  - Sublingual nitroglycerine 0.8-1.2 mg q 5-10 min
  - Intravenous nitroglycerine 10-200 ug/min (start at lower end of the dose range and gradually increase the dose)

Treatment of LVF

Furosemide (lasix)

- Induces diuresis
- May induce venodilation
  - extent not well established
- Dosing
  - 80 mg IV
  - Use lower dose if patient is <u>not</u> taking home lasix (40 mg)
  - Use higher dose if on daily lasix

Treatment of LVF

Morphine Sulfate

- No longer recommended as primary therapy for pulmonary edema
- Both sedative and analgesic
- Caution: respiratory depression; avoid naloxone
- Effects on preload and cardiac output are minimal compared with that of nitroglycerin and other vasodilators
- Use to relieve ischemia if chest pain accompanies pulmonary edema and is unrelieved by nitroglycerin
- Dosing
  - 2-5 mg IV q 3 min up to 15 mg

Thrombolytic Inclusion Criteria

- Chest pain consistent with acute MI
- <u>></u> 30 minutes in duration
- but not > 12 hrs
- ST elevation of <u>></u> 1mm in 2 contiguous leads
  - persisting after administration of NTG

Thrombolytic Exclusion Criteria

Absolute

- Allergic to agent
- Non diagnostic EKG
- No treatment of pain, per se
- No treatment based on history alone
- No treatment based on enzymes alone
- Bleeding - active or recent
- CVA, surgery, or trauma in past 2 months in a non-compressible site (recent surg., subclavian,…)
- Aortic dissection
- Pericarditis
- Diabetic retinal disease

Thrombolytic Exclusion Criteria

Relative

- Uncontrolled HTN (> 180/110)
- Bleeding - tendency
- Coumadinized
- Prolonged CPR (> 10 min)

Reperfusion Therapy

- Percutaneous Coronary Intervention (balloon angioplasty)
  - PCI: ***preferred reperfusion intervention*** since 2001
  - Should be considered for any short transport time or any failure to respond to lytic therapy
- Impediments to rapid PCI reperfusion
  - Delayed 12 lead, due to …
  - System design / protocol
  - Other

Delayed Reperfusion

- Ideal PCI (balloon angioplasty)
  - **≤ 90 minutes** from door to balloon (D2B)
- Impediments to rapid PCI reperfusion
  - System design / protocol
  - Delayed 12 lead, due to :
    - Protocol
    - EP, ED RN, EMT-P education
    - "Atypical" presentation
  - Other

Delays in STEMI Diagnosis and Reperfusion

- Any delay in time from triage to EKG : **worse clinical outcome** for STEMI patients (hospital mortality more than twice as high in patients without reperfusion as compared to that with reperfusion treatment with an estimate of more than 10,000 deaths annually are attributable to the underutili[zed] treatment for acute myocardial infarction in US) [*Heart* 2001;**86:**243-245]
- CP protocol
  - Triage for rapid 12 lead EKG
  - Protocol goal: less than 10 min from patient contact to ED physician notification
- Other strategies to reduce door-to-balloon time for Acute MI (in-hospital, cath lab,…)

Delays in Reperfusion

"Atypical" presentation

- Chief complaint-based indications for EKG (Graff L *Ann Emerg Med* 2000 36(6): 554-60) (5):
  - Older than 30 with chest pain
  - Older than 50 with syncope
  - Weakness
  - Tachycardia
  - Dyspnea

Other Delays in Reperfusion

- Evidence of differences in time to acute reperfusion in patients with MI has been studied repeatedly:
  - Racial differences (*JAMA.* 2004;292:1563-1572)
  - Ethnic differences (*N Engl J Med.* 2005; 353: 671–682.)
  - Gender differences (*Heart* 2001;86:243-245)

Reperfusion Considerations

Non thrombolytic anticoagulation agents (in addition to ASA)

- Reduce risk of cardiovascular death
- Prevent or decrease the incidence of reocclusion.
- Decrease incidence of DVT, reinfarction, embolic CVA, and formation of and embolization of a left ventricular wall-thrombus.
- Given after fibrinolysis, and/or before, during, or after PCI coronary angioplasty
- Agents
  - Intravenous heparin +/-
  - II B / IIIA agent
    - Eptifibatide (Integrilin) +/-
  - antiplatelet agent: clopidogrel (Plavix)

Emergent CABG (coronary artery bypass grafting)

CABG / Balloon PCI

Emergent percutaneous angioplasty or coronary artery bypass grafting is indicated for:

- Shock
- Persistent or recurrent pain
- Pulmonary edema
- Persistent tachycardia
- RV infarct
- Consider for
  - prior MI / CABG
  - widespread EKG changes

Summary

- Treatment for patient with unstable angina, AMI, arrhythmias, CHF, and shock
- Prehospital complications of MI and ischemia
- General treatment principles and examples of complications (RV MI)
- Inclusion and exclusion criteria for thrombolysis and mechanical revascularization
- Non thrombolytic anticoagulation agents
- Pitfalls of misinterpreting various types of non-cardiac chest pain.
- Importance of prehospital ACS triage and transfer.
- Preferred method of rapid reperfusion intervention : Percutaneous Coronary Intervention (PCI balloon angioplasty)
- Delays in STEMI Diagnosis and Reperfusion

Notes

- Triage of patients for a rapid (5-minute) electrocardiogram: A rule based on presenting chief complaints. Graff L . *Ann Emerg Med* 2000 36(6): 554-60
- Racial and ethnic differences in time to acute reperfusion therapy for patients hospitalized with Myocardial Infarction. Bradley E. H., et al *JAMA.* 2004;292:1563-1572.
- Sex and Racial Differences in the Management of Acute Myocardial Infarction, 1994 through 2002. Vaccarino V, et al, *N Engl J Med.* 2005; 353: 671–682.
- The patient with acute myocardial infarction who does not receive reperfusion treatment. *Heart* 2001;**86:**243-245 (September)

Examples of STEMI

STE in Leads	Wall Affected	Probable Culprit Coronary Artery
V_1 V_2	Septal	LAD
II, III, aVF	Inferior	RCA (occas: LCx)
V_3 V_4 V_5 V_6 I, aVL	Antero-lateral	LAD +/- LCx