

## Left Bundle Branch Block

### Definition:

Conduction abnormality of the left ventricle, causing wide QRS complexes and ST changes mimicking STEMI.

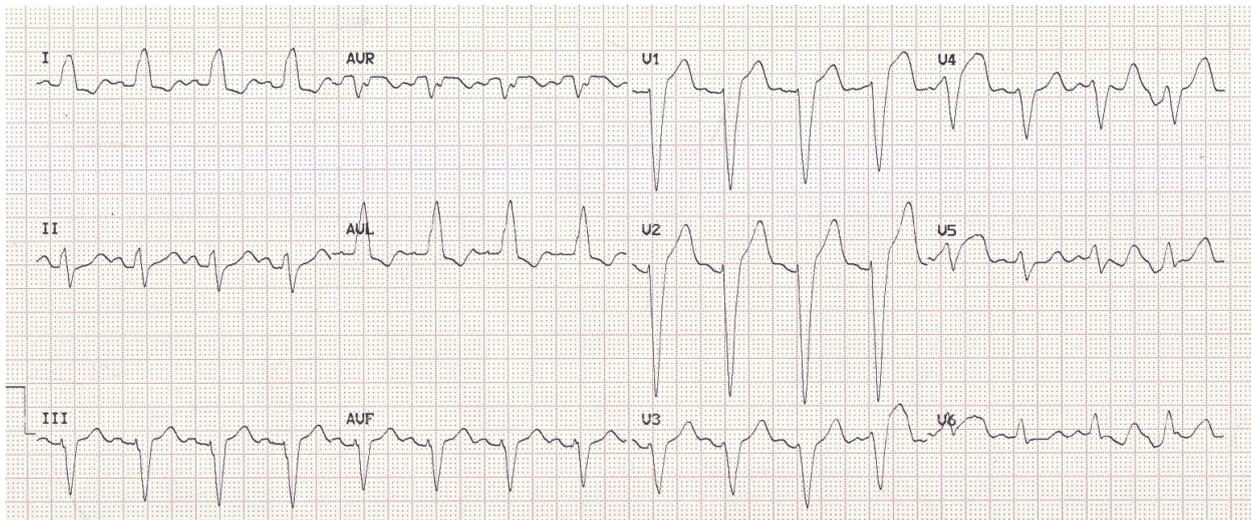
### History/Physical Exam:

History of CAD, hypertension, previous MI.

### Key 12-Lead Features:

- QRS > 120ms
- Prominent S (V1-3) / prominent R (V5/6, I/aVL)
- ST Elevation common in V1-4
- See [Sgarbossa Criteria](#) for Diagnosing MI in the presence of LBBB

### 12 Lead Sample



### References

1. Da Costa D, et al. Bradycardias and atrioventricular conduction block. 2002. [\[Link\]](#)

## Benign Early Repolarization

### Definition:

Benign ECG pattern mimicking STEMI.

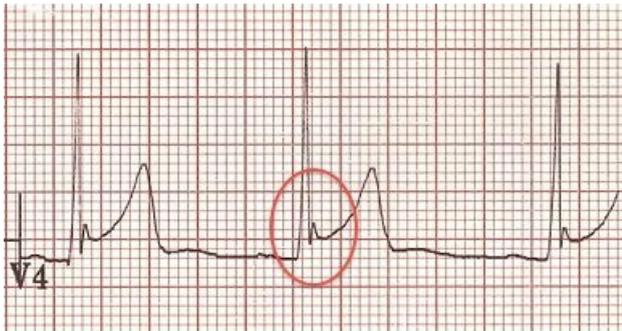
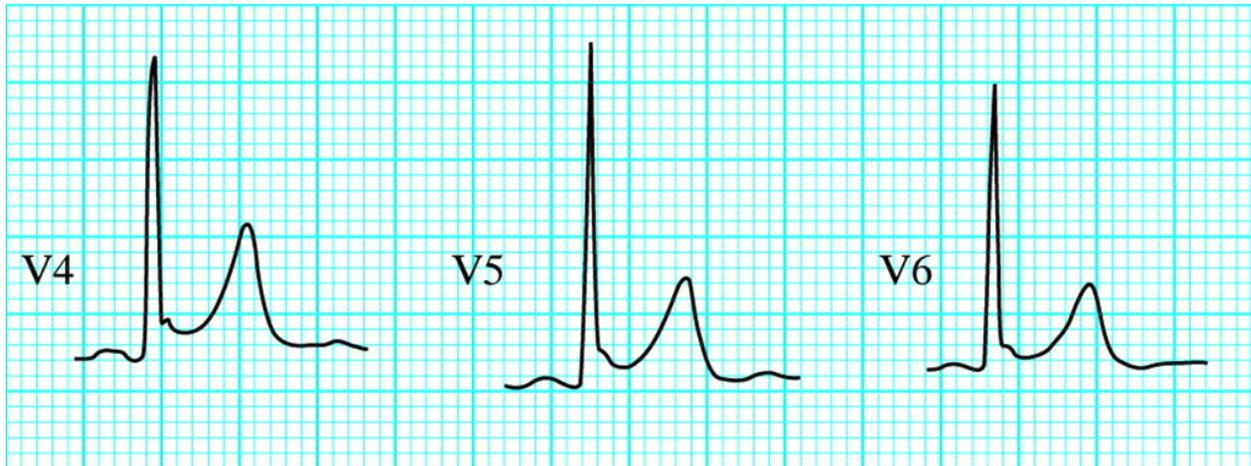
### History/Physical Exam:

Often young healthy males. May be found with concurrent chest pain. Common < 50 y/o, rare > 70 y/o.

### Key 12-Lead Features:

- Widespread concave ST elevation with J point elevation
- May have 'fish-hooked' Osborne wave
- No reciprocal ST depression to suggest STEMI (except in aVR)
- ST changes are relatively stable over time (no progression on serial ECG tracings)

### 12 Leads Samples



### References

1. Edhouse J, et al. ABC of clinical electrocardiography: Acute myocardial infarction-Part II. 2002. [\[Link\]](#)
2. Haïssaguerre M, et al. Sudden cardiac arrest associated with early repolarization. 2008. [\[Link\]](#)

# Pericarditis

## Definition

Inflammation of the pericardium.

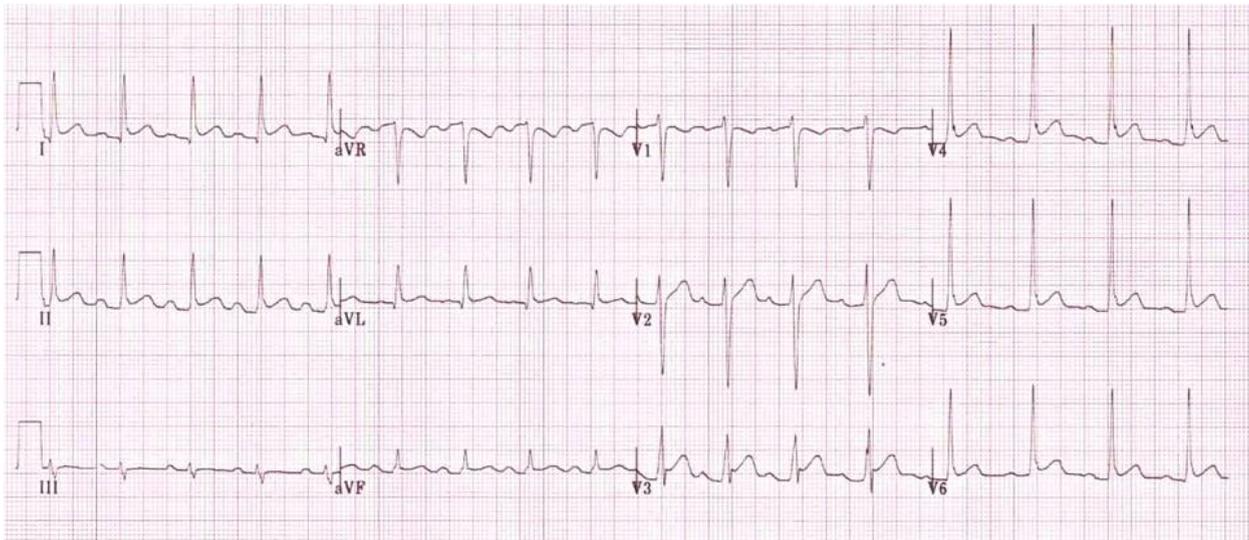
## History/Physical Exam

- Recent MI or CABG surgery, recent infection, recent chest trauma, chronic immune suppression, HIV. Sharp, pleuritic sub-sternal pain worsening when supine.
- May have a pleural friction rub. May demonstrate Beck's triad - hypotension, muffled heart sounds, and JVD.

## Key 12-Lead Features

- Widespread concave ST elevation and PR depression
- Reciprocal ST depression and PR elevation in lead aVR
- Measure baseline via TP Segment
- Sinus tachycardia is also common in acute pericarditis due to pain and/or pericardial effusion

## Sample 12 Lead



## References

1. Kinyasheva, N. Acute Pericarditis Within The Differential Diagnosis Of Chest Pain. 2017. [\[Link\]](#)

# Left Ventricular Hypertrophy

## Definition

Enlargement of the Left Ventricle of the heart, causing ECG changes that may mimic STEMI but which are generally benign.

## History/Physical Exam

History may include hypertension, aortic stenosis, hypertrophic cardiomyopathy.

## Key 12-Lead Features

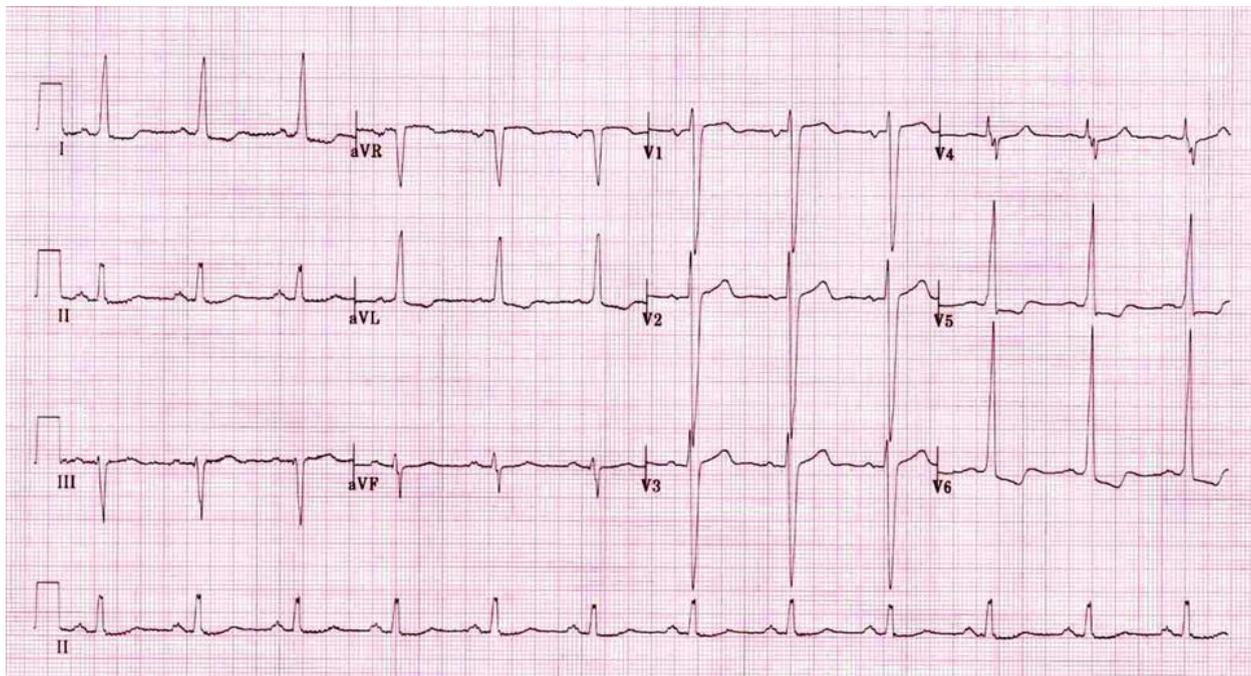
Presence of LVH

- $S(V1 \text{ or } V2) + R(V5 \text{ or } V6) > 35\text{mm}$

Strain Pattern

- ST Elevation V1-4
- ST Depression / Inverted T waves V5 and V6
- Generally proceeds from most elevated V1/2 to most depressed V6
- Consider utilizing LP15 measurements to help identify

## 12 Lead ECG Sample



[Further Reading](#)

## Reference

1. Ogah OS, et al. Electrocardiographic left ventricular hypertrophy with strain pattern: Prevalence, mechanisms and prognostic implications. 2008. [[Link](#)]

## DeWinter's T-Waves

### Definition

Early warning of an evolving STEMI.

### History/Physical Exam

History and findings suggestive of acute coronary syndrome.

### Key 12-Lead Features

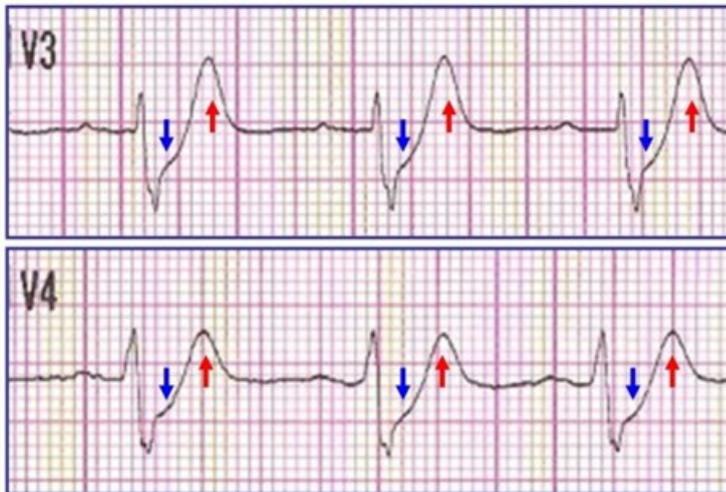
- J-Point depression with up-sloping ST segments.
- Tall, prominent, symmetric T waves in the precordial leads.
- Upsloping ST segment depression > 1mm at the J-point in the precordial leads.
- Absence of ST elevation in the precordial leads.
- ST segment elevation (0.5mm-1mm) in aVR.
- "Normal" STEMI morphology may precede or follow the DeWinter pattern.

### Key Treatment Points

- Patient advocacy for a cardiology consult
- Monitor for potential emerging STEMI

### 12 Lead ECG Samples

#### "de Winter" ST/T-wave complexes



[Further Reading](#)

### References

1. DeWinter et al. A new ECG sign of proximal LAD occlusion. 2008. [[Link](#)]

## Sgarbossa Criteria

### Definition

Used to identify AMI in the presence of LBBB or a paced rhythm.

### History/Physical Exam

History and findings suggestive of acute coronary syndrome.

### Key 12-Lead Features

ST elevation $\geq 1$ mm in a lead with upward (concordant) QRS complex	5 pts
ST depression $\geq 1$ mm in lead V1, V2, or V3	3 pts
ST elevation $\geq 5$ mm in a lead with downward (discordant) QRS	2 pts

$\geq 3$  points = 90% specificity of STEMI (sensitivity of 36%)

## Smith's Modified Sgarbossa

Replacement of Rule III: discordant ST-elevation measurement of  $> 5$  mm with

Smith's Rule:  $ST/S$  ratio greater than 0.25 = STEMI

- Measure the ST Segment Elevation in mm [X]
- Measure the height/depth of the S/R wave in mm [Y]
- $X \div Y = Z$
- $Z > 0.25 = \text{STEMI}$

Sensitivity: 91%

Specificity: 90%

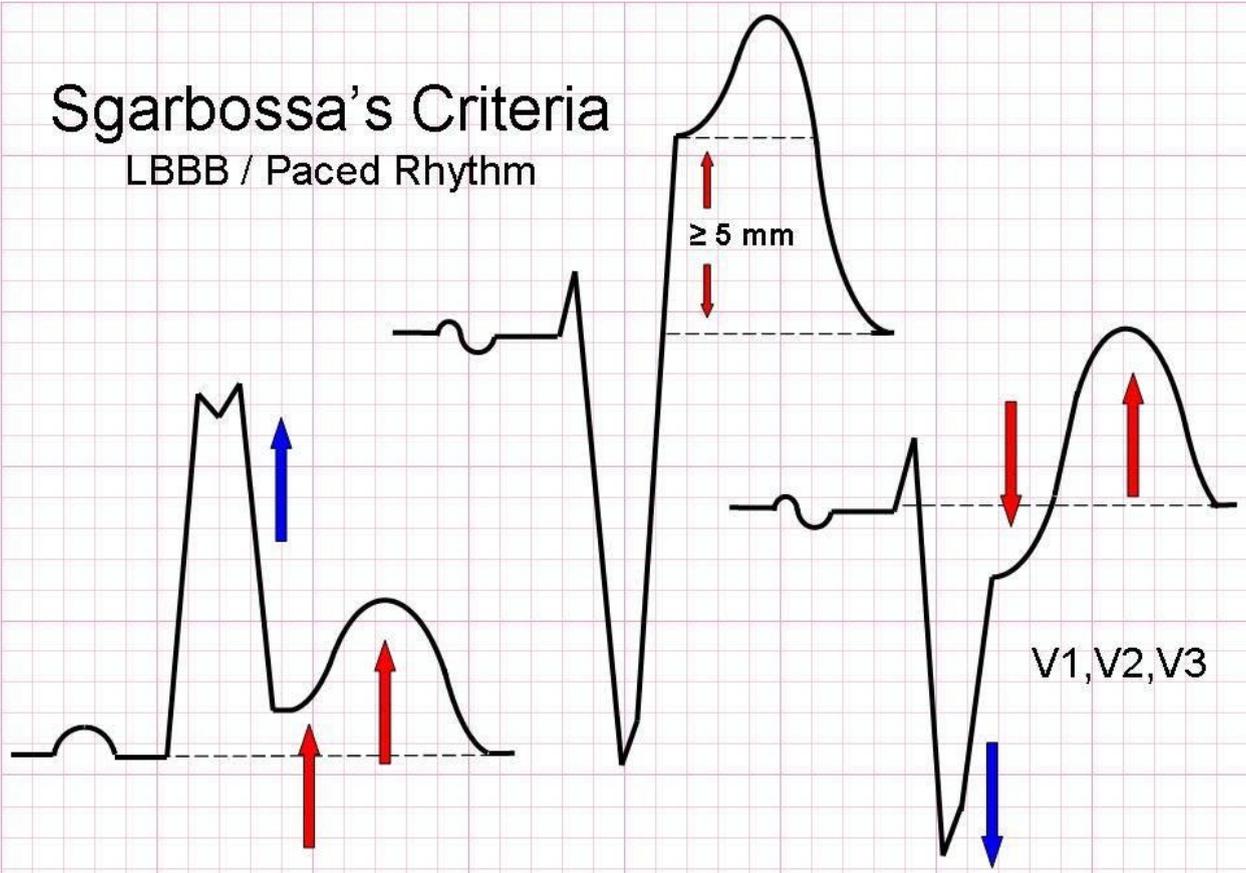
### Key Treatment Points

- Transmit as per current guidelines if believed ischemic
- Convey to PCI capable hospital
- Monitor for 12-lead changes and patient decompensation
- Treat as Acute Coronary Syndrome
- Patient advocacy at the hospital

### 12 Lead ECG Samples

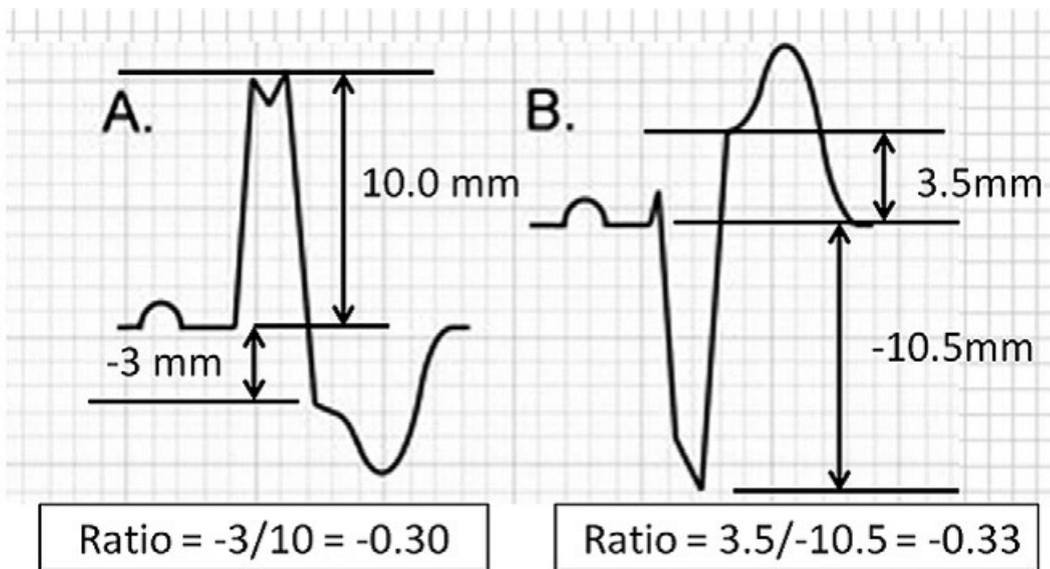
# Sgarbossa's Criteria

## LBBB / Paced Rhythm



### Smith's Modified Sgarbossa

Despite lacking > 5 mm elevation, both complexes below shown are positive for STEMI, due to ratios exceeding 0.25



[Further Reading](#)

### References

- Rodriguez, RM. Electrocardiographic Criteria for Detecting Acute Myocardial Infarction in Patients With Left Bundle Branch Block: A Meta-analysis. 2006. [\[Link\]](#)

# Wellens Syndrome

## Definition

Pre-infarction stage of coronary artery disease suggesting 80-90% LAD occlusion that often progresses to a devastating anterior wall MI.

## History/Physical Exam

Following an ischemic event suggestive of unstable angina. ECG findings are generally only visible once patient is pain free.

## Key 12-Lead Features

TYPE A: Biphasic T waves, most commonly in leads V2 and V3. Presents with upstroke/down-stroke.

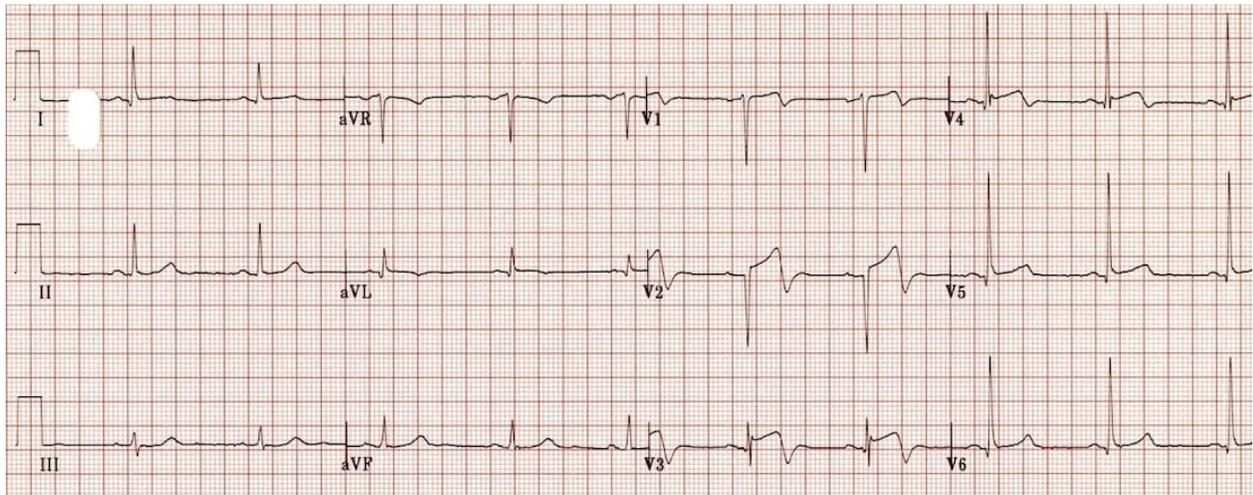
TYPE B: 76% of the time, deep inversion of the T-wave segment in the precordial leads, V1-V4.

## Key Treatment Points

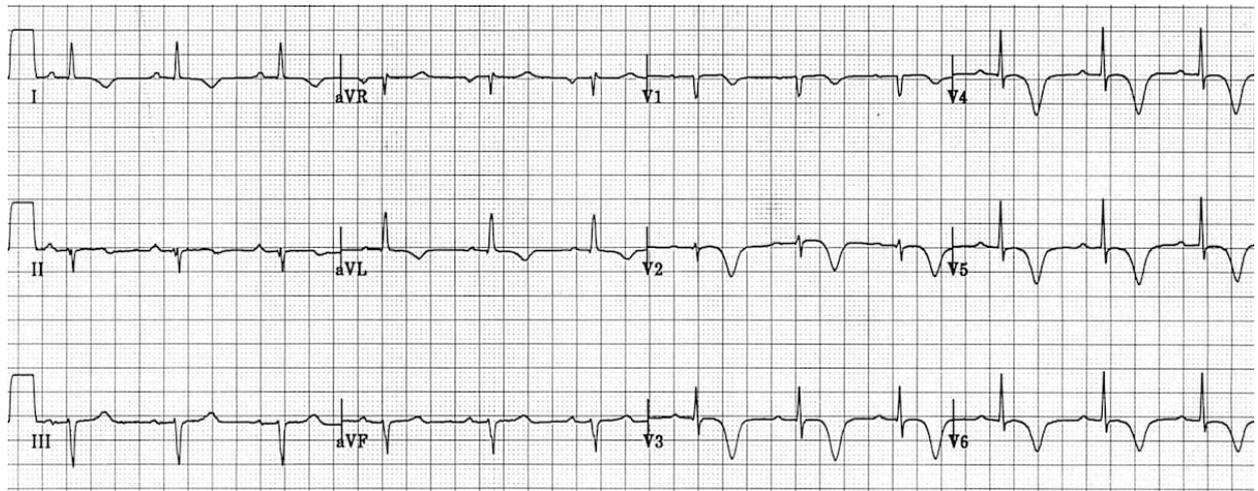
- Patient advocacy for a cardiology consult
- Monitor for potential emerging STEMI

## 12 Lead ECG Samples

### TYPE A



### TYPE B



[Further Reading](#)

#### References

1. Rhinehardt J, et al. Electrocardiographic manifestations of Wellens' syndrome. 2002. [\[Link\]](#)

## aVR STEMI

### Definition

Electrical activity from the right upper portion of the heart is recorded by aVR. Infarction in this area produces ST elevation in aVR and reciprocal changes in leads I, II, aVL, and V4-6.

Indicative of Left Main coronary artery occlusion, though can also reflect proximal LAD occlusion or severe triple-vessel disease.

### History/Physical Exam

History and findings suggestive of acute coronary syndrome.

### Key 12-Lead Features

- Widespread horizontal ST depression (often I, II, aVL, and V4-6)
- ST elevation in aVR  $\geq 1$ mm
- ST elevation in aVR  $\geq V1$
- aVR elevation in the presence of a tachycardia is often rate related and not suggestive of LMCA occlusion

### Key Treatment Points

- Transmit as per current guidelines if believed ischemic
- Convey to PCI capable hospital
- Monitor for 12-lead changes and patient decompensation
- Treat as Acute Coronary Syndrome
- Patient advocacy at the hospital

### Predictive Value of aVR Elevation

In the context of widespread ST depression + symptoms of myocardial ischemia:

- STE in aVR  $\geq 1$ mm indicates proximal LAD / LMCA occlusion or severe 3VD
- STE in aVR  $\geq 1$ mm predicts the need for CABG
- STE in aVR  $\geq V1$  differentiates LMCA from proximal LAD occlusion
- Absence of ST elevation in aVR almost entirely excludes a significant LMCA lesion

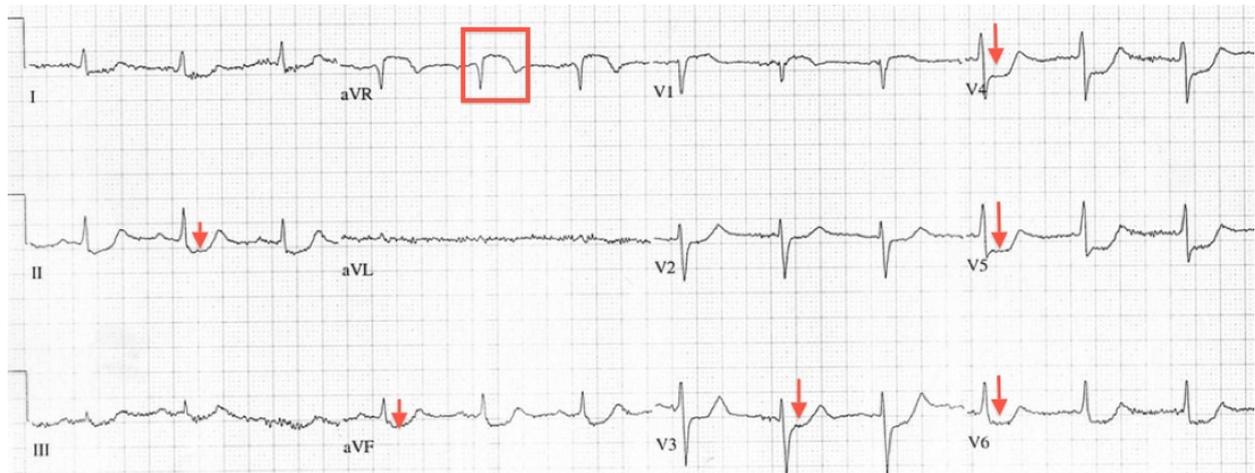
In the context of anterior STEMI:

- STE in aVR  $\geq 1$ mm is highly specific for LAD occlusion proximal to the first septal branch

Magnitude of ST elevation in aVR is correlated with mortality in patients with acute coronary syndromes:

- STE in aVR  $\geq 0.5$ mm was associated with a 4-fold increase in mortality
- STE in aVR  $\geq 1$ mm was associated with a 6- to 7-fold increase in mortality
- STE in aVR  $\geq 1.5$ mm has been associated with mortalities ranging from 20-75%

### 12 Lead ECG Sample

[Further Reading](#)**References**

1. Aygul N, et al. Value of lead aVR in predicting acute occlusion of proximal left anterior descending coronary artery and in-hospital outcome in ST-elevation myocardial infarction: An electrocardiographic predictor of poor prognosis. 2008. [\[Link\]](#)
2. Barrabes JA, et al. Prognostic value of lead aVR in patients with a first non-ST-segment elevation acute myocardial infarction. 2003. [\[Link\]](#)
3. Nabati M, et al.. ST-segment elevation in lead aVR in the setting of acute coronary syndrome. 2016. [\[Link\]](#)

## Posterior STEMI

### Definition

History and findings suggestive of acute coronary syndrome.

### History/Physical Exam

History and findings suggestive of acute coronary syndrome.

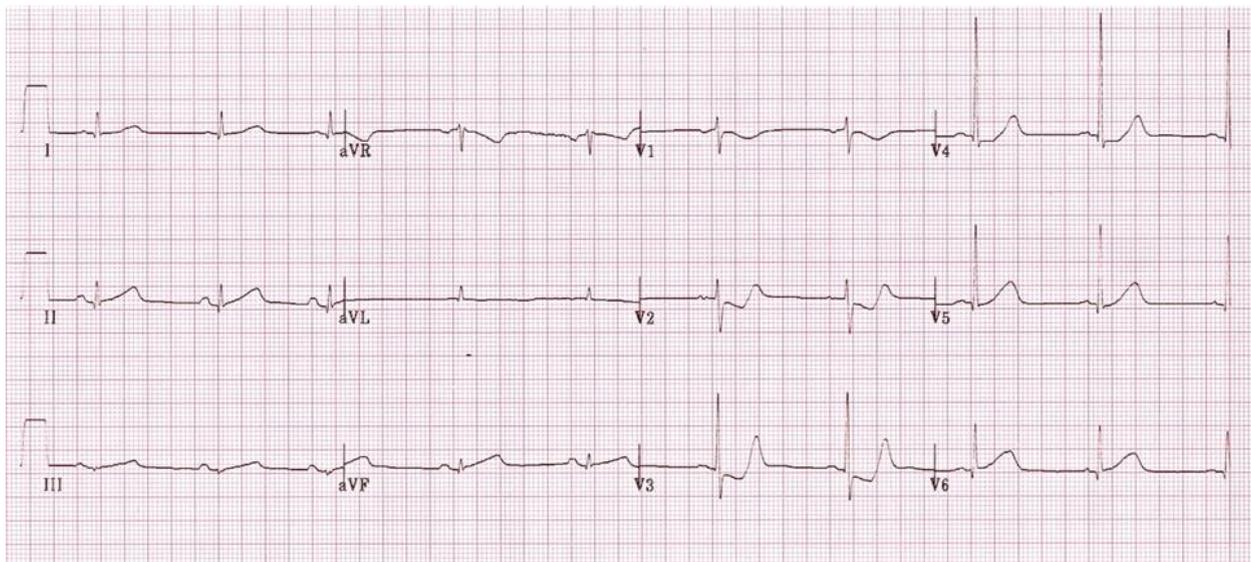
### Key 12-Lead Features

- Suspect Posterior MI with marked Precordial ST Depression V1-4 > 1mm (sensitive)
- ST Elevation in V7/8/9 > 0.5mm adds specificity

### Key Treatment Points

- Transmit as per current guidelines if believed ischemic
- Convey to PCI capable hospital
- Monitor for 12-lead changes and patient decompensation
- Treat as Acute Coronary Syndrome
- Patient advocacy at the hospital

### 12 Lead ECG Sample



[Further Reading](#)

### References

1. Van Gorselen, EOF, et al. Posterior myocardial infarction: The dark side of the moon. 2007. [\[Link\]](#)

# STEMI Patterns

**AHA Guidelines for Classifying STEMI**

ST-elevation in 2 anatomically contiguous leads measuring:

- Men < 40 years of age: 2.5 mm in V2-V3 and 1 mm in all other leads
- Men ≥ 40 years of age: 2 mm in V2-V3 and 1 mm in all other leads
- Women: 1.5 mm in V2-V3 and 1 mm in all other leads

70% sensitivity, 85% specificity for acute coronary occlusion

**Localizing STEMI**

I HIGH LATERAL LCX	aVR <b>(MAINSTEM)</b> Suspect Proximal LAD or Severe 3VD	V1 SEPTAL LAD	V4 ANTERIOR LAD
II INFERIOR RCA	aVL HIGH LATERAL LCX	V2 SEPTAL LAD	V5 LATERAL LAD / LCX
III INFERIOR RCA	aVF INFERIOR RCA	V3 ANTERIOR LAD	V6 LATERAL LAD / LCX

[Further Reading](#)

**References**

1. O’Gara PT, et al. 2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction: Executive Summary: A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. 2012. [\[Link\]](#)

