Author: Lance Hoffman, Chad Branecki Reviewer: Sarah Farris

Case Title: STEMI with concurrent LBBB

# Target Audience: Resident Physicians

Primary Learning Objectives:

1. Recognize the clinical presentation of an acute myocardial infarction

2. Identify ECG findings suggestive of AMI with a concurrent LBBB

3. Initiate appropriate therapy for an acute STEMI, including emergent revascularization

Secondary Learning Objectives:

1. Employ strategies to confirm STEMI with concurrent LBBB such as identifying a wall motion abnormality on echocardiography or comparison of a current and prior ECG.

2. Effectively communicate the diagnosis and treatment of a STEMI to patients

Critical actions checklist:

## Orders an ECG within the first few minutes of the evaluation

1. Correctly interprets the ECG as a LBBB with a concurrent STEMI
2. Administers an appropriate dose of aspirin to the patient (162-325mg PO and chewed)
3. Uses additional data to confirm the presence of a STEMI, such as comparison with a prior ECG or identifying a wall motion abnormality on bedside echocardiography
4. Initiates emergent revascularization appropriate to the practice setting, such as thrombolytics or cardiac catheterization

## Environment (if using as a simulation case)

1. Case can be run as simulation scenario. Sim lab should be set up as typical

critical care resuscitation room

1. Employ high fidelity simulation mannequin, capable of intravenous lines, intubation, and transmitting ECG data to monitor
2. Will need ECG, CXR viewer, possible bedside echocardiogram, code cart, and thrombolytic intravenous medication box

## Actors (optional)

1. Roles – paramedic, nurse, ED tech, Cardiology consultant
2. Who may play them – EMT, nurse, ED tech, attending physician
3. Action Role – Consultant may act as prompt, asking for prior ECG, or additional

data prior to taking patient to cath lab.

**For Examiner Only**

Author: Lance Hoffman Reviewer: Sarah Farris

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**CASE SUMMARY**

**CORE CONTENT AREA**

Cardiovascular – Acute STEMI

**SYNOPSIS OF HISTORY**

This 62 y/o man drove himself to the ED from work for evaluation of 4 hours of chest pressure. The discomfort started when he was at work shortly after eating lunch while he was changing the oil filter on a customer’s car.

**ROS:** Pertinent positives: chest pressure with discomfort radiating interscapularly, diaphoresis, nausea, mild dyspnea

Pertinent negatives: fevers, headache, cough, neck/shoulder/arm pain, abdominal pain, vomiting, diarrhea, leg pain, leg swelling, rashes

**Past Medical Hx:** Hypertension, Hypercholesterolemia, LBBB for at least 2 years

**Past Surgical Hx:** Appendectomy (2 years ago corresponding with initial identification of LBBB)

**Medications:** atenolol, lisinopril, hydrochlorothiazide, simvastatin

**Allergies:** No allergies

**Habits:** Smoking: life-long non-smoker

ETOH: averages 2 beers nightly

Drugs: life-long non-user

**Family Hx:** Hypertension, Hypercholesterolemia, Coronary Artery Disease

**Social Hx:** Marital Status: divorced > 20 years ago

Children: none

Education: high school graduate

Employment: automotive mechanic

**For Examiner Only**

**SYNOPSIS OF PHYSICAL**

**Patient Name:** Cisco Perez **Age & Sex:** 62y/o male

**General Appearance:** Diaphoretic, 80 kg male, sitting up in exam bed, mildly anxious/restless

**Vital Signs:** BP=155/88 P=64 R=22 T (oral)=98.8F Pulse Oximetry (RA)=93%

An otherwise normal physical exam consistent with uncomplicated acute myocardial infarction is present.

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**CRITICAL ACTIONS**

**Scenario branch points/ PLAY OF CASE GUIDELINES**

Key teaching points or branch points that result in changes in patient’s condition

1. Orders an ECG within the first few minutes of the evaluation

Cueing Guideline: If no ECG is ordered, have nurse ask candidate if there is anything a tech can do, or call for. The nurse will be busy starting an IV.

1. Correctly interprets the ECG as a LBBB with a concurrent STEMI

Cueing Guideline: Have the EKG tech/RN ask, “Why does this look so different compared to most ECGs we order?”

1. Administers an appropriate dose of aspirin to the patient (162-325mg PO and chewed)

Cueing Guideline: RN could ask if patient needs to be NPO at this time

1. Uses additional data to confirm the presence of a STEMI, such as comparison with a prior ECG or identifying a wall motion abnormality on bedside echocardiography

Cueing Guideline: Patient’s Primary care provider could call on phone and “ask if he could be of any assistance.” Have a tech ask of the physician “do you think his ECG looks like that all the time?”

1. Initiates emergent revascularization appropriate to the practice setting, such as thrombolytics or cardiac catheterization

Cueing Guideline: In opening code cart, RN could ask if MD needs anything out of the IV Thrombolytic box

SCORING GUIDELINES

(Critical Action No.)

1. Quickly places patient on cardiac monitor and ECG is ordered

2. Identifies a LBBB, with concerning changes for STEMI

3. Aspirin is given prior to any additional revascularization therapy

4. Utilized other resources to obtain old EKG, or bedside echocardiogram

5. Call is placed to interventional cardiologist regarding cardiac catheterization or directed to give thrombolytic therapy

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**HISTORY**

**Onset of Symptoms:** 4 hours ago

**Background Info:** This 62 y/o man drove himself to the ED from work for evaluation of 4 hours of chest pressure. The discomfort started when he was at work shortly after eating lunch while he was changing the oil filter on a customer’s car.

**Chief Complaint:** “My chest hurts.”

**Past Medical Hx:** Hypertension, Hypercholesterolemia, LBBB for at least 2 years

**Past Surgical Hx:** Appendectomy (2 years ago corresponding with initial identification of LBBB)

**Medications:** Atenolol, lisinopril, hydrochlorothiazide, simvastatin

**Allergies:** No allergies

**Habits:** Smoking: life-long non-smoker

ETOH: averages 2 beers nightly

Drugs: life-long non-user

**Family Hx:** Hypertension, Hypercholesterolemia, Coronary Artery Disease

**Social Hx:** Marital Status: divorced > 20 years ago

Children: none

Education: high school graduate

Employment: automotive mechanic

**ROS:** Pertinent positives: chest pressure with discomfort radiating interscapularly, diaphoresis, nausea, mild dyspnea

Pertinent negatives: fevers, headache, cough, neck/shoulder/arm pain, abdominal pain, vomiting, diarrhea, leg pain, leg swelling, rashes

**For Examiner Only**

**PHYSICAL EXAM**

**Patient Name:** Cisco Perez **Age & Sex:** 62y/o male

**General Appearance:** Diaphoretic, 80 kg male, sitting up in exam bed, mildly anxious/restless

**Vital Signs:** BP=155/88 P=64 R=22 T (oral)=98.8F Pulse Oximetry (RA)=93%

**Head:** Normal

**Eyes:** PERRL, no scleral icterus

**Ears:** Normal

**Mouth:** normal moisture and dentition

**Neck:** no JVD, no lymphadenopathy, normal non-tender thyroid

**Skin:** mildly diaphoretic without rash

**Chest:** non-tender, no subcutaneous emphysema

**Lungs:** breath sounds equal bilaterally without wheezes or rales

**Heart:** easily audible S1 S2 without S3 or S4, no murmurs

**Back:** non-tender

**Abdomen:** soft, non-tender, non-distended, well-healed RLQ appendectomy scar

**Extremities:** no edema, 2/4 symmetric pulses in radial and dorsal pedal arteries

**Rectal:** normal tone, heme negative

**Neurological:** normal

**Mental Status:** mildly anxious/restless in bed

**For Examiner Only**

**STIMULUS INVENTORY**

#1 Emergency Admitting Form

#2 CBC

#3 BMP

#4 U/A

#5 ABG

#6 Cardiac Enzymes

#7 Toxicology

#8 CXR

#9 CT

#10 2D Cardiac Echo

#11 ECG (current)

#12 ECG (7 months prior)

**For Examiner Only**

**LAB DATA & IMAGING RESULTS**

**Stimulus #2 Stimulus #5**

**Complete Blood Count (CBC) Arterial Blood Gas (with supp oxygen)**

WBC 21.0/mm3 pH 7.36

Hgb 14.4g/dL pCO2 40mm Hg

Hct 40.7% pO2 109mm Hg

Platelets 307/mm3 O2 Sat100%

Differential

Segs 84% **Stimulus #6**

Bands 2% **Cardiac Enzymes**

Lymphs 11% CK 100ng/mL

Monos 2% CK-MB 5.5ng/mL

Eos 1% Troponin 0.12ng/mL (elevated)

**Stimulus #7**

**Stimulus #3 Toxicology**

**Basic Metabolic Profile (BMP)** Serum

Na+ 137mEq/L Salicylate Neg

K+ 3.4mEq/L Acetaminophen Neg

CO2 26mEq/L Tricyclics Neg

Cl- 102mEq/L ETOH 0mg/dl

Glucose 188mg/dL

BUN 11mg/dL Urine

Creatinine 0.9mg/dL Cocaine Neg

Cannabinoids Neg PCP Neg

**Stimulus #4** Amphetamines Neg

**Urinalysis (U/A)** Opiates Neg

Color yellow Barbiturates Neg

Sp gravity 1.010 Benzodiazepines Neg

Glucose neg

Protein neg **Stimulus #8**

Ketone neg CXR normal

Leuk Est neg

Nitrite neg **Stimulus #9**

WBC 0-2/hpf Head CT: normal

RBC 0-2/hpf

**For Examiner Only**

**LAB DATA & IMAGING RESULTS**

**Stimulus #10**

2D Cardiac Echo: WMA with EF 45%

**Stimulus #11**

ECG (current): NSR, LAD, LBBB, ST elevation with pseudonormalization of T waves

**Stimulus #12**

ECG (7 months ago): NSR, LAD, LBBB, lateral T wave inversion

**Learner Stimulus #1**

**ABEM General Hospital**

**Emergency Admitting Form**

Name: Cisco Perez

Age: 62 years

Sex: Male

Method of Transportation: Private car

Person giving information: Patient

Presenting complaint: “My chest hurts.”

**Background:** This 62 y/o man drove himself to the ED from work for evaluation of 4 hours of chest pressure. The discomfort started when he was at work shortly after eating lunch while he was changing the oil filter on a customer’s car.

**Triage or Initial Vital Signs**

BP: 155/88

P: 64

R: 22

T : 98.8F orally

RA Pulse Oximetry: 93%

**Learner Stimulus #2**

**Complete Blood Count (CBC)**

WBC 21.0/mm3

Hgb 14.4g/dL

Hct 41.9%

Platelets 307/mm3

Differential

Segs 84%

Bands 2%

Lymphs 11%

Monos 2%

Eos 1%

**Learner Stimulus #3**

**Basic Metabolic Profile (BMP)**

Na+ 137 mEq/L

K+ 3.4 mEq/L

CO2 26 mEq/L

Cl- 102 mEq/L

Glucose 188 mg/dL

BUN 11 mg/dL

Creatinine 0.9 mg/dL

**Learner Stimulus #4**

**Urinanlysis (U/A)**

Color Yellow

Sp gravity 1.010

Glucose Negative

Protein Negative

Ketone Negative

Leuk. Esterace Negative

Nitrate Negative

WBC 0-2/hpf

RBC 0-2/hpf

**Learner Stimulus #5**

**Arterial Blood Gas (with supplemental oxygen)**

pH 7.36

pCO2 40 mm Hg

pO2 109 mm Hg

O2 Sat 100%

**Learner Stimulus #6**

**Cardiac Enzymes**

CK 100 ng/ml

CKMB 5.5 ng/ml

Troponin 0.12 ng/ml (elevated)

**Learner Stimulus #7**

**Toxicology**

Serum

Salicylate Negative

Acetaminophen Negative

Tricyclics Negative

ETOH 0 mg/dl

Urine

Cocaine Negative

Cannabinoids Negative

PCP Negative

Amphetamines Negative

Opiates Negative

Barbiturates Negative

Benzodiazepine Negative

**Learner Stimulus #8**

**Radiology Report**

Chest X-ray Normal without mediastinal widening, pneumothorax, consolidation, cardiomegaly or effusion

**Learner Stimulus #9**

**Radiology Report:**

Head CT Normal

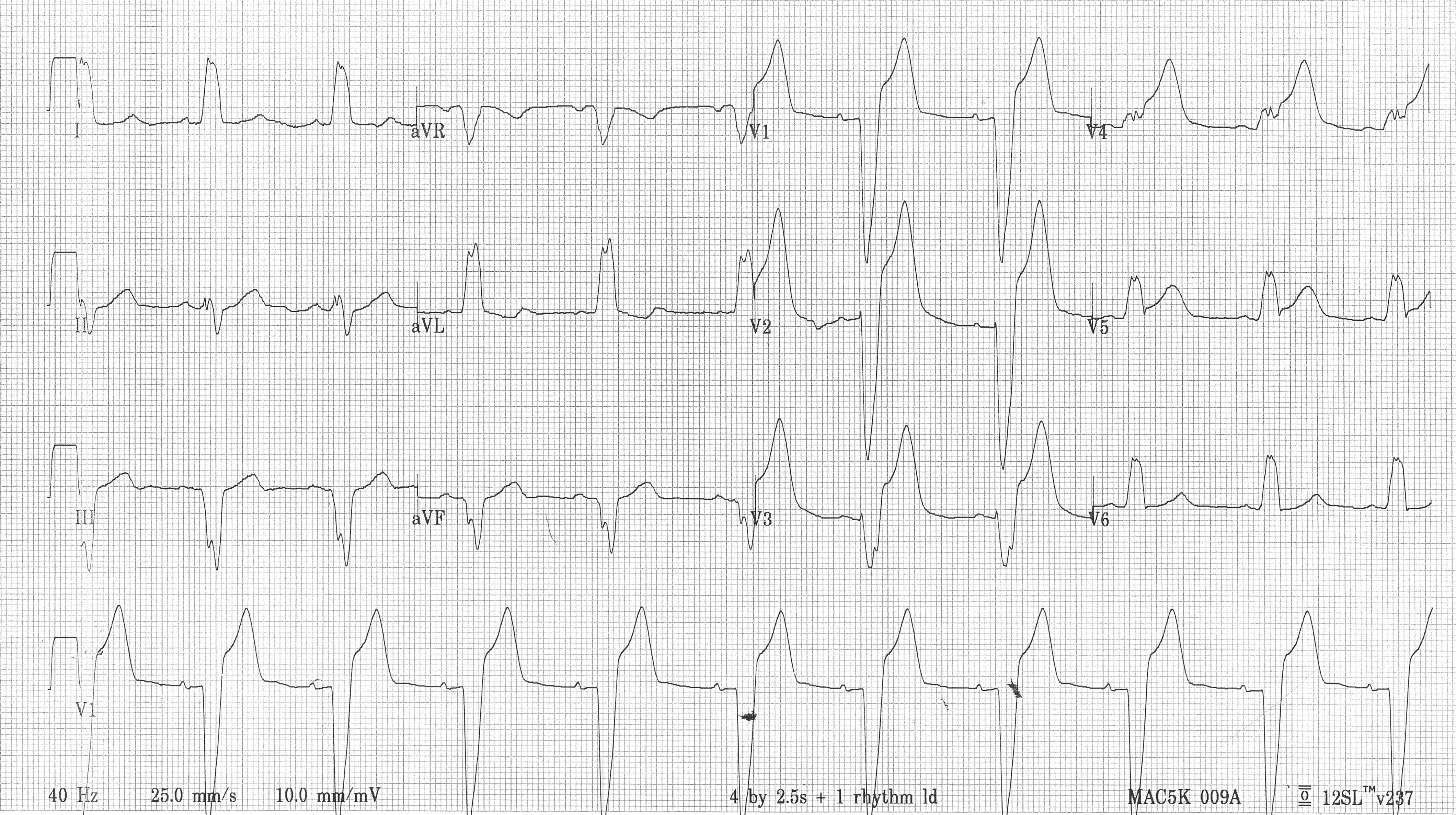
**Learner Stimulus #10**

**Echocardiogram**

2-D Transthoracic echo Decreased wall motion in the anterior and septal portions of heart with an estimated LVEF of 45%

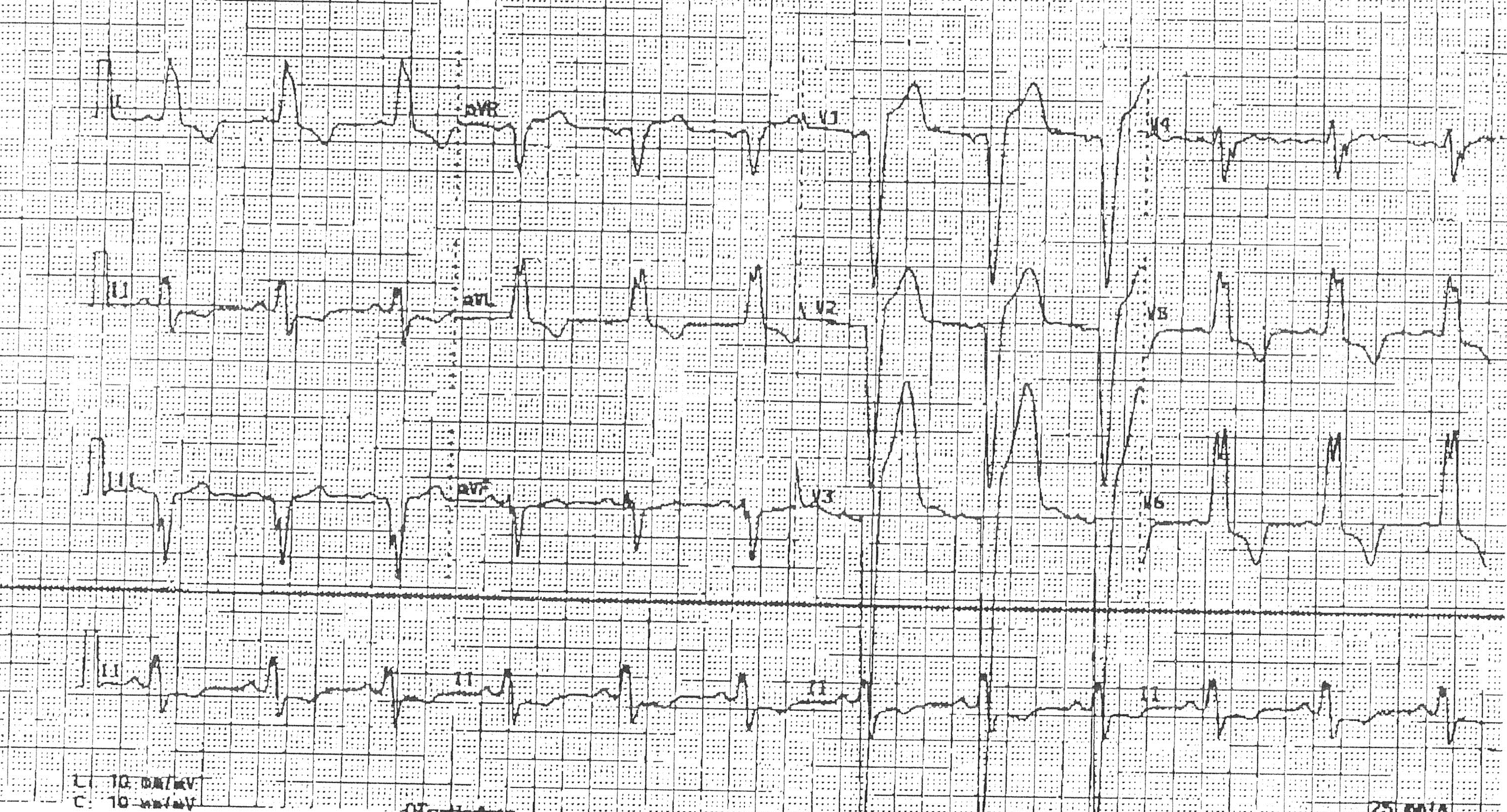
**Learner Stimulus #11**

**ECG**



**Learner Stimulus #12**

**ECG (7 months prior)**

**Optional**

**Feedback/ Assessment Forms (may choose form dependent on use of case)**

**Case Name Here**

**Candidate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Examiner \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Critical Actions:**

* Quickly places patient on cardiac monitor and ECG is ordered
* Identifies a LBBB, with concerning changes for STEMI
* Aspirin is given prior to any additional revascularization therapy
* Utilized other resources to obtain old ECG, or bedside echocardiogram
* Call is placed to interventional cardiologist regarding cardiac catheterization or directed to give thrombolytic therapy

**Dangerous Actions:** (Performance of one dangerous action results in failure of the case)

* Failure to place patient on Cardiac Monitor and order ECG within 5 minutes of arrival
* Identifies a LBBB, but does not recognize concerning changes consistent with STEMI
* Aspirin not given prior to revascularization therapy
* Does not try to obtain prior ECG, or stat bedside echocardiogram
* Failure to initialize cardiac catheterization or thrombolytic therapy

**Overall Score:**

* Pass
* Fail

**For Examiner**

Date: Examiner: Examinee(s):

Scoring: In accordance with the Standardized Direct Observational Tool (SDOT)

The learner should be scored (based on level of training) for each item above with one of the following:

NI = Needs Improvement

ME = Meets Expectations

AE = Above Expectations

NA= Not Assessed

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Critical Actions** | **NI** | **ME** | **AE** | **NA** | **Category** |
| Quickly places patient on cardiac monitor and ECG is ordered |  |  |  |  | PC, MK, PBL |
| Correctly interprets the ECG as a LBBB with a concurrent STEMI |  |  |  |  | PC, MK |
| Administers an appropriate dose of aspirin to the patient (162-325mg PO and chewed) |  |  |  |  | PC, MK, PBL,SBP |
| Uses additional data to confirm the presence of a STEMI, such as comparison with a prior ECG or identifying a wall motion abnormality on bedside echocardiography |  |  |  |  | PC, MK, PBL |
| Initiates emergent revascularization appropriate to the practice setting, such as thrombolytics or cardiac catheterization |  |  |  |  | PC, MK, PBL, ICS |

Category: One or more of the ACGME Core Competencies as defined in the SDOT

PC= Patient Care

Compassionate, appropriate, and effective for the treatment of health problems and the promotion of health

MK= Medical Knowledge

Residents are expected to formulate an appropriate differential diagnosis with special attention to life-threatening conditions, demonstrate the ability to utilize available medical resources effectively, and apply this knowledge to clinical decision making

PBL= Practice Based Learning & Improvement

Involves investigation and evaluation of their own patient care, appraisal and assimilation of scientific evidence, and improvements in patient care

ICS= Interpersonal Communication Skills

Results in effective information exchange and teaming with patients, their families, and other health professionals

P= Professionalism

Manifested through a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population

SBP= Systems Based Practice

Manifested by actions that demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value

**Debriefing Materials:**

* **LBBB, Ventricular Paced Rhythm and LVH can all mimic and confound the diagnosis of AMI.**
* **Criteria for LBBB will be: primarily negative QRS in V1 with poor R wave progression and monophasic R waves in V5 and V6. QRS duration of 0.12 secs or greater in limb leads. Broad slurred R in V6 with absent q, depressed ST segment and inverted T wave. Usually a broad slurred R in I and avl. Deep S wave in V1-V2 and normal PR interval.**
* **In the presence of acute infarction (as compared to prior ECG) there is actual ST elevation > 2mm V4 and V5. The ST segments are clearly elevated and have concerning concave morphology. The T waves also demonstrate pseudonormalization compared to the prior ECG obtained 7 months ago.**

**Keywords for future search**

**LBBB, STEMI, AMI, Chest Pain, ST segment changes**

**References**

Zack Pm, Aker UT, Kennedy HL. Pseudonormalization of T-waves During Coronary Angioplasty. Catheterization and Cardiovascular Diagnosis. May-June 1987; 13(3): 191-3.

Loperfido LA, et al. Significance of Transient ST-T Segment Changes During Dobutamine Testing in Q Wave Myocardial Infarction. Mar 1996; 27(3): 599-605.

Brady WJ, et al. Electrocardiographic ST-segment Elevation: The Diagnosis of Acute Myocardial Infarction by Morphologic Analysis of the ST Segment. Academic Emergency Medicine. Oct 2001; 8(10): 961-7.

Smith SW. Upwardly Concave ST Segment Morphology is Common in Acute Left Anterior Descending Coronary Occlusion. The Journal of Emergency Medicine. 2006; 31(1): 69-77.

**Has this work been previously published?** No

**Optional: Simulation Equipment Checklist**

**ENVIRONMENT**

This scenario requires (checked boxes):

|  |  |  |  |
| --- | --- | --- | --- |
| X | Simulator  Type: | | |
| X | Standardized Patient | | |
| X | | Non-Invasive BP Cuff |  | | ETT |  |
| X | | 2 lead EKG |  | | LMA |  |
| X | | Pulse Oximeter |  | | Laryngoscope |  |
|  | | Arterial Line |  | | Fiberoptic scope |  |
|  | | CVP |  | | Gum Bougie |  |
|  | | PA Catheter |  | |  |  |
|  | | Temperature Probe | X | | Crash Cart |  |
|  | | Capnograph | X | | Central line set up |  |
|  | | Resp Rate Monitor |  | | Chest tube set up |  |
|  | |  | X | | Ultrasound Machine |  |

|  |  |  |
| --- | --- | --- |
|  | SP for family member |  |
| X | Additional nurse SP |  |
|  | Other SP |  |