Goals and Objectives

To reduce mortality and morbidity for people who have cardiovascular disease, with a focus on those who experience an ST Segment elevation MI, through a systematic approach to reduction of time from identification to reperfusion.
ED Priority

• It is critical that basic life support (BLS) and advanced cardiovascular life support (ACLS) providers who care for ACS patients in the out-of-hospital setting and emergency department (ED) be aware of the principles and priorities of assessment and stabilization.
Definition of ACS

- Acute myocardial infarction (AMI) and unstable angina (UA) are part of a spectrum of clinical disease identified as acute coronary syndromes (ACS).
- The common pathophysiology is a ruptured or eroded atherosclerotic plaque.
Early Diagnosis of ACS

- Early Care: Recognize & Respond
  - Often mild symptoms, usually normal activity

- Late Care: Obvious Emergency & Respond
  - Incapacitating pain, diminished activity

- Too Late Care: Critical Emergency & Respond
  - Unconscious, CPR, Defibrillation, Probable death

- 85% of heart damage takes place within the FIRST TWO HOURS.

- Early Care is better care!
Pathophysiology of Acute MI

- A result of occlusion of arterial flow to the myocardium.
- Occlusion occurs via spasm, blood clot or stenosis.
- Ischemia, injury and necrosis can occur.
Risk Factors

- CAN’T Change
  - Age
  - Gender
  - Race
  - Family History

- CAN Change
  - Smoking
  - Diabetes
  - Obesity
  - High Blood Pressure
  - High Cholesterol
What are the Signs and Symptoms?

- Chest pain or discomfort, which may or may not involve pressure, tightness, or fullness in the chest
- Discomfort or pain in both arms, jaw, neck, back, or stomach
- Shortness of breath
- Feeling dizzy, light-headed, or fainting
- Nausea with or without vomiting
- Sweating
Remember... 

- Signs can show up days or weeks before a heart attack
- Not everyone complains of chest pain

Early Symptoms of a Heart Attack
Age Differences in ACS Symptoms

- ACS becomes progressively more common with increasing age.
- In persons aged 40 - 70, ACS is diagnosed more often in men than women.
- After age 70, men and women are affected equally.
- The elderly
  - Unusual fatigue
  - Shortness of breath
  - Sleep disturbance
  - Anxiety
Gender Specific Differences

- Men
  - Shortness of breath
  - Cold sweat
  - Chest pain

- Women
  - Unusual fatigue
  - Sleep disturbance
  - Indigestion
  - Anxiety
  - Nausea
Symptoms of ACS in Diabetics

- Symptoms may present only as fatigue, weakness or shortness of breath.
- Maintain a high index of suspicion for ACS when evaluating elderly, women and diabetics.
Other Possible Causes of Chest Pain

• Aortic dissection
• Pneumothorax
• Pericarditis
• Pulmonary embolus
• Esophageal rupture
• Ischemia/rupture of an intraabdominal organ

• Pain that is not typically associated with ACS
  – Is sharp, stabbing, especially with coughing
  – Is primarily in the mid to lower abdomen
  – Worsens on movement of the chest or arms
  – Occurs in very brief twinges
  – Radiates to the lower extremities
  – Is easily localized to one small area
  (Patients with these types of pain may still have ACS.)
Goals of Therapy for ACS

- Reduce the amount of myocardial necrosis that occurs with MI.
- Prevent major adverse cardiac events: death, nonfatal MI, and need for urgent revascularization.
- Treat acute, life-threatening complications of ACS
  - VFib, VTach, unstable tachycardias, symptomatic bradycardias.
Time is MUSCLE!

- Within 5-10 seconds of a heart attack, EKG changes will be seen.

- Within 20 minutes of a heart attack cardiac enzymes will be elevated.

- Within 2 hours, permanent damage to the heart will have occurred.
ED Assessment

• Ideally within 10 minutes of ED arrival, providers should obtain a targeted history, obtain a 12 Lead EKG and give to ED attending physician.

• Targeted history includes:
  – risk factors for ACS
  – associated signs and symptoms
  – prior cardiac history
  – factors that may preclude use of a fibrinolytic
ED Treatment of ACS (<10min)

- Start continuous cardiac monitoring
- O2 as needed to keep SaO2 > 94%
- Establish IV access, obtain blood for labs: initial cardiac marker levels, electrolyte and coagulation studies
- Aspirin 324 mg chew (if not given by EMS)
- Nitroglycerin sublingual
- Morphine IV (if pain not relieved by NTG)
- Obtain portable CXR ( <30 minutes)
EKG Basics
Obtain a 12-Lead EKG
The normal ECG tracing
EKG changes: Ischemia

- Normal T Waves
- Inverted T Waves
- Depressed ST Segment
ECG changes: Injury

- ST segment elevation of greater than 1 mm in at least 2 contiguous leads.

- Heightened or peaked T waves
Evolving MI

- **Preadmission**: Normal
- **Admission**: ST Elevation
- **1 Hour**: Q-Wave
- **24 Hours**: Q-Wave, T-wave inversion
EKG presentation

• EKG presentation of ACS encompasses ST-segment elevation myocardial infarction (STEMI), ST-segment depression, new left bundle branch block (LBBB) and nondiagnostic ST-segment and T-wave abnormalities.

• A non-ST-segment-elevation myocardial infarction (NSTEMI) is diagnosed if cardiac markers are positive with nonspecific EKG’s.
Diagnosis of STEMI

- The EKG is the front-line diagnostic tool in a STEMI
  - It is the first thing done and only thing needed if positive
  - It can diagnose a STEMI by measuring the electrical activity of the heart.
  - Different leads in an EKG can show the different areas of the heart affected by a blockage.

<table>
<thead>
<tr>
<th>MI</th>
<th>Artery Affected</th>
<th>EKG Leads</th>
</tr>
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<tbody>
<tr>
<td>Anterior</td>
<td>LAD</td>
<td>V2, V3, V4</td>
</tr>
<tr>
<td>Lateral</td>
<td>Circumflex</td>
<td>I, aVL, V5, V6</td>
</tr>
<tr>
<td>Inferior</td>
<td>RCA</td>
<td>II, III, aVF</td>
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“Is this a STEMI?”

- Using the EKG is vital to a rapid identification of patients with STEMI (ST elevation MI)
  - Cardiologists will stratify into low and high risk groups
- All patients with STEMI and symptom duration of <12 hours are candidates for reperfusion therapy with either fibrinolysis or PCI (percutaneous coronary intervention).
- Provide PCI within 90 minutes of arrival.
  - AUMC uses PCI as its primary intervention
- If PCI is not available the goal is to administer fibrinolytics within 30 minutes of arrival.
AUMC IN-HOUSE STEMI ALERT PROCESS

ECG AT AUMC Reveals STEMI (2)

Physician/NP/PA calls 1-2222 for "IN-HOUSE STEMI ALERT"

Paging Operator Pages Cath Team and Calls RRT Call

Physician Notifies Nursing staff to begin initial STEMI Treatment and prepare for immediate transport (1)

RRT Team Responds to patient and facilitates initial treatment, prepares for transport to cath lab or ICU

Cath Lab available

NO

Pt in an ICU?

NO

YES

Patient Transported immediately to cath lab

YES

Nursing Supervisor and RRT Team Locate and transport to an ICU Bed

NO

Continue initial STEMI Treatment and prepare for immediate transport (1)

Cath Lab available (3)

NO

YES

Additional information

1- Initial stabilizing treatments include O2, IV, ASA, NTG, Plavix. The patient should be prepared for immediate transport to the cath lab. (e.g. percutaneous coronary intervention (PCI), drug-eluting stent (DES), or CABG).

2- Visitors experiencing chest pain symptoms should be escorted to the Emergency Department immediately.

3- If cath lab is unavailable, the patient should be placed on heparin and considered for thrombolytics.

Goal = Door to Balloon of <60 Min
>90 Min is considered a failure
Critical Care Nurses

- Symptomatic patients or those with identified ST elevation MI will have EKG repeated every 10 minutes or as directed by physician.
- Perform Right Sided EKG on any patient with ST elevation or as directed by physician.
- Document and report abnormal EKG findings, elevated CK-MB and Troponin I results.
- Complete chest pain registry for quality improvement.
Right Sided EKG

- Right ventricular MI occurs 40% of the time with inferior MI.
- Significance: usually larger area of infarct involving both ventricles.
- Pt may become hypotensive with Nitroglycerin.
Cardiac Biomarkers

- Obtain Point of Care Troponin I during initial evaluation.
- Elevated troponin I correlates with an increased rate of death, increased thrombus burden and microvascular embolization.
- Therapeutic decisions and reperfusion therapy should not be delayed pending results of these tests.
- Obtain a troponin **3 hrs from baseline** *(or from time of symptom onset if known)*, then **6 hours from baseline or symptom onset**.
- Negative Serial Troponins rule out NSTEMI and STEMI.
AUMC Code STEMI Process

- Pt with identified STEMI: (by triage EKG or EKG done prior to arrival)
- Cath Lab notification: physician will call ECC at #560 with request to alert Cath Lab for Code STEMI
- Patient placed in Critical Pod; IV and labs obtained
- Aspirin 324 mg PO
- If time permits, prep bilateral groins with clippers
- Secure patient belongings with family or clerk
Cath Lab Preparation

- Consent for Cardiac Catheterization (completed by cardiology)
- Consider Heparin
- Consider Plavix
- Consider Integrilin

Pt disrobed and in gown (glasses and dentures are OK. Contact lenses must be removed)
- Voided/catheterized
- If time permits, prep bilateral groins with clippers
- Clerk will make extra pt stickers and copy of chart
- To cath lab on stretcher as soon as possible

Goal is Door to Balloon in < 90 minutes
VAMC STEMI ALERT TRANSFERS

STEMI Identified on ECG at VAMC

VAMC Staff Initiates Initial STEMI Treatment (e.g., O2, IV, NTG, ASA) and prepares for immediate transport (1)

Is the VAMC Cath lab immediately available?

YES

TO VAMC Cath Lab

NO

VAMC Physician notifies the Chief of Staff of STEMI Transfer

VA Physician Calls 706-721-5600 for “VA STEMI ALERT” and provides an ETA to the 2nd floor Crosswalk.

VAMC Unit Clerk faxes Demographics sheet and ECG to ECC at 706-721-5600 and initiates payment voucher (5)

VAMC Unit Clerk notifies the ECC at 706-721-5600 when departing the unit enroute to 2nd floor crosswalk - ECG and available current records with patient

ECC Calls 1-222- “VA STEMI Alert” Puts and Notifies Staff of ETA (2)

AUMC Staff follow STEMI ALERT Procedures

AUMC ED Registration Staff create the ED visit encounter

AUMC ED Team (3) Meet VAMC Staff with patient at the 2nd floor VA crosswalk (at AUMC Threshold) (4)

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Additional Information
1 - Transportation to the cath lab should supercede other interventions except immediate life-saving interventions. Additional interventions may be performed (e.g., heparin) but should not delay transport. Prepare for immediate transport. Send a copy of the ECG with the patient.
2 - ECC will notify the ED Senior resident, charge nurse and ED Critical Care nurse of the ETA of the STEMI Alert
3 - ED Team will consist of ED PGY 2 or 3 Resident, ED Nurse, and EMT. If the patient is intubated the team should include an RT.
4 - VAMC nursing staff, stretcher and equipment will accompany the patient until arrival in the ED or Cath Lab. More complete nurse report/handoff will occur at the bedside when the patient is transferred over. The VA Staff will return to the VA with their equipment.
PI Arrives at AUMC 2nd floor VA Crosswalk

- EMT Notifies Registration of Arrival
- ED nurse verifies status of cath lab
- ED Physician evaluates the patient on arrival in hallway or 2nd floor VA crosswalk

- Pt coding? (2)
  - NO
  - Cath Lab ready?
    - YES
      - Pt Transported to Cath Lab - use OR Elevators (4)
        - Code 63456
        - Cath Lab Code 0011*
        - Admit Order Placed by Cardiology Service
        - YES
        - Registration staff apply the armband
        - NO
        - Place in ED Critical Care Room, prepare for immediate transport, begin initial treatment for STEMI and/or stabilizing interventions (3)
        - Registration staff apply the armband
        - YES
  - NO
    - Registration staff apply the armband

Additional Information
1. Patients Armbands should be printed in the cath lab or ED depending on pt destination. Print patient labels on 8N.
2. Pts that are severely unstable or in a pre-code state may benefit from initial stabilizing treatment (e.g. endoscopy, intubation).
3. Initial STEMI treatments include O2, IV, ASA, NTO. The patient should be prepared for immediate transport and no interventions other than immediate life-saving interventions (e.g. intubation, CPR) should delay the transfer of the patient to the cath lab. Do not delay to start additional medications (e.g. hopenol) or to obtain imaging studies (e.g. OMT).
4. Elevator code is entered using the regular floor buttons.

Goal of Door to Balloon of <30 Min
>60 Mins considered failure

Prepare for immediate transport, continue medical management, consent for cath. Transport immediately when cath lab available
Additional ACC/AHA Class I Recommendations

- For STEMI/new LBBB:
  - Prepare for PCI.
  - Start adjunctive therapy (do not delay reperfusion)
  - Consider β-Adrenergic blockers
  - Consider Clopidogrel (Plavix)
  - Heparin

- For Unstable Angina or NSTEMI:
  - Start adjunctive therapy
  - Nitroglycerin
  - Consider β-Adrenergic blockers
  - Consider Clopidogrel
  - Heparin
  - Glycoprotein IIb/IIIa inhibitor (Integrilin)
Class I recommendations cont.

- For non-diagnostic changes in ST segment or T wave/low risk unstable angina:
  - Consider admission to ED Observation Unit
  - Follow serial cardiac markers
  - Repeat EKGs; continuous cardiac monitoring
  - Consider stress test
Stress Testing

• It is reasonable for patients with possible ACS who have normal serial ECG’s and cardiac Troponin to have a treadmill, stress myocardial perfusion imaging, or stress echocardiography before discharge OR within 72 hours after discharge.
Dysrhythmias

**Ventricular Tachycardia**

- Treated with defibrillation and/or cardioversion/antiarrhythmic medication
- If no pulse, perform CPR in addition to defibrillation

(Refer to current ACLS guidelines and physician orders.)

Graphic used with permission: Smart Draw 7.
Ventricular Fibrillation

- Treated with CPR, defibrillation, vasopressors, and if refractory, antiarrhythmic medications

Refer to current ACLS guidelines and physician orders.
Asystole

- Confirmed in two leads. Adjust size or gain.
- Treated with CPR, epinephrine, vasopressin.
- Treat the cause(s).

Refer to current ACLS guidelines and physician orders.

Graphic used with permission: Smart Draw 7.
Heart Blocks/Bradycardia

- Treated with atropine, if symptomatic
- Treated with cardiac pacing, either transcutaneous or transvenous
- Persistent, advanced AV block treated with permanent pacemaker

Example: 3rd Degree Heart Block

Refer to current ACLS guidelines and physician orders.

Graphic used with permission: Smart Draw 7.
Supraventricular Arrhythmias
Atrial Fibrillation/Flutter

• Sustained atrial fibrillation/flutter with hemodynamic compromise or ongoing ischemia

• Treated with synchronized cardioversion, antiarrhythmics, possibly beta blockers.

Refer to current ACLS guidelines and physician orders.

Graphic used with permission: Smart Draw 7.
Summary

**Unstable Angina**
- Non occlusive thrombus
- Non specific ECG
- Normal cardiac enzymes

**NSTEMI**
- Occluding thrombus sufficient to cause tissue damage & mild myocardial necrosis
- ST depression +/- T wave inversion on ECG
- Elevated cardiac enzymes

**STEMI**
- Complete thrombus occlusion
- ST elevations on ECG or new LBBB
- Elevated cardiac enzymes
- More severe symptoms
Patient Education

- Education starts on admission of patient
- Signs and symptoms of recurrence
- When to call 911 (do not drive)
- Medications
  - Importance
  - Purpose, dose, and side effects
  - Annual flu vaccine
- Diet, including cholesterol management
- Weight loss
- Exercise
- Lifestyle modifications
- Smoking cessation
- Importance of physician follow-up
References

