The ABCs of ACS

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Objectives

- Define Acute Coronary Syndrome
- Recognize the importance of prehospital intervention
- Know the basic principles behind ischemic heart damage
Time is Muscle

- Prompt dispatch and response
- Preparation and planning
- Initial assessment
- Initial intervention
Coronary Heart Disease

- 1.2 million Americans will have a first or recurrent coronary attack
- 494,000 of these people will die
- Coronary heart disease is the nation’s number one cause of death
- About 7.1 million Americans have survived a myocardial infarction
- About 6.4 Million Americans have angina
Initial Assessment

- Check vital signs with automatic or standard BP cuff
- Determine oxygen saturation
- Obtain IV access
- Obtain 12-lead ECG
- Obtain a brief, targeted history and perform a physical examination; use checklist (yes-no); focus on eligibility for fibrinolytic therapy
- Obtain blood sample for initial cardiac marker levels
Initial Treatment

- Oxygen at 4 L/min
- Aspirin 325 mg
- Nitroglycerin SL or spray
- Morphine IV (if pain not relieved with nitroglycerin)
Pharmacology of ACS

- Indications
- Physiologic effects
- Dose
- Precautions and contraindications
**Oxygen**

- Should be used in all patients with suspected ischemic heart disease
- Increase oxygen to ischemic cardiac tissue
- Dosing starts at 2 Lpm and titrated to SaO₂ or pain relief
- Relative contraindication in COPD patients
Nitroglycerin

- Why does it decrease the pain?
  - Increases venodilation
  - Decreases venous blood return to the heart
  - Decreases preload and cardiac consumption
  - Dilates coronary arteries
  - Increases coronary collateral flow
So when do I use Nitro?

- Best evidence supports use during:
  - LV failure (acute pulmonary edema or CHF)
  - Elevated BP (especially with signs of LV failure)
  - Large anterior infarction
  - Persistent ischemia
- Suspected ischemic chest pain
- Unstable angina
- Acute Pulmonary edema
How much Nitro should I give?

- Sublingual nitro: 0.3-0.4mg every 5 minutes
- Spray nitro: 2 sprays every 5 minutes
- IV: titrated infusion starting at 10 µg/min
Nitro Pitfalls

- Caution with SBP <100
- Caution with possible inferior or RV infarct
- Do not drop the blood pressure excessively
- Don’t give to a patient who is standing, or walk a patient after administration
- Warn a patient about the headache…
Morphine Sulfate
Morphine Indications

- Pulmonary edema
- Continuing pain in a normotensive and normovolemic patient.
More than just a high

- Reduction of ischemic pain
- Reduction of anxiety
- Reduction of myocardial oxygen demands
Morphine Dosing

- 2 to 4 mg, titrated to effect
- Goal is elimination of pain
  - Stop when SBP around 100
Morphine’s problems

- Hypotension
  - Inferior and RV infarction
  - hypovolemic
- Respiratory depression
- Nausea and vomiting
- Itching and bronchospasm
Aspirin

**Mechanism of action**
- Blocks the formation of thromboxane $A_2$
- Thromboxane $A_2$ actions
  - Platelet aggregation
  - Arterial constriction
Thromb-what?

Diagram:
- Arachidonic acid
  - cycloxygenase
  - Endoperoxides (PGG₂, PGH₂)
    - Thromboxane synthetase
      - Thromboxane A₂
        - Thromboxane B₂ (platelets)
    - Prostacyclin synthetase
      - Prostacyclin (PGI₂)
        - 6 Keto PGF₁α₂ (endothelial cells)
Aspirin Benefits

- Reduce overall mortality from
  - Acute MI
  - Non-fatal reinfarction
  - Non-fatal stroke
Dose and Indications

- 325mg PO (preferably the chewable)
- Give to any patient with suspected acute MI as soon as possible!
Contraindications

- Known Aspirin hypersensitivity or anaphylaxis reaction
- Relative contraindications
  - Asthma
  - PUD
  - Bleeding disorders
  - Liver failure
- Patients on coumadin can have aspirin!
The EKG

- Essential for the Diagnosis of Acute Coronary Syndrome
- A normal EKG does not exclude the possibility of a heart attack
- However; an abnormal EKG requires immediate treatment
The P wave

- The P wave is caused by Depolarization of the Sino-Atrial (SA) node

- The PR interval should last .12-.20 seconds

- There should be one P wave preceding every QRS complex
The QRS complex

- Signifies the depolarization of ventricles
- The QRS complex should last about .04 seconds (one small square)
- The QRS complex hides the repolarization of the Atria
The T wave

- The T wave Signifies the repolarization of the ventricles
- The T wave should last about .15 seconds and the QT interval should be about .35 seconds
- There should be one T wave following every QRS complex
Putting it all together
Focusing on the ST segment

- ST segment elevation
- 2 contiguous leads
- 1mm of elevation

Obvious

Subtle
Where is the lesion?

<table>
<thead>
<tr>
<th>I Lateral</th>
<th>aVR</th>
<th>V₁ Septal</th>
<th>V₄ Anterior</th>
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<tbody>
<tr>
<td>II Inferior</td>
<td>aVL Lateral</td>
<td>V₂ Septal</td>
<td>V₅ Lateral</td>
</tr>
<tr>
<td>II Inferior</td>
<td>aVF Inferior</td>
<td>V₃ Anterior</td>
<td>V₆ Lateral</td>
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Anterior Septal MI
Inferior MI
Transport

- IV, O₂, Monitor
- Prehospital 12 Lead
- Prehospital Pharmacology
  - ASA
  - SL NTG
  - Morphine
- Command call
ED treatment

- Antiplatelet Activity
  - ASA
  - Heparin
  - Plavix
  - IIb/IIIa inhibitors

- Oxygen Supply and demand
  - Coronary anatomy
  - Sympathetic and parasympathetic balance

- Fibrinolytics Vs. PTCA
Myocardial infarction

- **STEMI**
  - 1mm ST segment elevation in 2 contiguous leads
  - Cath Lab or lytic candidate
  - Know your receiving hospitals

- **NSTEMI**
  - Treated medically initially
  - Goal of therapy is antiplatelet activity
Who cares about platelets?

- Pathology of infarction is related to injury and platelet response in the tissue
- Stopping the response prevents inhibition of blood flow
- Decreased inflammation leads to decreased platelet activity
Heparin

- Mechanism of action: works with AT III to inhibit the conversion of fibrinogen to fibrin
- Weight based medication in IV form
- Also used for the treatment of DVT/PE and A-fib
Clopidogrel (Plavix)

- Mechanism: inhibits ADP binding to platelet receptors
- Dose: 300mg PO loading.
IIb/IIIa inhibitors

- Mechanism: binds to platelet glycoprotein IIb/IIIa receptors, inhibiting aggregation
- Platelets cannot stick together
  - Abciximab (Reopro)
  - Eptifibatide (Integrilin)
  - Tirofiban (Aggrastat)
β Blockers

- Reduce sympathetic input on heart
  - ↓ HR
  - ↓ BP
  - ↓ Myocardial contractility
- Goal is SBP ≤110, HR ≤60, or relief of chest pain
- Caution in pulmonary disease
What about the Cath lab?

- Best results for patients with acute coronary syndrome
- Minority of hospitals do primary angioplasty
- Goal is door to balloon time of < 90 minutes
What is done

- Femoral artery catheter
- Real time coronary angiography
- Balloon deployment across the target lesion
- Stent deployment
- Recovery in the coronary unit
Femoral artery Cathether
Coronary Angiography
Coronary angiography
Opening the Vessel
Stenting the vessel

- Wire mesh inserted through the groin
- Positioned via angiography
- Balloon inflated and the stent is deployed
- Actions of stent
  - Open the vessel
  - Push plaque against vessel wall
  - DES reduces inflammatory response
How it works

- Location Markers
- Inflated Balloon with Drug Coated Stent
- Stent Delivery Catheter
How it works
DES

CYPHER® Sirolimus-eluting Coronary Stent: sirolimus (drug) emitting inside an artery
The Goal

Diagram:

A. Artery with Plaque
B. Stent insertion with Inflated Balloon
C. Expanded Stent after Stenting