ABCs of ACS:

ACUTE CORONARY SYNDROME

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Objectives

- Define acute coronary syndrome
- Describe the pathophysiology of acute myocardial infarction
- Describe the contributing factors to acute coronary syndrome
- Identify the key elements in treating acute coronary syndrome and the role of the EMS personal
Coronary heart disease (CHD) is the leading cause of death in America.

- **Incidence**—1.2 million new or recurrent AMI annually
  - 41% of the 1.2 million are recurrent MIs
  - 38% die from the acute MI
- **Mortality**—1/2 million die annually (1 in 5)
- **Prevalence**—15,800,000 victims of angina, heart attack and other forms of CHD are still living

(AHA, 2004 Heart Attack and Angina Statistics)
Woman and Heart Disease

- Myth that heart disease = man’s disease
- 1 in 8 woman aged 45-64 has heart disease
- 1 in 4 over 65 have heart disease
- CAD leading cause of death in woman in US
Definition of ACS

- **Acute Coronary Syndrome (ACS)** is a term used to describe the spectrum of disease of the coronary arteries that range from unstable angina to acute myocardial infarction.
- **ACC/AHA Joint Guideline Statement, 2007:**
  - “any constellation of clinical symptoms that are compatible with acute myocardial ischemia”
  - Unstable Angina
  - MI (STEMI & NSTEMI)
Definitions (Cont.)

**Myocardial ischemia**

A condition in which oxygen delivery to and metabolite removal from the myocardium fall below normal levels, with oxygen demand exceeding supply

**Acute myocardial infarction**

An acute process of myocardial ischemia with sufficient severity and duration to result in permanent myocardial damage

(ACC/AHA Joint Guideline Statement, 2000)
Definitions (Cont.)

- **Angina pectoris** - a clinical syndrome typically characterized by a deep, poorly localized chest or arm discomfort that is reproducible associated with physical exertion or emotional distress and relieved promptly (i.e., <5 min) with rest or sublingual nitroglycerin

ACC/AHA Joint Guideline Statement, 2000
Definitions

- **Unstable Angina**
  - Chest pain that is different
  - No elevation of biomarkers
  - Transient changes in EKG
    - Should obtain during chest pain
  - Cardiac ischemia

- **Non-ST elevation MI (NSTEMI)**
  - Chest pain that is different
  - Elevation of biomarkers
  - ST depression
  - Prominent T-wave inversion
  - NO ST segment elevation
  - Cardiac ischemia-leading to cardiac infarction
This photograph shows a cross-section of a coronary artery affected by atherosclerosis. Deposits of plaque – fatty material, cholesterol, calcium and blood clot – have narrowed the artery considerably. A heart attack happens when the coronary artery becomes blocked.

http://www.pbs.org/wgbh/nova/heart/troubled.html
Definitions

- **ST segment elevation myocardial infarction (STEMI)** – an acute process of myocardial ischemia with sufficient severity and duration to result in myocardial necrosis; see ST segment elevation

  \[ \text{STEMI} = \text{AMI} \]

(ACC/AHA Joint Guideline Statement, 2000)
Definitions: Older Terms

- **Non-Q wave myocardial infarction**
  An AMI that is not associated with the evolution of new Q waves on the ECG
  Now known as NSTEMI

- **Q Wave myocardial infarction**
  An AMI that is associated with the evolution on new Q waves on the ECG
  Now known as STEMI
Q less than 1/4 of the R height, and less than one box wide, is considered normal

http://www.madsci.com/manu/ekg_qwav.htm
Q waves are “significant” if they are greater than 1 box in width (longer than 0.04 msec) OR are larger than 1/4 of the R wave
Causes of ACS

- Clot formation
- Build up of plaque that ruptures causing occlusion downstream
- Ventricular hypertrophy
- Hypoxia due to CO$_2$ poisoning or acute pulmonary disorders
- Emboli to coronary arteries
- Coronary artery vasospasm
- Coronary anomalies
- Cocaine, amphetamines, ephedrine
Atherothrombosis: A Generalized and Progressive Process

Formation of the Platelet Plug

1. Adhesion
   - Platelets
   - vWF/GP Ib Bind
   - Collagen
   - GP Ia/Iia Bind

2. Activation
   - Thrombin
   - ADP
   - 5 HT
   - TXA₂

3. Aggregation
   - Activated GP IIb/IIIa
   - Fibrinogen

4. Platelet Plug

Pathophysiology

- Narrowing of epicardial blood vessels secondary to atheromatous plaque
- Plaque ruptures = exposure of the basement membrane = platelet aggregation = thrombus forms, fibrin accumulates => hemorrhage into the plaque.
- Varying degrees of vasospasm
  - Can have partial or complete occlusion of vessel
  - Results in myocardial ischemia
    - Total occlusion of vessel for more than 4-6 hrs results in irreversible necrosis
Illicit Drugs and the Heart

- **Cocaine:**
  - Powerful stimulant of the CNS, PNS
  - Quickly absorbed
  - At risk for cocaine-related deaths even in low-doses
  - ¼ of heart attacks in people ages 18-45 are cocaine related
  - Study done in Ann Arbor MI in 2003:
    - Suggested guidelines for ED physicians for treating cocaine related CP

http://www.med.umich.edu/opm/newspage/2003/cocaineheart.htm
Cocaine can cause the blood vessels in the body to constrict, slowing the flow of blood and helping to cause chest pain and even a heart attack.

http://www.med.umich.edu/opm/newspage/2003/cocaineheart.htm
Methamphetamines:
- “Crystal meth”
- Stimulant
- Rapid elevation of heart rate and BP

Heroin:
- Opiate (related to morphine)
- Produces relaxed effect after initial rush
- Causes blood clots
- Ecstasy:
  - Mild stimulant
  - Raises BP
  - Reduces pumping efficiency of the heart
- Marijuana:
  - Increase HR
- Anabolic Steroids:
  - Can raise LDL levels, increasing risk of atherosclerosis
  - High BP
  - Blood clots
- Inhalants:
  - Can lead to tachycardia
  - “Sudden sniffing death”
Signs and Symptoms

- Chest pain
  - Radiation to neck, jaw, shoulder, teeth, abdomen and back
- Short of breath
- Cough
- Lightheadedness
- Dizziness
- Fainting
- Nausea/Vomiting
- Sweating (profuse)
- Feeling of impending doom
- New onset left bundle branch block
- New onset a-fib
Assessment of Chest Pain

P – precipitating factors

Q – quality (rate of scale of 1 to 10 with 10 being the worst discomfort; this is useful in evaluating the effectiveness of nitroglycerin on the discomfort)

R – region and radiation

S – signs/symptoms associated with discomfort

T – time and response to treatment
Common Physical Presentation

- **Objective**
  - HR
  - BP
  - RR
  - Peripheral perfusion
  - Heart sounds
  - CHF

- **Clinical Presentation**
  - Diabetics
  - Women
Diagnostic Tests

- **Initial:**
  - 12 lead EKG
  - Serial serum cardiac markers
    - CPK, isoenzymes, troponin
  - PCXR

- **After diagnosis:**
  - Stress test
  - Echocardiogram
  - Cardiac catheterization
A Little On EKGs…

- Record electrical activity
- Can tell us acutely infarcting or ischemia
- What area is involved
- Changes suggestive of **ischemia**
  - Deep symmetric T-wave inversion
  - ST elevation or ST depression
  - ECG may be completely normal
- Changes suggestive of **injury**
  - ST segment elevation
12 Lead EKG (cont.)

- **Changes suggestive of AMI (infarction)**
  - Q waves (.04sec and 1/3 height of R wave) unless isolated in III
  - ST-T elevation (>1mm limb, >2mm precordial)
  - ST depression in V1, V2
  - T wave inversion unless isolated in III or V1
  - New left bundle branch block
Inferior Wall MI with possible lateral wall involvement
The arrows point to the site of a heart attack, where the heart muscle has died from oxygen deprivation. Normally, the area would look pink.

http://www.pbs.org/wgbh/nova/heart/troubled.html
ANTERIOR WALL
occlusion of
Left Anterior Descending
Coronary Artery
causes changes in leads
$V_1, V_2, V_3, V_4$

LATERAL WALL
occlusion of
Left Anterior Descending
or Circumflex Coronary Artery
causes changes in leads
$I, aVL, V_5, V_6$

INFERIOR WALL
occlusion of
Right
Coronary Artery
causes changes in leads
$II, III, aVF$
Acute Coronary Syndrome

Electrocardiogram

ST-elevation

Cardiac markers

positive

Myocardial infarction

STEMI

Q-wave MI

NSTEMI

non-Q-wave MI

No ST-elevation

negative

Unstable angina
ACC/AHA Guidelines

- Patients with suspected ACS need evaluation ASAP
- CP pts transported by ambulance:
  - 1/3 MI
  - 1/3 UA
  - 1/3 non-cardiac
  - 1.5% of these pts developed cardiopulmonary arrest prior to arrival to the hospital
ACC/AHA 2004 Guidelines for Management of STEMI, pg 303

**Onset of symptoms of STEMI**

1. Call 9-1-1
2. Call fast

**9-1-1 EMS Dispatch**

**EMS on-scene**
- Encourage 12-lead ECGs
- Consider prehospital fibrinolytic if capable and EMS-to-needle within 30 min

**Goals**

**Patient**
- 5 min after symptom onset

**Dispatch**
- 1 min

**EMS on scene**
- Within

**EMS transport**
- Prehospital fibrinolysis:
  - EMS-to-Needle within 30 min
- EMS transport: EMS-to-Balloon within 90 min
- Patient self-transport: Hospital Door-to-Balloon within 90 min

**Total ischemic time:** Within 120 min*

*Golden Hour = First 60 minutes
Reperfusion Therapy

Thrombolytic therapy

- Restore artery patency after infarct
- Indications:
  - Chest pain 12 hours or less
  - ST segment elevation (>0.1mV) in two contiguous precordial leads or at least 2 adjacent limb leads
  - New BBB and history suggestive of AMI
  - Physiologic age < 75 years

(AHA 2004)
Reperfusion Therapy (Cont.)

Thrombolytic therapy

- Absolute Contraindications
  - Previous hemorrhagic stroke at any time
  - Known structural cerebral vascular lesion (AVM)
  - Ischemic stroke within 3 months (exception acute stroke within 3 hours)
  - Significant closed head/facial trauma within last 3 months
  - Suspected aortic dissection
  - Active internal bleeding (excluding menses)
Reperfusion Therapy (Cont.)

Thrombolytic Therapy

- **Relative Contraindications**
  - Chronic severe, poorly controlled HTN
  - Uncontrolled HTN on presentation (SPB >180 or DBP >110)
  - Ischemic stroke >3 months, dementia or known intercranial pathology
  - Traumatic or prolonged CPR
  - Major surgery (< 3 weeks)
  - Recent (2-4 weeks internal bleeding
  - Pregnancy
  - Current use of anticoagulants
  - Non compressible vascular punctures
Reperfusion Therapy (Cont.)

Primary PCI

- Indications
  - Within 12 hours of symptom onset
  - With ST elevation or LBBB who develop shock within 36 hours of MI and are suitable
  - Severe CHF and/or pulmonary edema and onset of symptoms within 12 hours
  - Onset of symptoms within the prior 12 - 24 hours and 1 or more of the following:
    - Severe CHF
    - Hemodynamic or electrical instability
    - Persistent ischemic symptoms

- Not recommended in asymptomatic patients > 12 hours after onset of STEMI if the patient is hemodynamically & electrically stable
Reperfusion Therapy (Cont.)

- **Primary PCI**
  - Angioplasty
  - Stent placement
  - Arthrectomy
  - Angiojet
  - Rotablade

Thrombus is drawn into the catheter where it is fragmented by the jets and evacuated from the body.
Additional Therapies

- IABP Therapy
- CABG
- LVAD/BiVAD
- Transplant
Complications Post MI

- Arrhythmias
- Cardiogenic shock
- Congestive heart failure
- Acute mechanical changes
- Pericarditis
- Thromboemboli
- Cardiac tamponade
- Ventricular aneurysm
Patient Education

- Risk Factor Modification
- Treatment of Angina
- Medication Regime
- Nutrition
- Resuming Activities of Daily Living
- Cardiac Rehab
- Resources
Questions?????
Bibliography


Bibliography

- “This is our heart on drugs: study may help ER doctors identify and treat chest pain caused by cocaine”. http://www.med.umich.edu/opm/newspage/2003/cocaineheart.htm