The actions of healthcare providers during the first several hours of a heart attack determine the magnitude of any benefit from treatment and intervention.

A system that works together efficiently is paramount in reducing mortality and optimizing the benefit from any acute cardiac care strategy.
The Facts

• **About every 25 seconds someone in America will have a coronary event**

• **Every minute someone dies from one**

• **Coronary heart disease caused 1 of every 6 deaths in the US in 2007**

• **Each year an estimated 785,000 Americans will have a new coronary attack, and about 470,000 will have a recurrent attack**
The Facts

- 30% of STEMI patients receive no reperfusion therapy despite availability, and the absence of contraindications.

- < 50% of patients treated with fibrinolytics have a door to needle time within 30 minutes.

- Only 35% of patients treated with PCI have a door-to-balloon time within 90 minutes.
The Facts

• 20% of STEMI patients have contraindications to fibrinolytic therapy, but 70% of those do not receive reperfusion with PCI

• EMS activation of the cardiac cath lab speeds the time to diagnosis and reperfusion therapy, but, 50-75% of patients drive themselves or are transported by family or friends to the hospital
Acute Coronary Syndrome (ACS) will strike 935,000 people a year in the United States, an estimated 250,000 of those will be STEMIs.

In 2011, 2,284 Minnesotans suffered a STEMI, according to the Minnesota Department of Health.

Cardiovascular disease is the #2 leading cause of death in MN.

While the state has a significantly lower mortality rate for Myocardial Infarction, we still have 18/73 counties in the defined Rural MN Mission Lifeline Project that have higher than national average mortality for Acute Myocardial Infarction.
The MN state average for hospitalizations for heart attack is less than the national average, 55/73 counties have less than average rates of hospitalization. Further evaluation as to why there is a lower than normal admission rate could identify opportunities.

The MN state average for patients who die during hospitalization for acute myocardial infarction is lower than the national average. However, 44/73 counties still have higher than the state average of patients who die while hospitalized for acute myocardial infarction.

2009-2010 Acute Myocardial Infarction (ICD10 I21 & I22)
35+ Age-Adjusted Death Rate per 100,000
Minnesota Hospitals

Source: CDC/NCHS Compressed Mortality File
What is MISSION: LIFELINE?
Rural MN M:L Grant

- **6.5 Million Grant 2013 – 2016**
  - The Leona M. and Harry B. Helmsley Charitable Trust - $4.6 million gift
  - Medtronic Foundation/Philanthropy - $300,000 gift
  - Otto Bremer Foundation - $200,000 gift
  - Shakopee Mdewakanton Sioux Community - $100,000 gift

Additional Funders:
- Karla and Tim O’Donnell
- Mayo Clinic Health System Mankato
- Thom Family Foundation
- St. Luke’s Hospital and its Foundation

Additional in-kind gifts from the American Heart Association and many additional partners will total over $1 million
• **Mission: Lifeline will:**
  – Promote ideal STEMI systems of care
  – Help STEMI patients get the life-saving care they need in time
  – Bring together healthcare resources into an efficient, synergistic system
  – Improve overall quality of care

• **The initiative is unique in that it:**
  – Addresses the continuum of care for STEMI patients
  – Preserves a role for the local STEMI-referral hospital
  – Understands the issues specific to rural communities
  – Promotes different solutions/protocols for rural vs. urban/suburban areas
  – Recognizes there is no “one-size-fits-all” solution
  – Knows the issues of implementing national recommendations on a community level
Rural MN Primary PCI Capable Hospitals

- Bemidji
- Duluth (2)
- Mankato
- St. Cloud
Our Goals

• Increase survival and quality of life for patients experiencing Heart Attacks in rural Minnesota by:
  
  – Preventing or minimizing myocardial damage (infarct size)

  – Preventing major adverse cardiac events and complications: serious or fatal arrhythmias, congestive heart failure, rupture of the heart, and death

  – Anticipating and treating life-threatening complications

  – Maximizing efficiency of our care

  – Reducing time between onset of symptoms and PCI/Fibrinolytics
Our Goals

• Overarching goal is to decrease time from symptom onset until coronary artery is open!

• Do not delay transport for 12L ECG (Urban goal: 1st contact to ECG < 10 minutes)
  – Urban vs. Rural
  – Local Protocol Development

• From 1st contact to PCI < 90 minutes

• From rural hospital ED to PCI < 120 minutes

• Lytic administration Goal: Door to needle < 30 minutes

  • Remember!! These are MAXIMUM times
Our Goals

• The role of the EMT:
  – Educating their communities on signs of AMI and stressing early calls for help
  – Recognizing a possible Acute Myocardial Infarction (AMI) patient
  – Alerting the receiving facility EARLY
  – Not delaying scene time
  – Initiating treatment promptly
  – Obtaining and transmitting a 12-lead for physician review
The “traditional” STEMI system

- **Patient**
  - ~30 Minute Onset of CP S/S
  - EMS Transports ~30 Minutes

- **EMS**
  - EMS Transports ~30 Minutes

- **ED**
  - ~60 Minute ED Evaluation to “Confirm” STEMI

- **Cardiology**
  - Cardiology Consult ~30-60 Minute Wait

- **Cath lab**
  - At least 30-45 Minutes to arrive and ready the cath lab

Back In The Day - Time from onset to treatment could exceed 200 Minutes (Non-Transfer Patients)
Today’s STEMI System

EMS identifies STEMI patient, early acquisition on 12 Lead, early notification

Cath Lab team is activated and prepares for patient arrival

Patient arrives to hospital, Direct to Cath Lab when ready
A 45 year old male experiences sudden chest pain while working on his farm in rural MN.

He called 911 approx 2 minutes after the pain started.
Within 11 minutes, First Responders and the BLS ambulance started arriving. The nearest ALS ambulance had been requested at the time of initial dispatch due to the cardiac nature of the call. When responders arrived on scene, they decided to request the helicopter also.
Scenario continued

- ALS on scene
- 12-lead shows pt is having an AMI
- Flight on scene & pt is loaded
- Pt arrives in cath lab with team waiting. Never went to ER.
Scenario continued

3 minutes later they find a 100% blockage to his right coronary artery.

10 minutes later the artery is open and blood flow is restored to that part of the heart.
Scenario continued
Scenario continued
Scenario continued

• Patient could have driven to another hospital without a cath lab:
  
    32 minutes + time to transfer patient to cath lab hospital = HUGE DELAY

• Patient could have driven self to cath lab hospital to be seen 1st in ER:
  
    36 minutes + ER wait time + getting cath team & room ready = DELAY

• Patient called 911, BLS ambulance knew something bad was happening & called for ALS, activated cath lab in field

    = 44 minutes from scene to heart fixed

All because a 12-lead was done pre-hospital!!!!
12 Leads ARE Important

• The 12-Lead is the central component for triage of patients with chest discomfort

• Physicians NEED the 12-Lead to determine whether or not STEMI is present, so they can activate their internal STEMI Alert Team.

• Time is muscle!!! Every minute counts!
Improving the System of Care for STEMI Patients

STEMI Chain of Survival

1. Early Symptom Recognition & Call for Help
2. EMS Evaluation & Treatment
3. Emergency Department Evaluation & Treatment
4. Reperfusion Therapy
BLS Scope of practice in MN

- Acquisition of 12L ECG is an allowed skill for all EMS Providers in MN.

- Procedure for acquisition should be developed under the direction of each agency’s medical director.

- You do NOT need to:
  - Read or interpret the 12-lead
  - Diagnose the patient
EMS Goals

Now:

- Learn how to perform a 12-lead.
- Get comfortable with your monitor.
- Do 12-leads on your cardiac patients.
- Start having conversations with your local hospital, PCI center, and develop protocols with your medical director.

Later (6 months?):

- Have more education on cardiac patients and how our 12-leads help.
- Review calls with your medical director.
- Ask for feedback from your local hospital or PCI center.
ECGs

• Graphic representation of the electrical activity in the heart

• Reflect ONLY electrical activity NOT mechanical activity

• Can only tell us if there is a disturbance in electrical rhythm or conduction

• Can NOT tell us if the patient has a pulse
What is a STEMI?

• **STEMI – ST Elevation Myocardial Infarction**

  - Complete occlusion of a coronary artery that eventually produces elevation of the ST segment in the ECG of most patients.

  - Cardiac muscle death begins and proceeds rapidly through the various layers of the heart supplied by that artery unless flow is reestablished.
Obstructions in the coronary arteries can cause the muscle underneath to die
Plaque build up in the coronary artery blocking blood flow and oxygen to the heart.

Damage and death to heart tissue shown in purple.
Dead or injured muscle does not transmit electricity normally.

**Diagram:**
- Sinoatrial (SA) node
- Internodal pathways
- Intraatrial pathway
- Atrioventricular (AV) junction
- Bundle of His
- Right bundle branch
- Purkinje fibers
- Left bundle branch
ECG: Normal Tracing

• Has both upward and downward deflections and will look different depending on which lead or “view” you are looking at.

• The important thing is we have a stable baseline (isoelectric line)
Dead or injured muscle does not transmit electricity normally
Obtaining a 12-Lead

Clear ECG: What to look for?

• **Little or no artifact**

• **Steady baseline**
ECG: Normal Tracing
STEMI
EKG – Wandering Baseline

Artifact
Signs and Symptoms of Acute Coronary Syndrome

- Chest Pain or Discomfort
- Shortness of Breath
- Back, Arm, Neck, Jaw and/or Stomach Pain
- Anxiety or feeling of impending doom
- Nausea/Vomiting
Who should get a 12-lead ECG?

- Any patient who has signs of AMI, NOT just patients with “Chest Pain”
- Unexplained fatigue
- Sometimes the only signs are syncope, diaphoresis, and or weakness
- Patients who “just don’t feel right”
- Patient complaint of palpitation or irregular heart beat

Consider 12-Lead on ALL of your MEDICAL patients!
Assessment

- **O – Onset** “What were you doing when the pain started?”
  What prompted you to seek treatment today?
- **P – Provokes** “Does anything make it worse or better?”
- **Q – Quality** “What does the pain feel like?”
- **R – Radiation** “Does the pain move anywhere?”
- **S – Severity** “Scale of 1-10?”
- **T – Time** “When did the pain start”
BLS Treatment

- ABCs
- Position of Comfort
- Oxygen
- Vital Signs
- ASA
- Nitroglycerine
- ECG-12 lead

- Call for ALS
  Is air transport indicated?
  What are your regional plans
- History
- Alert the Receiving Facility
- Transport Promptly!!
ALS Drug Therapies May Include:

- Morphine
- Dopamine
- Anti-platelet
- Anti-arrhythmic
- Anti-coagulant
Obtaining a 12-Lead

Does NOT have to increase scene time!
Statewide guideline approved by the EMS Advisory Committee, Hospital Advisory Committee and Task Force

- Defines who should receive a 12-Lead

**Obtain 12 L ECG with Initial Vital Signs**

**Goal**: First Medical contact to ECG \( \leq 10 \) min, Scene time: \( \leq 15 \) minutes *to provide early identification and pre-hospital arrival notification for suspected myocardial infarction or STEMI.*

- Chest pain, pressure, tightness or persistent discomfort above the waist in pts. \( \geq 35 \) yrs. of age
- "Heartburn" or epigastric pain
- Complaints of “heart racing” (HR >150 or irregular and >120) or “heart too slow” (HR < 50 and symptomatic)
- A syncopal episode, severe weakness, or unexplained fatigue
- New onset stroke symptoms (< 24 hours old)
- Difficulty breathing or shortness of breath (with no obvious non-cardiac cause)
- ROSC (return of spontaneous circulation) post cardiac arrest
- Recent Cocaine, stimulant and/or other Illicit drug use (pts. of any age)
- If initial ECG is not diagnostic but suspicion is high for MI and symptoms persist, obtain serial ECG’s at 5-10 minute intervals
• When should we call a “STEMI Alert”
• 3 options, call alert when any of the three are met
• Work with your medical director and local hospitals for feedback
• Some over-triage is expected and appropriate

PH (Pre-Hospital) STEMI ALERT Activation Criteria:

**Goal: Identify STEMI, Alert receiving facility- do not delay transport. Activate STEMI Alert when any one of the following criteria met & signs & symptoms suspect of (AMI) acute myocardial infarction including chest discomfort as described below are demonstrated with a duration of >15 minutes <24 hours

• 12 L ECG trained ALS EMS recognize ST segment elevation of ≥ 1 mm in 2 contiguous leads
• Confirmed Interpretation of STEMI transmitted and reviewed by a Practitioner (Physician, NP, PA)
• ECG Monitor interpretative statement infers: “Acute Myocardial Infarction” with signs & symptoms suspect of acute myocardial infarction including chest discomfort and symptoms listed above
MN Mission: Lifeline EMS STEMI Guideline #3

Determine Transport Destination

- **Transport time ≤ 60 minutes** and total time from first medical contact (EMS at patient’s side) to PCI (Percutaneous Coronary Intervention) **FMC to PCI ≤ 120 minutes**. Notify medical control and consider transport directly to **PCI Capable Receiving Hospital for Primary PCI**.
- **Activate STEMI Alert**, transmit 12 L ECG as able, provide report to receiving hospital

- **Transport time ≥ 60 minutes** and estimated time from first medical contact (EMS at patient’s side) **FMC to PCI ≥120 minutes**. Notify medical control and consider transport to the **closest appropriate non-PCI capable referring hospital** for possible fibrinolytic therapy and urgent transfer to a PCI Capable Receiving Facility for reperfusion.
- **Initiate fibrinolytic checklist** per protocol
- **Activate STEMI Alert**, transmit 12 L ECG as able, provide report to receiving hospital
- **Consider Air Transport.**

**Diversion Criteria:** If patient demonstrates instability and/or has any one of the following Diversion Criteria requiring ED evaluation by a practitioner proceed to **closest appropriate hospital:**

- Possible need of head CT or neurological intervention / Confusion
- Emergent intubation Immediate circulatory stabilization
- Chest trauma or MVC victims
- Consider DNR Status
- Consider Left Bundle Branch Block

Revised 4-2014

• **EMS services should be empowered to make these choices**
MN Mission: Lifeline EMS STEMI Guideline #4

- Top section – recommended ALS & BLS Treatment
- Bottom section – recommend ALS only guidelines

**BLS & ALS**

- Administer **O2 starting at 2 L/Min per nasal cannula**, titrate as needed to maintain SpO2 > 92%
- Obtain Systolic/Diastolic **blood pressure** (BP) in both arms
- Administer **Chewable Aspirin 324 mg** by mouth or rectally
- Administer **Nitroglycerin Sublingual 0.4 mg** every 5 minutes up to 3 doses if chest discomfort present and SBP > 100. Check BP prior to each administering dose. Hold if SBP < 100 mm HG.
- Evaluate if Erectile Dysfunction or Pulmonary hypertension medications taken in the past 24 hours including: Sildenafil (Viagra, Revatio), Vardenafil (Levitra, Staxyn), or Avanafil (Stendra), Tadalafil (Cialis, Adcirca). Hold nitrates for 48 hours following the last dose
- BLS only: Request ALS Intercept per local protocol
- Establish large bore IV (L) upper extremity preferred) **access per protocol – Normal Saline 500ml KVO**
  Establish a 2nd IV line as time allows.

**ALS**

- **Clopidogrel (Plavix) 600 mg** by mouth if transferring for PPCI after confirmation by PCI Receiving Facility and local medical control per protocol
- **Heparin IV Bolus 70 Units/kg IV, max 5,000 Units** if transferring for PPCI after confirmation by PCI Receiving Facility and local medical control per protocol
- Establish a **Nitroglycerine IV Drip** if chest discomfort is unrelieved. Initiate @ 5 mcg/min & titrate in increments of 5mcg/min to maintain a systolic BP of 100 mm/Hg or greater. Hold nitrates as indicated.
- Administer **Analgesia** as needed for discomfort per protocol
• Documentation is key to determining treatment for STEMI patients. Hospitals need this information ASAP.
• STEMI patients are very time-critical. Goals should be kept in mind at all times to reduce total time from onset to definitive treatment.

**Documentation Reminders:**
- Provide Copy of EMS Run Sheet with Report to RN or MD
- If STEMI/AMI alert is requested of the receiving hospital, document the time.
- Provide a Printed Copy of Pre-Hospital 12 L ECG with Report to RN or MD

**Patient Care Goals:**
- Provide early identification of patients and early notification of the hospital for suspected AMI or STEMI.
- Utilize an assessment tool that may reduce the time from onset of symptoms to receiving definitive cardiac interventions at the receiving hospital.
- Prepare patient for immediate transport with indicated medications administered en route to hospital. Attempt to limit the scene time to the shortest time possible.
**MN Mission: Lifeline EMS STEMI Guideline #6**

- **MN Mission: Lifeline goals will result in better outcomes for STEMI Patients**
- **Our statewide data collection tool will look at the reporting measures to determine where more effort and education is needed**

**AHA Mission: Lifeline EMS Best Practice Goals**

1. All patients with non-traumatic chest discomfort, $\geq$ 35 yrs. of age, treated and transported by EMS receive a pre-hospital 12-lead electrocardiogram
2. All STEMI patients transported directly to a STEMI receiving center, receive a first (pre-hospital) medical contact to PCI time $\leq$ 90 minutes directly or $\leq$ 120 minutes for Interfacility hospital transfers
3. All lytic eligible STEMI patients treated and transported to a referring hospital for fibrinolytic therapy receive a door to needle time $\leq$ 30 minutes

**AHA Mission: Lifeline EMS Reporting Measures:**

1. Time from symptom onset to EMS dispatch
2. Time from dispatch to EMS vehicle arrival at receiving or referring hospital door
3. Number of suspected AMI/STEMI patients treated and transported by EMS who receive a 12-lead ECG
4. Number of STEMI patients treated and transported to a referring hospital for potential reperfusion by fibrinolysis therapy who receive a Fibrinolytic Checklist Screening enroute to identify possible contraindications.
5. Number of STEMI patients who received a pre-hospital ECG, recognized STEMI, and called for a STEMI Alert at the receiving or referring hospital prior to arrival.
Obtaining a 12-Lead

• Explain what you are doing

• Do NOT slow down your treatment

• Work as a team

• Protect patient’s modesty as much as you can
Obtaining a 12-Lead

Expose the Chest

- Remove clothing and recover with a gown or sheet
- This allows for a more complete exam
- Prevents tangling of your cables
- Enhances the opportunity for quick defibrillation
Obtaining a 12-Lead

• Prep the skin to facilitate better electrode contact and increase signal strength
  
  – Remove excess hair if necessary
  
  – Rub skin with towel or gauze to remove sweat, oil, and dirt, and to scratch the dermis

Improving the System of Care for STEMI Patients
Obtaining a 12-Lead

Connect electrode patches to cables

- Attach electrodes to cables before applying to your patient
Obtaining a 12-Lead

**Lead Placement**

**Limb Leads**
- **RA** – White
- **RL** – Green
- **LA** – Black
- **LL** – Red

“white on right, smoke above fire, clouds above grass”

**Precordial (chest wall) Leads (V leads)**
- **V1** 4th intercostal space, right of the sternum
- **V2** 4th intercostal space, left of the sternum
- **V3** between V4 and V2
- **V4** 5th intercostal space, left, mid-clavicular line
- **V5** 5th intercostal space, left, anterior axillary line
- **V6** 5th intercostal space, left, mid-axillary line

Use the nipple line as a visual reference for V-leads
V4 should be under the left nipple.
Obtaining a 12-Lead

• Lead Placement
Obtaining a 12-Lead – Lifepak

Turn the monitor ON
Assure all cables are attached
Obtaining a 12-Lead – Lifepak

Press 12 Lead Button
Obtaining a 12-Lead – Lifepak

- Dial in patients age and gender

Remind Patient to Hold Still!!
Obtaining a 12-Lead – Lifepak

- Wait....

Takes about 10 seconds
Obtaining a 12-Lead – Lifepak

When acquired - It will print automatically
Obtaining a 12-Lead – Phillips

Turn the monitor ON
Obtaining a 12-Lead – Phillips

After attaching all cables to patient, press 12-lead
Improving the System of Care for STEMI Patients

Press Start Acquire Button

Obtaining a 12-Lead – Phillips
Enter patient’s age and gender
This monitor also asks the reason for the 12-lead.

Now remind the patient to hold still...
Wait...

It takes a few seconds to acquire.

When done it will print out also.
Obtaining a 12-Lead – Zoll

Turn the monitor ON
Obtaining a 12-Lead – Zoll

After attaching all cables to patient, press 12-lead
Obtaining a 12-Lead – Zoll

Press “PT Info” and enter patient age & gender
Obtaining a 12-Lead – Zoll

Tell patient to hold still and then press “Acquire”
Obtaining a 12-Lead – Zoll

Wait as it acquires the ECG.

When done it will print out.
Obtaining a 12-Lead

- Leave 12L hooked up to patient on the way to the hospital for all monitors

- Re-take and re-transmit if patient condition worsens or symptoms change

- Re-transmit if monitor prints out a second 12L (Physio-control LP 15 only)
Transmitting

- Transmit as soon as possible
  - May utilize Bluetooth technology or modem. Both rely on cellular technology
  - Transmission should take place while moving towards destination.
  - Think of the technology as sending an ECG text message.

- Communicate with ER that a transmission is incoming

- Coordinate with ER to streamline care and prevent duplicating our efforts
Obtaining a 12-Lead

• A NORMAL EKG DOES NOT RULE OUT AMI!

• ALWAYS TREAT THE PATIENT NOT THE MONITOR!!!
EKG – Steady Baseline
Artifact
Causes of Artifact

- Patient Movement
- Cable Movement
- Vehicle Movement
- EMI (Electro-magnetic interference)
Obtaining a 12-Lead: Artifact

**Tips to avoid artifact or unclear 12 lead tracing**

- Make the patient as comfortable as possible
  - Supine is preferred
  - Have patient breathe normally (no holding breath)

- Check for subtle movement
  - Toe tapping
  - Shivering

- Look for muscle tension
  - Hand grasping rail
  - Head raised to “watch”
Obtaining a 12-Lead: Artifact

Cable Movement

- Some “slack” between monitor and patient is needed

- Not too much slack

- Sometimes securing/draping cables onto cot helps

- Ensure connection to patches are tight
Obtaining a 12-Lead: Artifact

Vehicle Movement

- Acquisition in a moving vehicle
  - Successful in some locations
  - Failure in others
  - Site specific

- Consider briefly pulling over to obtain 12 lead ECG for 10-15 seconds
Electromagnetic Interference

- Can interfere with electronic equipment
  - Airlines prohibit use of electronic equipment during takeoff and landing because of this

- Maintain awareness of possible EMI sources
  - Cell phones
  - Radios
  - Most electrical devices
Obtaining a 12-Lead

Strategies for Success

• Make sure patient cables do not touch power cords

• Move away from AC equipment

• Turn off or remove devices

• Move away from areas with electrical “noise”
Summary

• Our goal is to increase the survivability of AMI patients in Minnesota

• Remember to call for ALS and alert the receiving facility EARLY

• The patient and treatment is FIRST

• ECG is secondary to treatment, BUT, if you can accomplish both simultaneously GREAT!
Summary

• The 12-lead is a useful tool for Physicians to identify STEMI and activate STEMI Teams

• However, a NORMAL 12-Lead does NOT rule out AMI!!!

• Treat your PATIENT, Not the MONITOR

Improving the System of Care for STEMI Patients
Thanks For Listening
Now Let’s Practice!
Additional ALS Slides – Use as appropriate based on audience
Conductive System of the Heart

- Sinoatrial (SA) Node
- Internodal Pathways
- Atrioventricular (AV) Node
- Bundle of His
- Right Bundle Branch
- Left Bundle Branches
  - L Anterior BB
  - L Posterior BB
- Purkinje Fibers
Coronary Artery Supply to the Myocardium

• Right CA:
  – 55% SA Node, Internodal Pathways, R Atrium, 90% AV Node, Inferior Wall, Posterior Wall, 1/3 Posterior Septum, ½ Posterior Fasicle LBB

• L Anterior Descending CA:
  – L Anterior Wall, Bundle of His, Bundle Branch, Ant. Fasicle LBB, 2/3 Septum

• L Circumflex CA:
  – L Atrium, Lateral Wall, Posterior Wall, 45% SA Node, 1/2 Posterior Fasicle LBB
Look at the electrical flow through the atria, into the septum and how it spreads itself through the ventricles.

This also correlates with what we see on a typical ECG tracing.
Coronary Artery Disease

**Stent** placement - before and after placement, in the first picture you can see the spasm, and restricted blood flow
Coronary Artery Disease

Again here you can see the initial narrowing, then complete obstruction, and return of circulation by **PIC balloon** placement. You can also see collateral circulation formation.
3-Lead ECG

- Monitor Quality

- Diagnostic Quality
Electrical Tracing Views
12-Lead ECG
12-Lead ECG

NORMAL SINUS RHYTHM
NORMAL ECG
12-lead ECG

- Ventrate: 66 BPM
- PR interval: 172 ms
- QRS duration: 96 ms
- QT/QTc: 416/429 ms
- P-R-T axes: 70 61 53
12-Lead ECG

80 milliseconds = 0.08 seconds

Normal Duration Times in the ECG

- Each tiny box = 0.04 seconds
- PR Interval = 0.12 – 0.20
- QRS = 0.06 – 0.11

QRS 0.12 and greater is extended
12-Lead ECG

[ECG Image]

Improving the System of Care for STEMI Patients
Figure 12-9: Negative, isoelectric, and positive ECG waves resulting from vectors.
ECG Tracing Method

- **Time**: 0.2 sec
- **Voltage**: 0.1 mV
- **1 mV**: 0.04 sec

- **PR**: QRS
- **QRS Complex**: T Wave
- **ST Segment**: U Wave
- **RR Interval**: QT
Q waves

- Physiologic Q waves – “Normal”
  - < .04 sec (40ms)
- Pathologic Q
  - “Abnormal”
  - ≥ .04 sec (40 ms)
  - 1/3 the size of the R wave
• Q wave
Myocardial Infarction Labels

- Non-ST-Elevation MI (NSTEMI) = Non-Q-Wave MI (NQMI)
- ST Elevation MI (STEMI) = Q-Wave MI (QMI)
- UA = unstable angina
Evolution of AMI

- **Hyperacute**
  - (Ischemia)

  ![Heartbeat Diagram](image)

**Three I’s of an AMI**

- Ischemia – inverted T wave
- Infarct – ST elevation
- Injury – pathologic Q wave
Evolution of AMI

- Acute (Infarct)
• Age undetermined
  (Injury – Tissue Necrosis)
J-Point

Improving the System of Care for STEMI Patients
ST Segment
ST Segment

- Compare to TP segment
Find Baseline, J-points and ST segments

ST Segment Analysis

NO  YES  YES  NO  YES  NO
**AMI recognition**

Two things to know:
- What to look for
- Where you are looking

**Accurate ECG**

Look for:
- Negative aVR
- One complete cardiac cycle in each lead
- Appropriate speed

**AMI Recognition**

What to look for:
- ST segment elevation
  - One millimeter or more (one small box)
  - Present in two anatomically similar viewing leads
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<th>I</th>
<th>aVR</th>
<th>V1</th>
<th>V4</th>
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<td>II</td>
<td>aVL</td>
<td>V2</td>
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<td>III</td>
<td>aVF</td>
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<th>Limb Leads</th>
<th>Chest Leads</th>
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<td>III</td>
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A System for Assessing a 12 Lead

- **I** Inferior Leads II, III, AVF
- **SEE** Septal Leads V1, V2
- **ALL** Anterior Leads V3, V4
- **LEADS** Lateral Leads V5, V6, I, AVL
Inferior Wall

- II, III, aVF
  - Left Leg

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<td>III</td>
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Lateral Wall

- I and aVL
  - Left Arm

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<td>III</td>
<td>aVF</td>
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Lateral Wall

- V5 and V6
  - Left lateral chest

<table>
<thead>
<tr>
<th>I</th>
<th>aVR</th>
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Lateral

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<td>III</td>
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Lateral Wall MI
Anterior Wall

- V3, V4
  - Left anterior chest

| I  | aVR | V1 | V4 |
| II | aVL | V2 | V5 |
| III | aVF | V3 | V6 |
Anterior Wall MI
Name:  
ID#: 082098141840  
PR Int: 124  
QRS Dur: 72  
QTc: 375/403  

HR: 74  
P-ORS-T axes: 28 51 36  

Age: 08/20/98  
Sex: 14:26:45  

Lead #1  

I  
aVR  
V1  
V4  

II  
aVL  
V2  
V5  

III  
aVF  
V3  
V6  

25mm/s  

x1.0  

Comments:
Septal Wall

- V1, V2
- Along sternal borders

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Improving the System of Care for STEMI Patients
AMI Localization

- **Anterior:** V3, V4
- **Septal:** V1, V2
- **Inferior:** II, III, AVF
- **Lateral:** I, AVL, V5, V6
AMI Recognition

• Know what to look for
  – ST elevation
  – $\geq$ 1mm
  – Two contiguous leads

• Know where you are looking
  – Use pocket card as a reference
  – You will soon have this memorized

A normal 12-lead ECG *DOES NOT* rule out AMI
Improving the System of Care for STEMI Patients
Improving the System of Care for STEMI Patients
HR: 69
PR Int: 164
P-QRS-T Axes: 74 48 17
QRS Dur: 92
QT/QTc: 368/388

5:39:35 PM  11/1/98
12-Lead #1
Reciprocal Changes
Reciprocal Changes

II, III, aVF  \[ \text{I, aVL, V leads} \]

Reciprocal changes

- Not necessary to presume infarction
- Strong confirming evidence when present
Improving the System of Care for STEMI Patients
NEVER make the mistake of presuming that a single 12-lead rules out an MI.

If time allows, repeat the 12-lead in ANY symptomatic patient.
AMI Recognition
AMI Recognition

- Imitators of infarct
  - LVH
  - Ventricular beats
  - BBB
  - Others
SINUS TACHYCARDIA WITH SINUS ARRHYTHMIA
NONSPECIFIC INTRAVENTRICULAR BLOCK
LATERAL INFARCT, AGE UNDETERMINED
INFERIOR INFARCT, AGE UNDETERMINED
ABNORMAL ECG
ATRIAL FIBRILLATION WITH RAPID VENTRICULAR RESPONSE WITH
5 ABERRANT CONDUCTION OR VENTRICULAR PREMATURE COMPLEXES
ABNORMAL LEFT AXIS DEVIATION
LEFT BUNDLE BRANCH BLOCK
1 ABNORMAL ECG

** UNCONFIRMED **
Atrial Tachycardia with short PR interval
Cannot rule out atrial flutter
Nonspecific intraventricular conduction block (130+ ms QRS duration)
Anterior infarct (40+ ms Q wave and/or ST/T abnormality in V3/V4), age undetermined
Inferior infarct (40+ ms Q wave and/or ST/T abnormality in II/AVF), age undetermined
Abnormal ECG

** Unconfirmed **
Summary

• AMI recognition
  – Know what you are looking for
    • 1mm of ST elevation
    • Two contiguous leads
  – Know where you are looking
    • Positive electrode as an “eye”
    • Pocket card
Summary

• Reciprocal changes
  – Not necessary to presume infarction
  – Strong confirming evidence when present

• ST segment elevation is presumptive evidence for AMI

• Other conditions may also cause ST elevation

A normal 12-Lead ECG **DOES NOT** rule out AMI
Scenario Slides
SCENARIO #1

- At 1000 hours you are dispatched for a 55 year old male complaining of back pain and shoulder pain. Pt states he will be in the garage of the residence. Upon arriving on scene there are no notable hazards and the scene appears to be safe. You enter the garage where the pt is found sitting on a stool next to a bench with tools. Pt is holding his left shoulder with his right arm. Pt states that he was working on his race car and his left shoulder and back started to hurt all of a sudden.

- You are 10 minutes from a community hospital and 30 minutes away from a PCI center.
SCENARIO #1

- What information do we want to know about this patient?
Patient is conscious. His Airway is open and he is able to talk. Pt had a sudden onset of left shoulder and back pain. Pain is a sharp pain starting in the middle of his back radiating to his left shoulder. Pt was working on his race car at time of onset. Pt states he tried to keep working, but he was experiencing too much pain while turning a wrench with his left arm. Nothing has made the pain any better. Pt rates his pain on a scale of 1-10 at a 9. Pt denies any chest pain, shortness of breath, trauma to his back or shoulder, dizziness, headache, or nausea. Pt is alert and oriented to person, place, time, and event. Pt skin color is pink, warm, and diaphoretic. Pt appears to be restless and anxious and repeatedly asks why his shoulder and back all of a sudden started hurting when he did not cause any trauma to them. Pt last oral intake was at lunch today and consisted of a hamburger, fries, and pop.
• HISTORY
  – Pt has a history of Coronary Artery Disease, hypertension, and a heart attack 7 years ago.

• MEDICATIONS
  – 81 mg ASA daily in the morning, metoprolol, nitrostat pills as needed.

• ALLERGIES
  – None
SCENARIO #1

• What is our treatment plan for this patient?

• Where should we transport this patient?
SCENARIO #1

• VITALS
  – BP 108/60
  – Pulse 90
  – Respirations 18 and unlabored
  – SpO2 98% room air.

• Lung Sounds
  – Clear and equal bilaterally

• Periphery
  – No edema noted, good skin turgor, pink color, normal perfusion
SCENARIO #1

07-MAR-1968 (28 yr)
Male Caucasian

18-MAY-1996 13:38
© 1997 Frank G. Yanowitz, M.D.
SCENARIO #1

• **BLS TREATMENT**
  
  – Call for ALS intercept if not already done, Oxygen starting at 2L/min nasal cannula to keep SpO2 > 92%, ASA (note: pt takes 81mg daily), nitroglycerine, apply cardiac monitor and establish 12-lead on medical pt. due to trauma being ruled out. Transmit 12-lead to designated hospital. Keep the pt calm and continue ongoing assessment. Contact receiving hospital and advise them of pt condition and confirmation of 12-lead transmittal.
SCENARIO #1 ALS TREATMENT

- Same as BLS treatment and also establish IV access with fluids running to maintain blood pressure, interpret 12-lead, ASA (note pt takes 81 mg daily), nitro/drip per protocol, consider pain management per protocol (morphine for example.) Monitor vitals and keep blood pressure above 100 systolic per per protocol.

- Consider:

  Heparin 70 units/kg maximum of 5000 units IV &
  Plavix 600 mg PO
SCENARIO #1

• ONGOING ASSESSMENT:
  – Pain: 4 out of 10 after 3 SL nitroglycerine and 4 baby aspirin.
  – Vitals: BP 94/50, Pulse 100, Respirations 20 and unlabored, SpO2 99%
  – Patient complains of a headache following nitroglycerine administration
  – No other changes noted
SCENARIO #1

• OUTCOME

  – Pt 12-lead shows a normal sinus rhythm with ST elevation noted in anterior and lateral leads. Pt is having a STEMI.

  – Upon arrival to PCI facility pt is taken directly to cath lab for cardiac catheterization and receives a stent to the LAD.
Left Anterior Descending (LAD)
SCENARIO #2

- You are dispatched to a female pt that is experiencing an upset stomach, nausea, and vomiting. You respond emergent to the scene. Upon arrival you are greeted at the door by a 46 year old female that is holding her abdomen. Upon entering the house, you note it is very un-kept, but appears the scene is safe. Pt states that she has not felt good for a few days and has been nauseated. Pt states that this morning she started to have an upset stomach and just recently started to vomit.

- You are 25 miles from the nearest hospital, it is a PCI center.
SCENARIO #2 ASSESSMENT

- Reveals pt that is alert and oriented to person, place, time, and event. Pt skin color is pale, cool, and diaphoretic. Pt symptoms started two days ago. Pt states she is holding her abdomen because she feels nauseated, but denies any abdominal pain. Pt denies any chest pain or shortness of breath. Pt states that nothing has made the nausea better and it has progressively gotten worse and reports an upset stomach and vomiting that started this morning. Lung sounds are clear and equal bilaterally with equal rise and fall of the chest noted. Pt PERRL. Pt denies any headache, visual changes, or dizziness. Pt last oral intake was last night and it consisted of two pieces of toast and powerade.
SCENARIO #2

• HISTORY
  – Hypertension

• MEDICATIONS
  – Daily vitamin, Lopressor

• ALLERGIES
  – Contrast dye
SCENARIO #2

• What is our treatment plan for this patient?
SCENARIO #2

• **VITALS**
  - BP 136/74
  - Pulse 102
  - Respirations 22
  - SpO2 92% room air

• **PERIPHERY**
  - No edema noted, good perfusion
SCENARIO #2

- HR 100 bpm
- PR 0.148s
- QRS 0.092s
- QT/QTc 0.342s/0.441s
- P-QRS-T Axes: 65° 66° 100°

- 12-Lead ECG
- 81 May 87

- *** ACUTE MI SUSPECTED ***
- Abnormal ECG **Unconfirmed**
- Normal sinus rhythm
- ST elevation consider inferior injury or acute infarct

- IV1, IV2, IV3, IV4, IV5, IV6, LaV1, LaV2, LaV3, LaV4, LaVF, LaVR
SCENARIO #2 BLS TREATMENT

- Oxygen via nasal cannula starting at 2 LPM which improves SpO2 to 99%. Cardiac monitor is applied showing a rate of 102. 12-lead EKG preformed, print out read **ACUTE MI SUSPECTED**. 12-lead transmitted to your designated hospital but failed.

- Call ALS intercept and advise hospital ASAP of pt condition and monitor’s identification of suspected Acute MI.

- Give 324 mg of ASA and give SL NTG per protocol.
SCENARIO #2 ALS TREATMENT

- Same as BLS, but also establish IV access with fluids running, establish 2nd IV if time permits. Interpret 12-lead, nitro/drip per protocol (watch for hypotension, use caution in confirmed inferior MI), reassess vitals maintaining systolic blood pressure of 100 systolic per protocol. Consider antiemetic for nausea.

- Consider:
  - R) sided 12 Lead
  - Heparin 70 units/kg maximum of 5000 units IV &
  - Plavix 600 mg PO
SCENARIO #2

• ONGOING ASSESSMENT
  – BP 124/68 Pulse 100, Respirations 20, SpO2 99%
  – Nausea and vomiting have subsided after administration of antiemetic
  – No other changes
SCENARIO #3

- What would your opportunities be for additional resources?
SCENARIO #2

• OUTCOME

– Pt is presenting with nausea, vomiting, and upset stomach. With treatment that has been rendered, and outcome of that treatment and assessment, has found that the pt has a STEMI (Inferior MI). Pt is taken directly to cath lab for cardiac catheterization. Vessel was open 50 minutes after 911 call was initiated.
Inferior - RCA
RCA Post - PCI
You are dispatched for a 58 year old male patient complaining of chest pain for the past hour. You respond emergent to the call. Upon arrival you are greeted at the door by the pt wife and a small barking dog. The wife put the dog in the kennel and the scene appears to be safe. The wife leads you to the back bedroom of the home where the pt is located. On the way the wife informs you that the pt looks like he does the last time he had a heart attack which was 3 years ago. Wife also informs you that the pt has hypertension, CHF, and smokes. Pt is found sitting up on the edge of the bed conscious and breathing. Pt is noted to be obese in size and has pale diaphoretic skin. Pt is clutching his chest and states that it hurts.

You are 60 minutes from the nearest hospital which is a PCI center. The PCI center has helicopter service. ALS ambulance is also 60 minutes away.
SCENARIO #3

• ASSESSMENT

  - Pt is alert and oriented to person, place, time and event. Skin is pale, cool, and diaphoretic. Pt tells you his chest pain woke him from his sleep about an hour ago and it has not gone away. Pt felt fine last night before bed. Pt describes his pain as a dull pressure that radiates to his right arm. Lung sounds are clear and equal bilaterally. No fever noted. You note respirations are labored. Pt states he has not eaten since last night and has not had anything this morning. Pt is rating his chest pain at 10 out of 10 and is still clutching his chest.
SCENARIO #3

• HISTORY
  – Hypertension, CHF, Heart attack (2 stents placed 3 years ago), smoker

• MEDICATIONS
  – Aspirin, Norvasc, Lasix, and Zocor

• ALLERGIES
  – None
SCENARIO #3

• What is the treatment plan for this patient?
SCENARIO #3

• VITALS
  – BP: 122/64
  – Pulse 98
  – Respirations 28 labored
  – SpO2 97% room air

• PERIPHERY
  – Edema noted to feet and ankles (pt says it is normal for him)
SCENARIO #3

• BLS TREATMENT
  – Call for ALS.
  – Apply oxygen as needed starting nasal cannula at 2 / LPM progressing to 10-15 LPM as needed to maintain SpO2 > 92%. 324mg ASA, nitro per protocol while maintaining a blood pressure above 100 systolic per protocol. Apply cardiac monitor and obtain 12-lead EKG. Transmit EKG to PCI capable hospital. Notify receiving hospital of pt condition and confirmation of 12-lead transmittal.
• Following first SL NTG administration:
  – BP 80/40
  – Pulse 90
  – Respirations 26 labored
  – SpO2 98% with oxygen
SCENARIO #3

- CONTINUED BLS TREATMENT
  - Stop any further SL NTG administration
  - Repeat 12-lead due to change in patient condition and transmit to ER
  - Monitor vital signs closely
  - Update ALS with changes in patient condition
  - Lay patient flat or trendelenberg
SCENARIO #3 ALS TREATMENT

- Establish IV access and run normal saline. Fluid bolus to improve hypotension. Consider second IV. Interpret 12-lead. Consider right sided 12-lead. Pt showing a normal sinus rhythm. Reassess lung sounds with every fluid bolus especially with pt history of CHF. Consider morphine for pain control and anxiety. If pt blood pressure improves and stabilizes, consider nitro infusion per protocol. If blood pressure does not improve consider adrenergic agent.

Consider:

- Heparin 70 units/kg maximum of 5000 units IV &
- Plavix 600 mg PO
- Activating critical care air transport – Do not delay transport!
SCENARIO #3

• **ONGOING ASSESSMENT**
  
  – BP 104/50 after fluid bolus
  – Pulse 96
  – Respirations 24
  – SpO2 99% with oxygen
  – Pain has decreased with analgesic to a 4 out of 10
  – Skin color is pale, cool, and clammy
  – Patient tells you “I think I am going to die”
Pt 12-lead notes a normal sinus rhythm with ST elevation in leads II, III, and aVF being suggestive of an AMI (Inferior MI). Pt is taken directly to cath lab for cardiac catheterization.
You are dispatched to the home of a 40 year old female who has been experiencing chest pain for the past day. You respond emergent to the location and arrive in a middle class neighborhood. The scene appears to be safe with no potential hazards noted. You ring the doorbell and a voice shouts out for you to come in. Pt is found sitting in the living room in her recliner conscious and breathing. Pt states that for about a day now she has been having a dull pain in her chest and nothing seems to make it go away.
SCENARIO #4

• ASSESSMENT
  – Pt is alert and oriented to person, place, time, and event. Skin is pink, warm, and dry. Pt is complaining of a dull substernal chest pain that has lasted for about a day. Pt has tried to take an antacid with no relief. Pt states that when she gets up to clean or exerts herself the pain gets worse. Pt states that at rest the pain is better, but it does not go away completely. Pt rates her worst pain at 7 out of 10 upon exertion and 5 out of 10 upon resting. Pt states that the pain stays in her chest and is non radiating. Pt states that she just finished eating oatmeal for breakfast along with 2 cups of coffee. Pt denies any nausea, vomiting, dizziness, or headache.
SCENARIO #4

• HISTORY
  – Pt denies any medical history

• MEDICATIONS
  – Pt only takes a daily vitamin and has taken it today

• ALLERGIES
  – Strawberries
SCENARIO #4

• What is the treatment plan for this patient?
SCENARIO #4

• VITALS
  – BP 160/94
  – Pulse 76 regular
  – Respirations 22 unlabored
  – SpO2 97% room air
SCENARIO #4

• BLS TREATMENT
  – Call for ALS intercept.
  – Apply oxygen starting at 2L/min per nasal cannula to maintain SpO2 > 92%, administer ASA, SL NTG per protocol while maintaining blood pressure above 100 systolic., apply cardiac monitor and obtain 12-lead EKG, transmit 12-lead EKG to appropriate hospital. Contact receiving hospital and update with patients condition and confirmation of 12-lead transmittal.
SCENARIO #4

• ALS TREATMENT
  – Same as BLS treatment and also establish IV access and consider running fluids at appropriate rate to maintain systolic blood pressure. Consider nitroglycerine drip and analgesic for pain. Interpret 12-lead and confirm transmittal to appropriate hospital.
SCENARIO #4 ONGOING ASSESSMENT

- BP 154/88, pulse 80, respirations 20 unlabored, SpO2 99% with oxygen
- Pts pain is a 2 out of 10 after receiving the ASA and nitroglycerin
- Transport is uneventful, no further changes in patient condition.
- Keep 12 L cables attached and reassess ECG for additional changes every 10 minutes as symptoms persist
SCENARIO #4

- OUTCOME

  12-lead shows a normal sinus rhythm with no ST elevation or depression noted on initial 12-lead or serial 12-leads thereafter. Pt is brought to ER and has elevated troponin levels and is admitted to the ICU for further evaluation to rule out Non-ST segment Myocardial Infarction.
SCENARIO #5

- You are dispatched to a local assisted living facility for a pt that is possibly having a stroke. You respond emergent to the scene. Upon arrival the scene appears to be safe as usual when you are called there. You take your cot and your equipment inside to the nurses’ station. The nurses take you to the pt apartment and state that the pt is fairly independent and became a resident of the nursing home after have a stroke a few months ago. Pt is a 75 year old male patient that is found sitting on the couch of his assisted living apartment. Staff states they came to check on the patient this morning and the pt told them he did not feel good.

- PCI capable hospital is 50 minutes from assisted living facility.
**SCENARIO #5**

**ASSESSMENT**

- Pt is alert and oriented to person, place, time, and event, but can say random non pertinent things at times. Staff states that the pt has done this before but today it seems to be more often than usual. Pt skin is flushed, slightly diaphoretic, and warm. Pt tells you that he has not felt good since 0200 this morning when he woke up feeling a little nauseated. Pt states the nausea had subsided shortly after he woke and has been intermittent since. Pt denies any emesis. Pt states that he feels a little dizzy, has a headache and slightly short of breath. You note that the pt has some facial droop to the left side of his face. Pt PERRL. CMS X 4 is present. Pt denies any chest pain at this time. Pt gait is a little unsteady per staff. Pt states that he felt fine when he ate dinner last night and went to bed. Pt starts to become a little anxious and now keeps repeating “I just do not feel good and I feel short of breath.” Pt has not taken any of his medications today and states he does not think he took them last night either.
SCENARIO #5

• HISTORY
  – Stroke a few months ago, Heart attack 12 years ago, coronary artery disease, hypertension, renal insufficiency.

• MEDICATIONS
  – Aspirin, Lasix, Plavix, Lisinopril, Lopressor

• ALLERGIES
  – Sulfa, seasonal allergies
SCENARIO #5

• What is the treatment plan for this patient?
SCENARIO #5

• VITALS
  - BP 170/90
  - Pulse 110
  - Respirations 22 unlabored
  - SpO2 95% room air
SCENARIO #5

Name: [Redacted]

HR 104 bpm
10:54:34
QRS 0.096s
0.366s/0.481s
71° 76° 43°

Anna ACUTE MI SUSPECTED
Abnormal ECG Unconfirmed
- Sinus tachycardia
- Left atrial enlargement
- Possible anterior infarct, possibly

Lead 2

ems12lead.com
SCENARIO #5

• BLS TREATMENT
  
  – Apply O2 at 2LPM per nasal cannula to maintain SpO2 >92%, check for signs of a stroke and question staff about pt recent stroke history, apply cardiac monitor and obtained 12-lead, transmit 12-lead to appropriate facility, obtain a blood glucose level, listen to lung sounds

  – Call for an ALS intercept, notify receiving agency of patient condition and confirmation of 12-lead transmittal. Follow any orders given by medical control after receiving agency has received and interpreted 12-lead.
SCENARIO #5

• ALS TREATMENT
  – Same as BLS treatment and also establish IV access, interpret 12-lead and treat appropriately
SCENARIO #5

• FURTHER ASSESSMENT FINDINGS

  – Per staff pt has noted left sided facial droop upon admittance to the assisted living center and is normal for him
  – Blood glucose level is 177
  – Lung sounds are slightly diminished in the bases, otherwise clear and equal bilaterally
  – 12-lead EKG reveals a sinus tachycardic rhythm with ST elevation in leads V1, V2, V3, V4, V5 and V6
FURTHER TREATMENT

- Appropriate care for patient after obtaining 12-lead would consist of ASA, nitro per protocol keeping blood pressure above 100 systolic per protocol, and analgesic for pain
  - Consider
  - Heparin 70 units/kg maximum 5000 unit bolus IV
  - Plavix 600 mg PO
SCENARIO #5

OUTCOME

- Patient started to have chest pain just moments prior to arrival at the hospital. Patient is taken directly to cath lab where there was 100% LAD blockage noted and a stent was placed.

First patient contact to PCI 81 minutes!
SCENARIO #6

• You are dispatched to a residence for a male patient that is not acting normal. Your crew responds emergent to the call. Upon arriving in a rundown neighborhood, a bystander comes out the door of the residence to greet you. You see no apparent threats and the scene appears to be safe. You are lead to the basement of the residence to find a 39 year old male lying in the middle of the floor. Pt appears to be conscious and breathing, but does not look at you when entering the room. Bystander states that he is the patient’s neighbor and he noticed he did not collect his newspaper this morning nor his mail when it arrived at noon. Neighbor states this was very unlike the patient and so he went to check in on his neighbor and found him like this and called 911.

• You are 20 minutes from the local community hospital and 90 minutes from a PCI center
Patient is conscious and will slowly look over at you when you talk to him. Pt will answer some questions, but seems to be confused as to what is going on, the time, and where he is at. The neighbor tells you he thinks the patient is a diabetic, but that is all he knows about the patient. You try to ask the patient some more detailed questions and he does not respond or has inadequate information. Pt will state that he has no pain at this time. Patient skin is pale, cool, and diaphoretic. You note that the pt is doing some construction on the basement from the construction tools lying around. There are no other clues in your surroundings that help identify what could be going on with the patient and the neighbor states he does not know if his family lives in town. The patient remains confused, but is willing to let you assess him and take his vitals.
SCENARIO #6

• HISTORY
  – Possibly diabetic per the neighbor’s statement

• MEDICATIONS
  – You look around the house and find a bottle of insulin in the fridge and you cannot find any other medications

• ALLERGIES
  – Unknown
SCENARIO #6

- What is the treatment plan for this patient?
SCENARIO #6

• VITAL SIGNS
  – BP 150/70
  – Pulse 98 and regular
  – Respirations 26
  – SpO2 94% room air
  – Blood glucose level 46
SCENARIO #6

• BLS TREATMENT
  - Apply high flow oxygen as patient tolerates, patient has patent airway and able to swallow allowing you to treat low blood sugar with oral glucose per protocol, reassess patient blood sugar level and reassess patient condition and further assess patient after treating hypoglycemia.
As you reassess the patient he is now alert and oriented to person, place, time, and event. Patient skin is still pale, cool, and diaphoretic. Patient states that he has not felt good for a few days and thought it may be his blood sugar levels acting up, but most of the time they have checked out fine on his glucose monitor. Patient states he has been trying to adjust his doses of insulin to see if he would feel better and he has been feeling worse. Patient states that he is feeling a little light headed and has been having some intermittent pain in his left shoulder, but thinks it may be from doing construction on his basement. Patient denies having any nausea or vomiting. Patient feels a little short of breath upon exertion, otherwise feels his breathing is adequate. Patient has no signs of a stroke upon examination after treating the hypoglycemia. Patient states that he has no pain in his chest, but you get the impression that patient feels unsure about his pain and overall symptoms. Patient seems to be worried and asks what you think is wrong with him? Patient states that he is only diabetic and takes insulin. Patient denies any other medications. Patient states that his last doctor visit he was told his cholesterol was borderline high.
SCENARIO #6

• How would you continue to treat this patient?
SCENARIO #6
SCENARIO #6

- BLS TREATMENT AFTER REASSESSMENT
  - Continue oxygen therapy and call for ALS intercept. Recheck blood glucose.
  - Apply cardiac monitor and obtain a 12-lead. Transmit 12-lead to the most appropriate facility.
  - Call receiving hospital and notify them of patient condition and confirmation of 12-lead transmittal. Follow any orders given by medical control after they interpret 12-lead.
SCENARIO #6

• REASSESSMENT VITALS

  – BP 152/76
  – Pulse 110 and regular
  – Respirations 24
  – SpO2 99% after oxygen
  – BGL after treating low blood sugar 168.
SCENARIO #6

• ALS TREATMENT

  – Continued BLS treatment. Also establish IV access. Interpret 12-lead.
  – Confirm that the patient has no allergies now that he is oriented. Give ASA and nitroglycerine per protocol. Consider analgesic if pain becomes a complaint. Notify receiving agency of treatments done. Maintain blood pressure above 100 systolic.
  – Complete thrombolytic eligibility checklist
Patient still unsure if he is having chest pain or not but seems to be apprehensive to admit to it. Skin condition remains the same. After interpretation of 12-lead pt is showing significant ST elevation in leads II, III and AvF reciprocal changes noted. Patient was taken to Community hospital center 20 minutes away given thrombolytic (TNKase) within 30 min of arrival and urgently transferred to PCI hospital 70 minutes away for possible cardiac catheterization and PCI.

ST elevation and chest pain persisted post TNKase administration en-route to PCI hospital. Pt was taken immediately to the cath lab, evaluated by cardiologist and a stent was successfully performed to the RCA.