Getting Pumped About STEMI and Cardiogenic Shock

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By the end of this presentation, participants will be able to:

- Describe the process for a STEMI through the continuum of care.
- Verbalize time sensitive treatments in the care of a STEMI patient.
- Verbalize EMS roles in caring for the STEMI patient.
• Heart Disease remains to be the No. 1 cause of death in the US.

American Heart Association, 2017
Every 40 seconds an American will have a heart attack.

American Heart Association, 2017
• About 790,000 people in the US have heart attacks each year. Of those, about 114,000 people will die.
• Average age at the first heart attack is 65.3 years for males and 71.8 years for females.
Why is the ST Segment so Important?

- The ST Segment represents the section of the complex in which the ventricles are between electrical depolarization and repolarization.
- It is a key indicator as to whether the patient may be experiencing ischemic insult or injury to the myocardium.
• ST elevation at the J point in at least 2 contiguous leads.
• Men ≥2 mm Women ≥1.5 mm in V2-V3
• ≥1 mm in other contiguous chest leads or the limb leads
• ST depression in V1-3 without ST elevation in other leads may indicate a posterior myocardial infarction
What causes a STEMI?

- **ST** segment
- **Elevation**
- **Myocardial**
- **Infarction**

1. STEMIIs are associated with the build up of plaque which ruptures in the coronary arteries.
2. This stimulates platelets to stick together/aggregate and vessels near the rupture to constrict
3. If the unstable area becomes totally blocked by a clot, also called a thrombus, a STEMI is occurring.
Ruptured Plaque

Non-ST Elevated Myocardial Infarction

ST Segment Myocardial Infarction
Symptoms of a Heart Attack

Well-Known

• Pressure, squeezing or fullness in chest
• Pain radiating to the arms.

More Subtle

• Nausea
• Shortness of Breath
• Fatigue
• Jaw pain
• Back pain
• Stomach pain
• Light headedness

American Heart Association 2015
Women’s Symptoms

• Extreme Fatigue
• Lower chest / upper abdominal pain
• Nausea/Vomiting
• Shortness of Breath
• Light headedness
• Dizziness
• Upper back pain
“Time is Muscle”

American Heart Association, 2011
ECG Then and Now

**THE HISTORY OF ECG MACHINE**

**1903**

Willem Einthoven
A Dutch doctor and physiologist. He invented the first practical electrocardiogram and received the Nobel Prize in Medicine in 1924 for it.

**NOW**

Modern ECG machine has evolved into compact electronic systems that often include computerized interpretation of the electrocardiogram.
Leads with Corresponding Wall Involvement
Reciprocal Changes

Leads opposite injured area may show ST depression due to two leads viewing the MI from opposite angles.

Inferior (II, III and aVF) $\rightarrow$ V leads
Lateral (V5-6, I, and aVL) $\rightarrow$ II, III, and aVF
RV $\rightarrow$ none
Anterior wall (V1-4) $\rightarrow$ II, III and aVF
Posterior wall (V7-9) $\rightarrow$ V1-3
What About Right Sided ECG’s?

- Right sided ECG’s are performed to help diagnose Right Ventricular Myocardial Infarction.
- ECG leads are placed in the mirror image on the right side of the chest as compared to the left side of the chest.
- Elevation in the right sided leads you can suspect a right sided infarct.
- V4R is the most sensitive and specific lead
Right Sided ECG’s (cont).

• If you have a patient that has definite ST-segment elevation, it is best to load them into the ambulance and get them to the Cath Lab ASAP.

• Do not delay patient transport to perform a right sided ECG.
Right Sided ECG
Posterior MI’s are associated with inferior wall MI’s and Right Ventricular Infarcts.

With normal lead placement, a posterior ECG will present as ST segment depression in the septal leads V1 and V2.
• If ST segment depression is noted in V1 and V2, suspect Posterior Wall MI.

• Why ST depression and not elevation?

• Do not delay transport to obtain a posterior ECG.
Posterior ECG’s

- V6 connects to V9
- V5 connects to V8
- V4 connects to V7
Complications From STEMI

- Ventricular Septal Defect
- Papillary muscle rupture or dysfunction,
- Cardiac free wall rupture
- Ventricular Aneurysm
- LV outflow tract obstruction
- LV or RV Failure with Cardiogenic Shock
Guidelines for Transfer

- First Medical Contact Time
- ECG Time
- System activation/call for transport
- Transfer out
- Medication Administration
PCI Time Benchmarks

- **Transport to a PCI Capable Facility:**
  Ideal First Medical Contact (FMC)-to-device time of **90 minutes** or less.

- **Transport from a Non–PCI-capable Facility to a PCI Capable Facility:**
  FMC-to-device time system goal of **120 minutes** or less.*18–21 (Level c
What is First Medical Contact?

- First Medical Contact (FMC) is the time when the patient is first evaluated by either EMS or another health care professional prior to arrival at the PCI facility.
- For EMS cases, the FMC time is when the health care provider is at the patient.
- For arrival by private vehicle it is the arrival time to the ED.
- The 90/120 minute clock starts at the time of FMC.
Transfer Considerations

- Receiving ER is placed on STEMI alert
- The cath lab makes a room available
- The ICU staff ensures a bed is ready
- Med Flight is activated if needed
  - Weather impacts response times
EMS Barriers

- Resources – 12 Lead ECG machine equipment and training, lack of transmission capabilities, personnel
- Not always possible to get ALS or air transport to get patient to PCI center
EMS Barriers Continued

- Weather
Safety First!

Infographic courtesy of EMS.gov
EMS Responsibilities

• Obtain 12 Lead ECG within 5 minutes – preferred, 10 minutes benchmark of first medical contact.

• If transmission capabilities exist, transmit ECG to nearest hospital IMMEDIATELY

• If transmission capabilities do not exist, notify receiving hospital that you are bringing in a suspected STEMI.

• Limit scene time to 15 minutes.
EMS Responsibilities (cont.)

• Provide copies of the run report to hospital and upload to database within 24-48 hours.

• Provide hospital providers with a thorough handoff.

• **Always send cardiac arrest rhythm strips and 12 leads with patient to the hospital.**
Tips for Referring Hospitals

• Obtain ECG within **5 minutes** of patient arrival
• **5 Minutes** STEMI ECG to decision, contact PCI Center and transport within 5 minutes of obvious STEMI ECG.
• **Goal: Door in door out = 30 Minutes**
• If ECG does not meet STEMI criteria: perform serial 12 leads every 15 minutes to monitor for evolving STEMI or if patient condition changes.
• Contact cardiology for a consult. This can be done by calling the UW Access Center.
• If transport is delayed due to weather or availability, consider thrombolytic therapy.
• Goal: **Door to needle = 30 Minutes**
Tips for Referring Hospitals (cont.)

• If transport is delayed due to weather or availability, consider thrombolytic therapy.
• Goal: **Door to needle = 30 Minutes**
• Send copies of all documentation from current ED visit and EMS documentation – Including all pre-hospital and in-hospital significant rhythms strips
Tips for Referring Hospitals (cont.)

- Discontinue IV drips
- Explain to patients what is happening and that things will be moving fast.
- Send along family information if the information is readily available.
• Feedback will be provided within 24 to 48 hours.
• Feedback can only be provided if documentation is available to obtain times and details of the case. Expect longer wait times for feedback if documentation is not completed in a timely manner.
• Beneficial to review cases with all staff
Transfer Considerations

- Receiving ER is placed on STEMI alert
- The cath lab makes a room available
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Regional Field Activation Protocol

UWHC Regional EMS Field Activated STEMI Transport Protocol
Access Center

**Med Flight Transport**

- EMS calls Med Flight with field activated STEMI via 911 dispatch.

**Ground Transport**

- EMS calls Access Center (AC) with field activated STEMI.

1. **Med Flight to inform EMS**
   - Med Flight calls Access Center (AC) emergency line @ 800-6102 with the following script:
     - This is Med Flight Dispatch calling to activate the Heart Attack Team and the Interventional Cardiologist for a field activation STEMI by ___EMS service & ___ETA. EMS will call the Direct Heart Line with a report once we lift off with the patient.

2. **Follow ground transport process**
   - Med Flight to coordinate intercept with EMS.
   - Med Flight to call hospital with ETA updates.
   - Med Flight to admit patient when patient arrives.

3. **AC calls patient name, DOB & EMS call back #**
   - AC requests patient name, DOB, EMS name, call back # & ETA.
   - AC asks EMS to please hold, while page out Heart Attack Team and Interventionalist.

4. **AC pages Interventional Cardiologist on call with code “STEMI report & AC call back #”**
   - AC pages Interventional Cardiologist on call with code “STEMI report & AC call back #”.
   - AC notifies EDC or CTL @ 262-2398 of ground STEMI & ETA.

5. **AC enters pre-admit in HL for F4M5**
   - AC enters pre-admit into Health Link for F4M5.

6. **AC connects Interventional Cardiology to connect with EMS for post procedure report**
   - Interventional Cardiology calls AC to connect with EMS for post procedure report.
   - CTL to confirm cath lab status with EMS when EMS contacts ED via radio – 10 minutes out.
   - EDC or CTL to update ETA via heart attack page.
   - Page to include: “update ETA on ___EMS ground STEMI”.

7. **AC enters pre-admit into Health Link for F4M5**
   - AC enters pre-admit into Health Link for F4M5.

8. **Interventional Cardiology calls AC back to connect with EMS for post procedure report**
   - Interventional Cardiology calls AC back to connect with EMS for post procedure report.
   - EDC admits patient upon arrival using the existing pre-admit entered by the AC.
Cardiogenic Shock
Cardiogenic shock is when the heart is unable to pump enough blood to meet the body’s needs.
Cardiogenic shock complicating AMI results in 5-15% which equals approximately 40,000-50,000 people in the US per year.

Leading cause of death in AMI with mortality rates of 40-50%
Causes of Cardiogenic Shock

- Myocardial Infarction
- Myocarditis
- Endocarditis
- Weakened heart from any cause
- Arrhythmias
- Tamponade
- Pulmonary Embolism
• Systolic BP of < 90mmHG
• Elevated left-sided filling pressures
• Impaired organ tissue perfusion as evidenced by:
  – Altered mental status
  – Oliguria
  – Cool, clammy skin
  – Elevated serum lactate levels
Assessment

• Mental Status
  – Is the patient alert and oriented or confused and/or lethargic?

• Vital Signs
  – Is the SBP $< \ or \ >$ 90
  – Heart rate and rhythm
  – Respiratory status
    • Breathing fast and labored or normal
    • Oxygen saturation
Assessment (cont.)

• Physical assessment
  – Cardiac and Pulmonary auscultation
    • New Murmurs or rales
  – Peripheral vascular assessment
    • Cool and clammy to the touch
    • Strength of peripheral pulses
  – Urine output
    • Is it adequate?
Treatments

- Oxygen, Bi-PAP, CPAP, or intubation if necessary
- Inotropes
- Vasopressors
- Mechanical circulatory assist device
What are Mechanical Circulatory Support Devices?

- IABP
- TandemHeart Impella
- Cardiohelp
- LVAD
- RVAD
- TAH
STEMI / Cardiogenic Shock Case Study
• 49 y.o. male with a positive family history of heart disease, obesity, and seizure disorder who began to experience chest pain after dinner which was associated with vomiting and diaphoresis. His mother heard him collapse, so she ran to help. Unfortunately she was unable to move him. She used her Life Alert to summon help. The patient did not receive CPR until the EMS arrived (amount of time without CPR 5-10 minutes). He was found to be in VF and was shocked once and then went into PEA.
EMS Radio Call into UW
EMS ECG at 1952
EMS Treatment

- CCR upon arrival
- Rhythm VF defibrillated, remained in VF
  Compressions resumed
- High flow oxygen via NRB
- IV Left AC due to failed IO
- Fluid bolus
- 1mg Epi
- Glucose checked
EMS Treatment (cont.)

- Defib charged – patient in PEA, charged dumped, compressions resumed
- Organized rhythm with pulse, agonal respirations. Patient moved to stretcher. BVM to assist respirations.
- 12 lead done en route to UW which revealed anterior STEMI
ED Treatment

- 12 Lead upon arrival
- Second IV placed
- Intubation
- Propofol
- Cooling blankets
- Patient sent to CT scan to rule out head bleed.
Cardiac Catheterization

- **Staff involved:**
  - 2 Physicians
  - 2 RNs and 1 Cardiovascular Tech
  - Consent is obtained

- **Patient prep:**
  - ECG, pulse oximetry, BP
  - Table is only 22 inches wide (holds 500 lbs.)

- **Procedure:**
  - Sterile drape placed
  - Access (Radial or Femoral)
  - Interventional guide inserted
  - Wire inserted into culprit vessel
  - Coronary balloon, stent balloon or aspiration catheter inserted
  - Goal Cath door to balloon inflation (DBT) 25 minutes
Coronary Angiogram
Angioplasty and Thrombectomy
Stenting
Cath Lab Interventions

• 100% Proximal Left Anterior Descending
• 3.0mm x 38mm drug-eluting stent placed
• Patient developed acute stent thrombosis while still in the Cath Lab, so two additional drug-eluting stents needed to be placed.
• Cardiohelp (ECMO) placed
• Swan-Ganz and cooling catheter inserted
100% LAD
(Different Patient)
Stented LAD
(Different Patient)
Left Anterior Descending Culprit Lesion Case Study Patient

Pre-Intervention

Post-Intervention

100% Prox LAD
Hospital Course

- **5/15** - Patient’s right foot became ischemic due to large cannulas from ECMO. HE was taken back to the Cath Lab for revision from VA ECMO to veno-venus. IABP placed to off load the LV. Temporary bypass of SFA with arterial to arterial bypass.
- **5/19** – ECMO decannulated
- **5/21** – Extubated and following commands
- **5/31** – Discharged to rehab facility
Pre-Hospital to Cath Lab Time Line

- 911 Call placed: 1930
- At Patient: 1935
- Depart Scene: 1952
- Arrived to UW: 2004
- Arrived in Cath Lab: 2051
- 1st Device Deployed: 2110

FMC to Device = 95 Minutes
High Quality CPR is vital to patient survival
Transmit STEMI ECG’s IMMEDIATELY to receiving center to expedite patient care
Time is critical for STEMI and Cardiogenic Shock patients
Detailed handoffs and providing all documentation from the field are essential to expedite continuity of care.
Teamwork is the key to success!
References


