Section 6

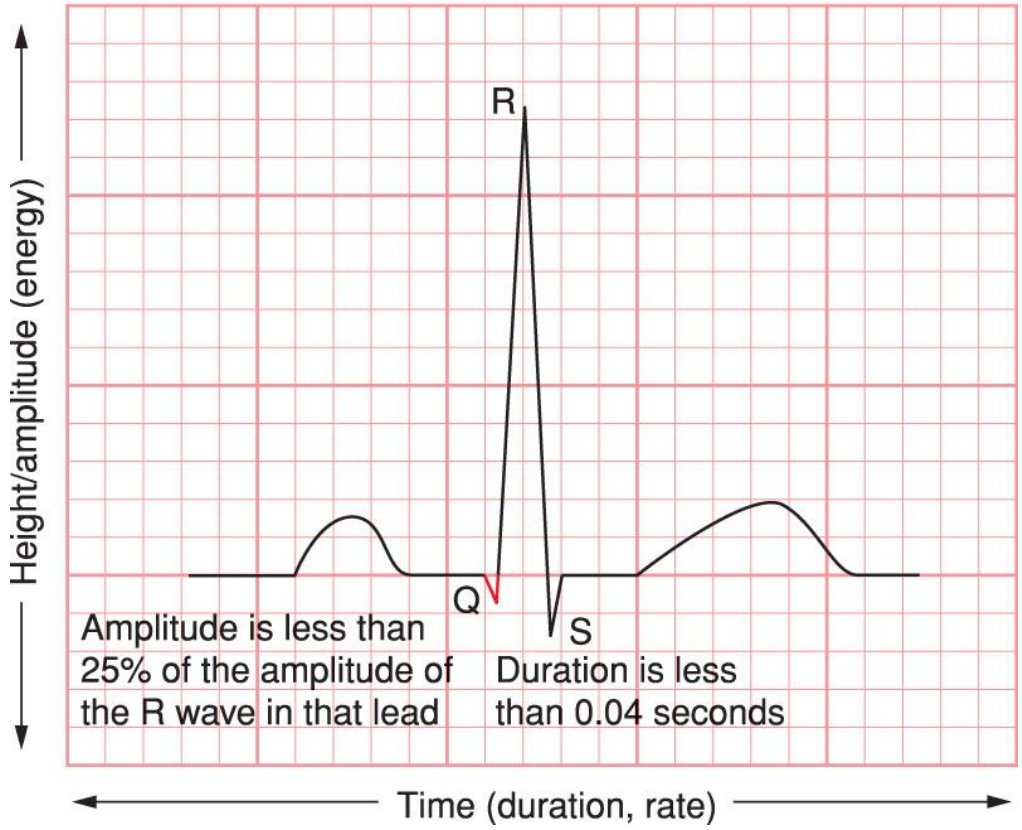
Landscape of
Ischemia
Acute Infarct
Old Infarct/MI

Objectives

- At the conclusion of this presentation the participant will be able to
  - Outline a systematic approach to 12 lead ECG interpretation
  - Demonstrate the process for determining axis
  - List criteria for LVH, RVH, LBBB, RBBB, Bifasicular and trifasicular block, acute and chronic MI changes
  - Define QTc significance and other abnormalities

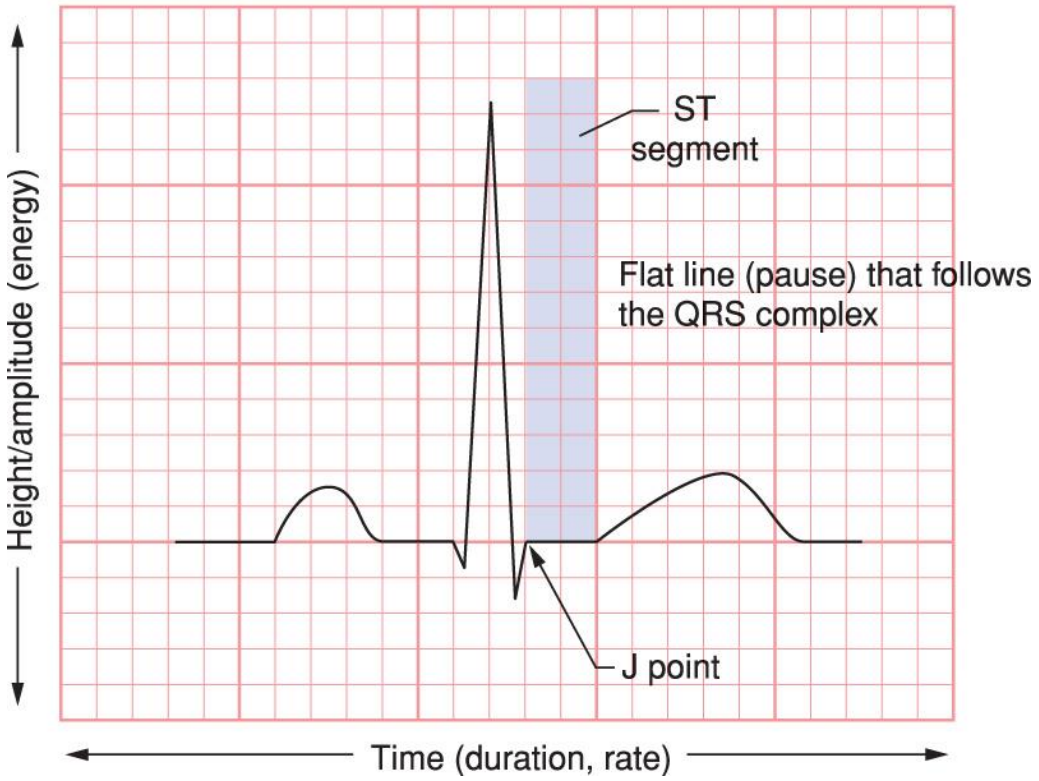
Q Wave

- First part of QRS complex
- First downward deflection from baseline



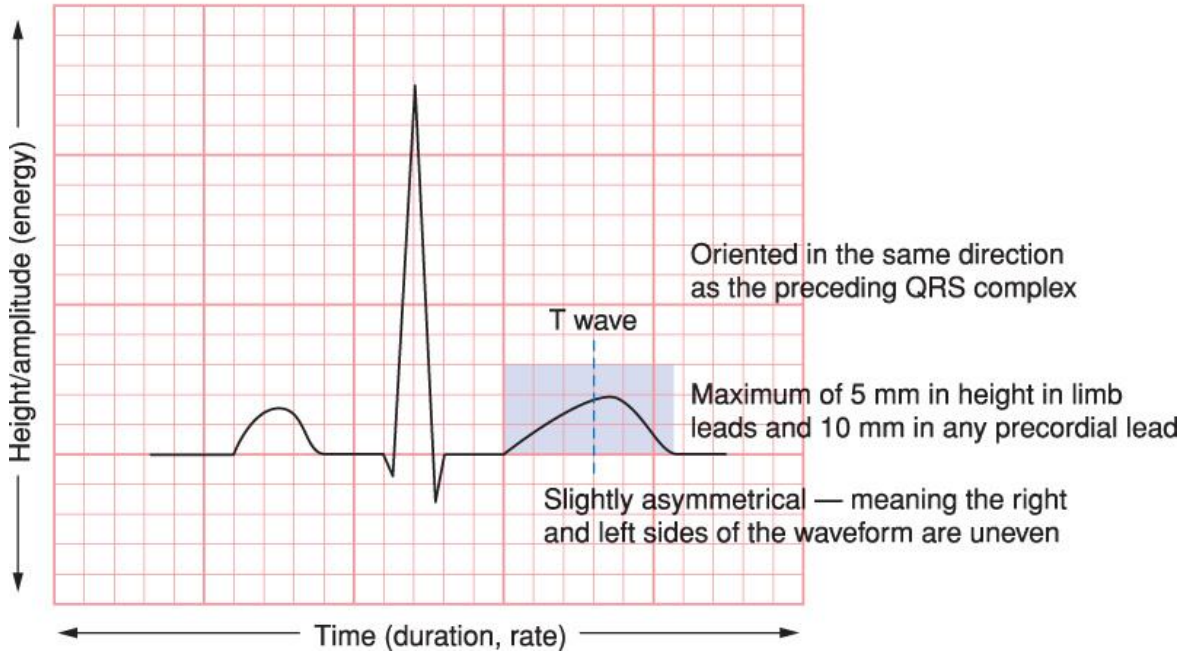
ST Segment

- Flat line that follows the QRS complex and connects it to T wave



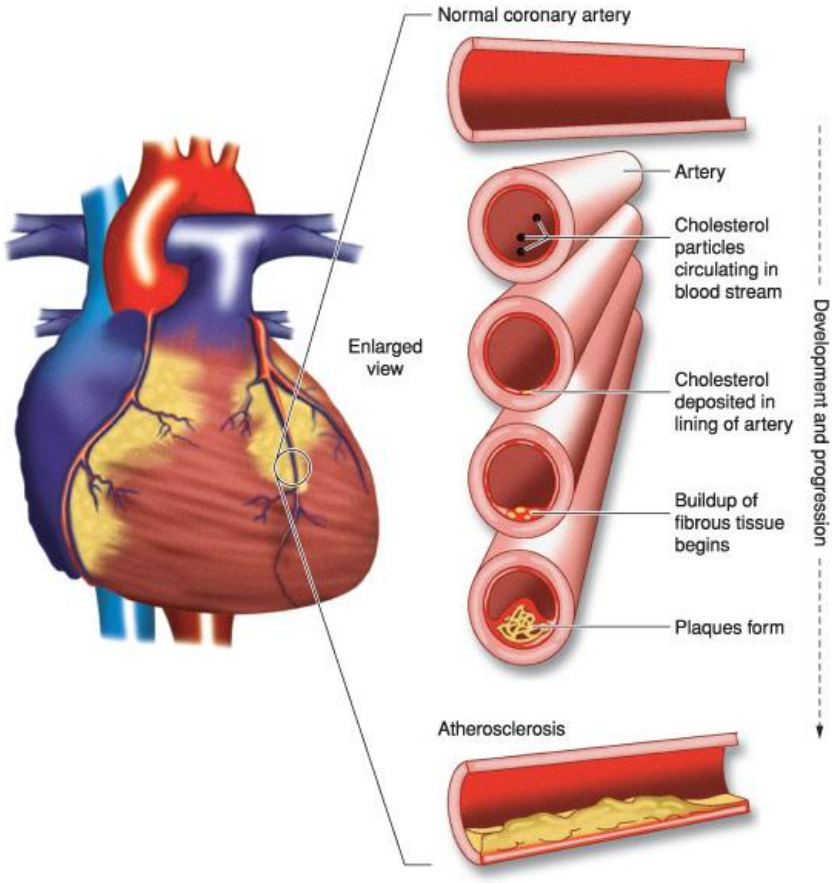
T Wave

- Slightly asymmetrical and oriented in same direction as preceding QRS complex



Ischemia, Injury, and Infarction

- Occurs with interruption of coronary artery blood flow
- Often a progressive process



I

A

Landscape of an MI

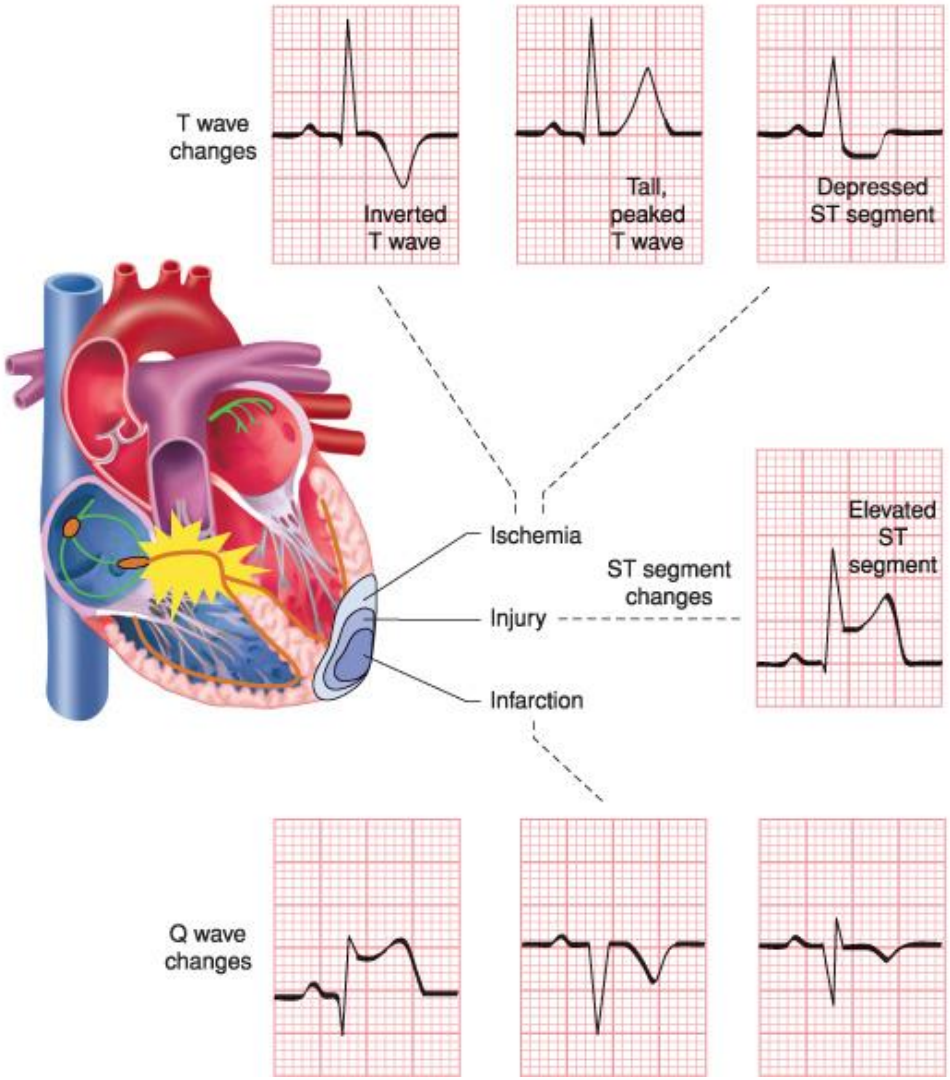
- Changes in the 12 lead that may indicate :
  - Ischemia
  - Injury
  - Infarct

- Must have changes in two or more contiguous leads

I Lateral	aVR	V1 Septal	V4 Anterior
II Inferior	aVL Lateral	V2 Septal	V5 Lateral
III Inferior	aVF Inferior	V3 Anterior	V6 Lateral

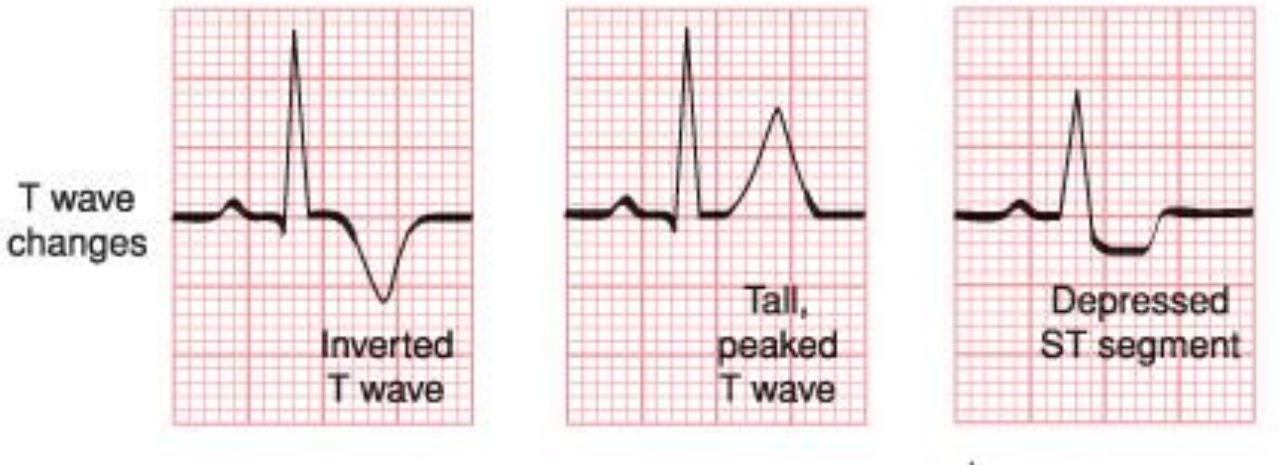
Diagram showing the contiguous leads in the same color

ECG Indicators



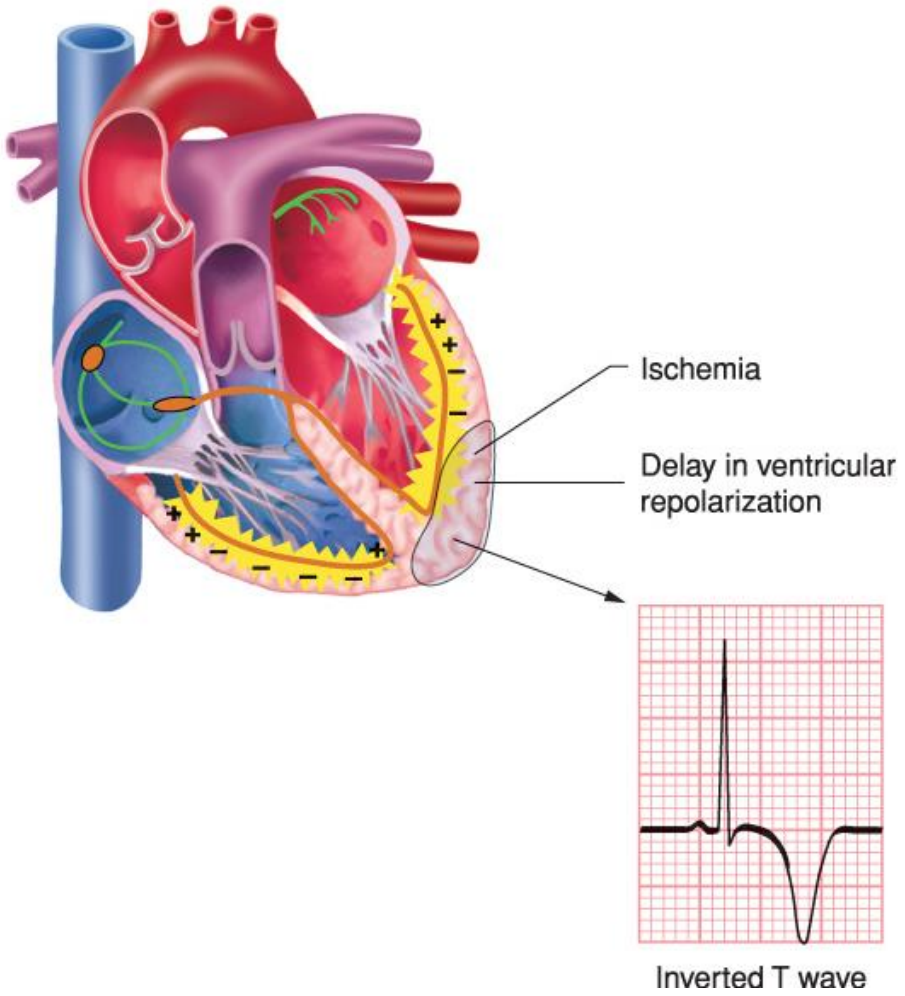
Myocardial Ischemia

- Characteristic signs:

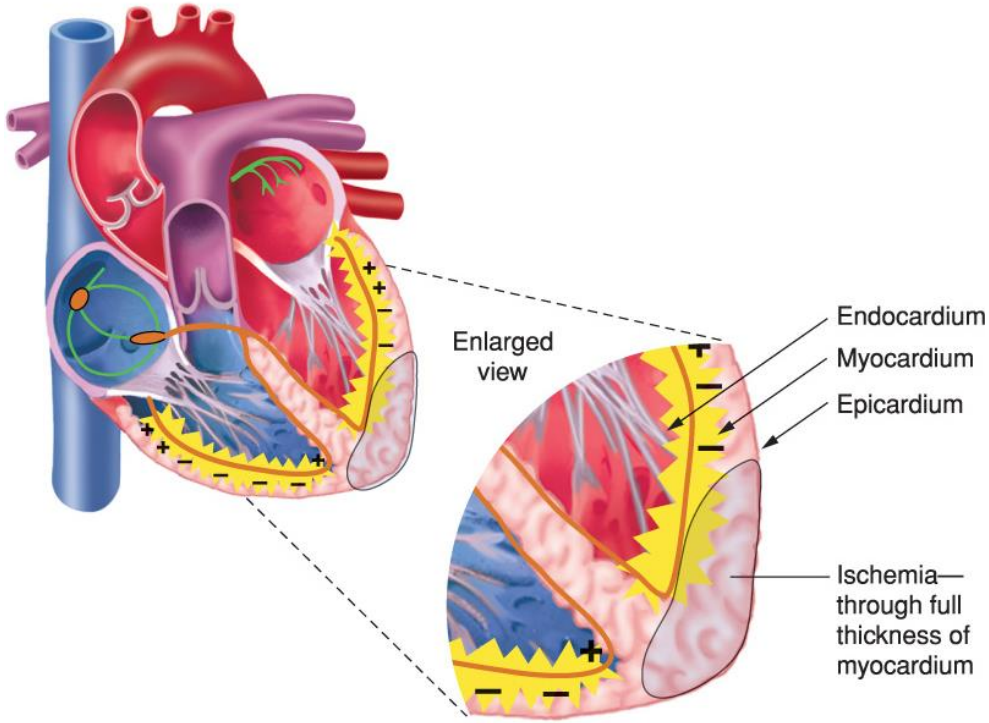


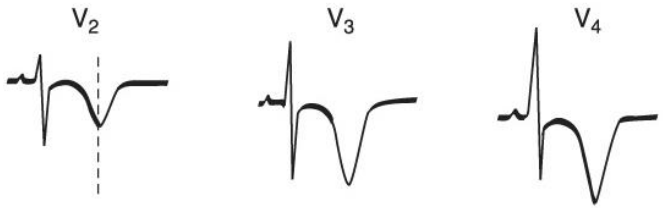
T Wave Inversion

- Occurs because ischemic tissue does not repolarize normally



T Wave Inversion



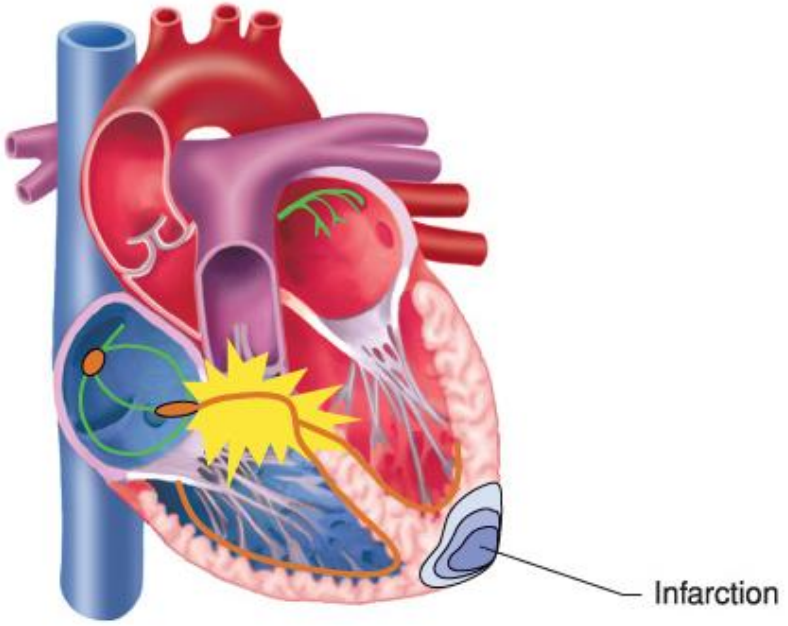


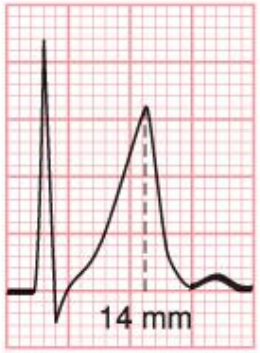
T wave is symmetrical — meaning the right and left sides of the waveform are the same size

I

Peaked T Waves

- May be seen in early stages of acute myocardial infarction
- Within a short time (two hours) T waves invert





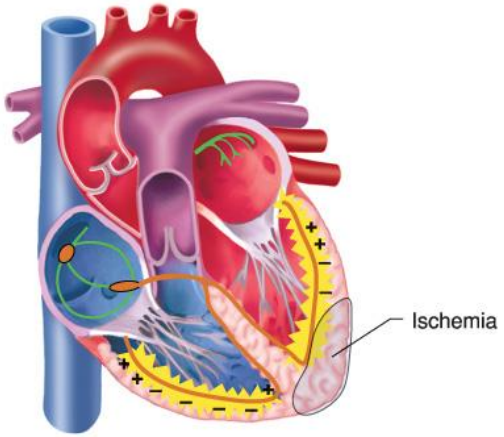
T wave is more than 6 mm high in limb leads and 12 mm in precordial leads

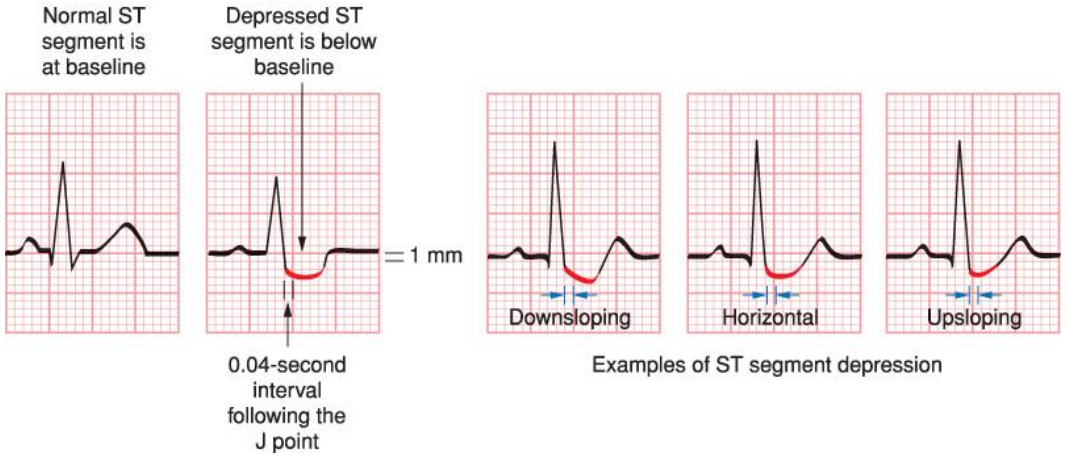
or

T wave is more than two-thirds the height of the R wave

ST Segment Depression

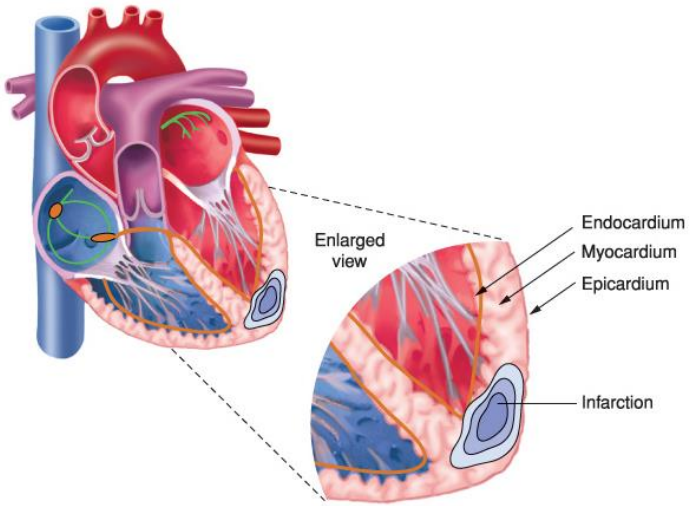
- May or may not include T wave inversion

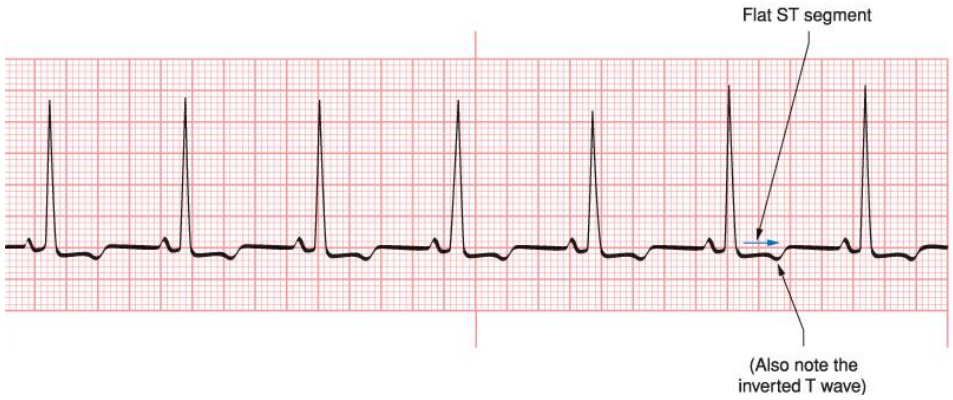




Flat ST Segment Depression

- Results from Non STEMI





Landscape of an MI

- **Ischemia:** T wave inversion

  ST segment depression

  – Other causes of T wave inversion

  Cardiac: BBB

  Ventricular hypertrophy

  Pericarditis

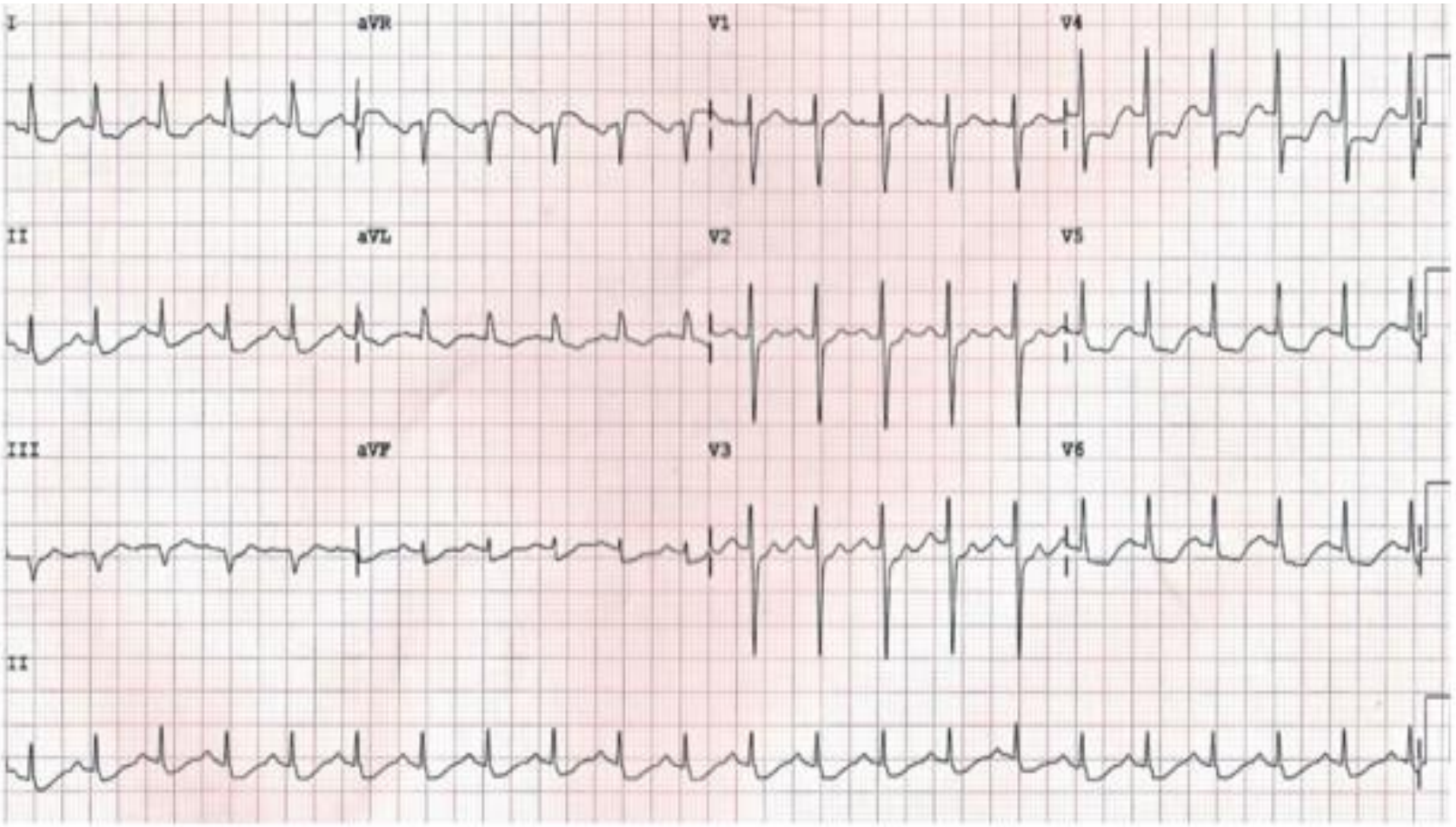
  Non-cardiac:

  Electrolyte disorders

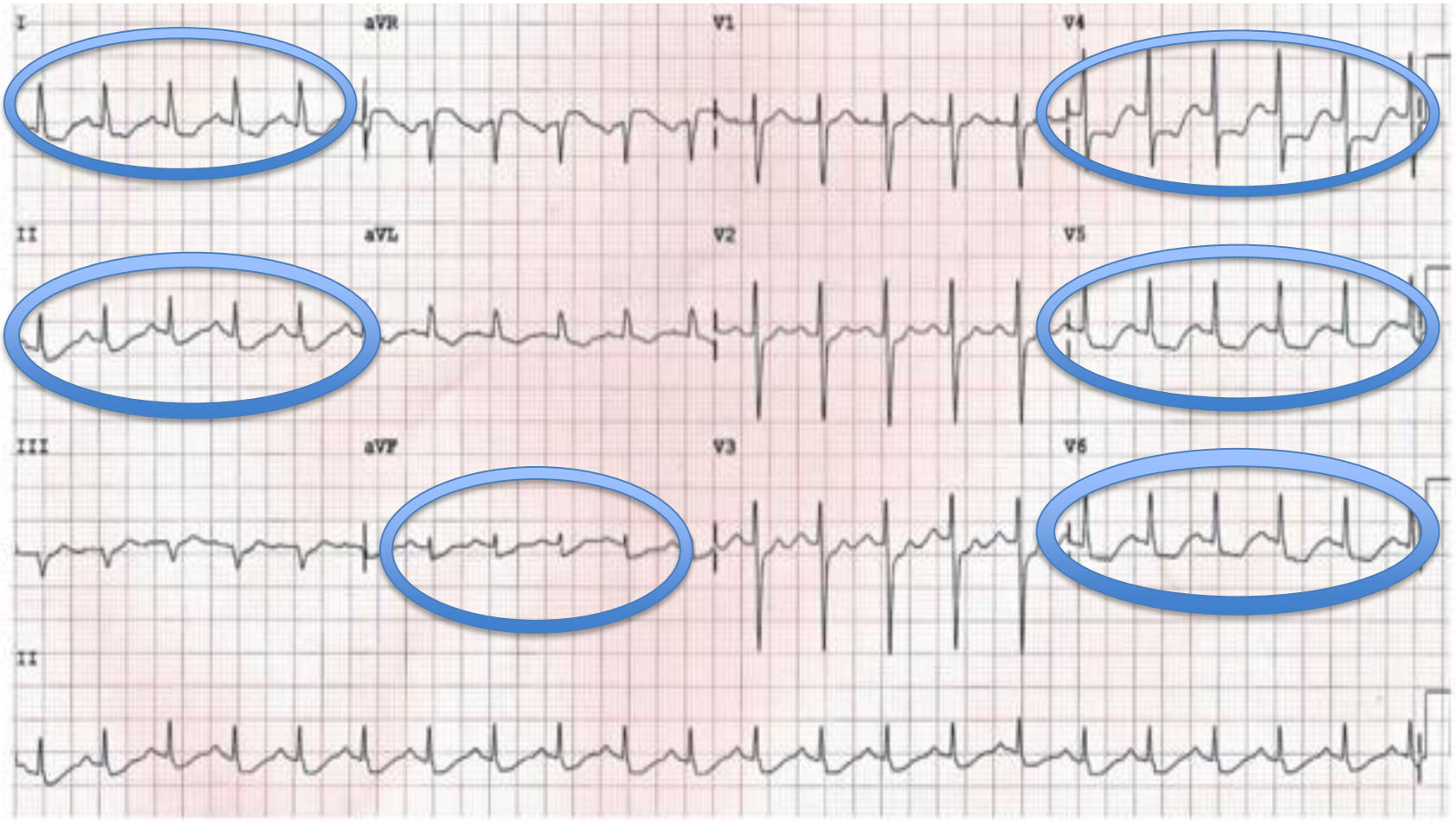
  Shock

  Positional changes

  CNS disorders(subarachnoid hemorrhage)

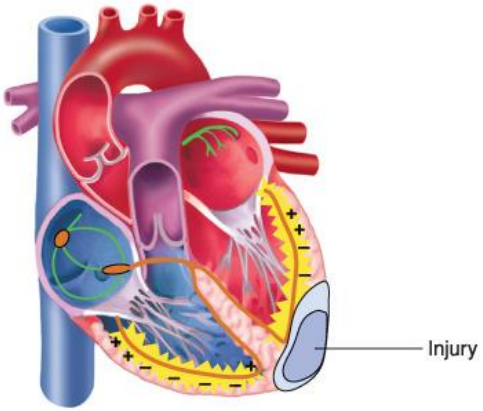

I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II

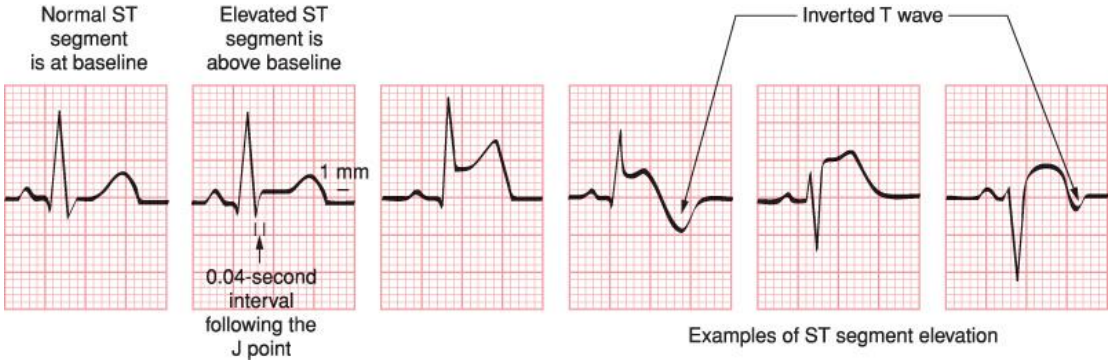
Inferior and Lateral Ischemia



ST Segment Elevation

- Earliest reliable sign that myocardial infarction has occurred





Landscape of an MI cont.

- Injury: ST elevation

  Indicates acute injury:

  1mm or > in limb leads

  2mm or> in precordial leads

  Other causes:

  Pericarditis

  Ventricular aneurysm

I Lateral	aVR	V1 Septal	V4 Anterior
II Inferior	aVL Lateral	V2 Septal	V5 Lateral
III Inferior	aVF Inferior	V3 Anterior	V6 Lateral

Diagram showing the contiguous leads in the same color

Landscape of an MI cont.

- Necrosis (infarction): Q wave

  Q wave: indicates dead tissue, results in a negative deflection. Significant or pathologic Q waves are wide and deep. A Q wave is at least 0.04 in duration(1mm) and 25% of the entire QRS complex.

  Other causes:

  Ventricular hypertrophy

  Diffuse myocardial disease

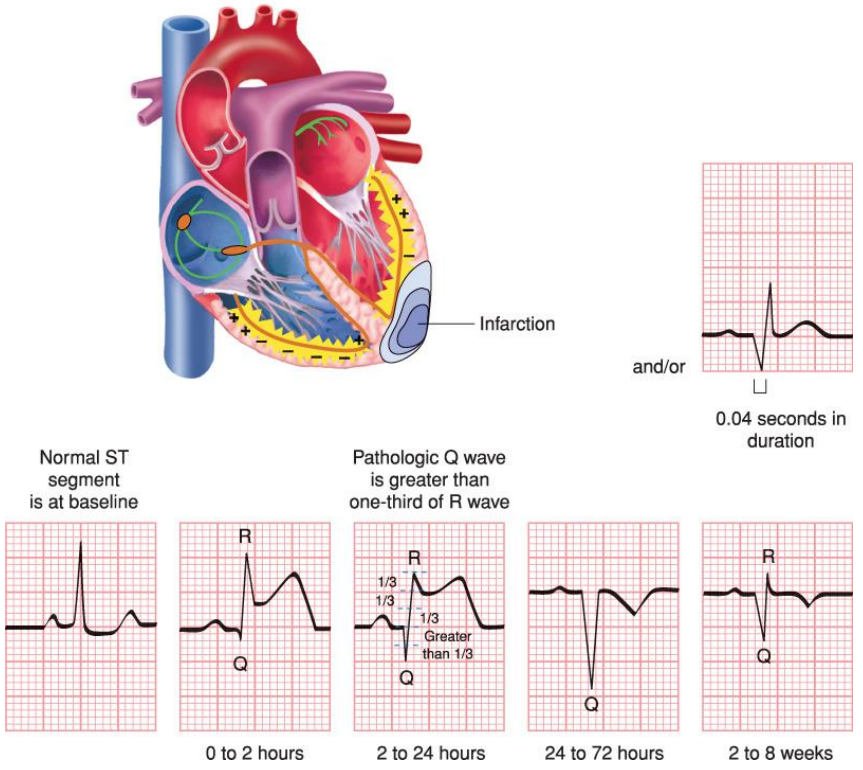
  Fascicular blocks

  Small Q waves may be present in presence of

  Non STEMI

Pathologic Q Waves

- Indicate presence of irreversible myocardial damage or myocardial infarction



Landscape of an MI cont.

- Myocardial ischemia
  - Results from temporary interruption of blood flow
  - Least acute phase
  - Electrically irritable, prone to dysrhythmias
  - Alters repolarization of ischemic cells
  - Appears on ECG as ST segment or T wave changes
  - Reversible with prompt treatment

Landscape of an MI cont.

- Myocardial Injury

  Results from prolonged interruption of oxygen and nutrients

  Causes tissue damage

  Appears on ECG as ST elevation > 1mm with or without loss of R wave

  Reversible with prompt treatment

Landscape of an MI cont.

- Myocardial Infarction
  - Results from cell destruction
  - Causes electrically inert tissue, non-conducted electrical impulses
  - Prevents depolarization/repolarazation of myocardial cells
  - ECG is abnormal with evidence of abnormal Q waves , ST or T wave abnormalities
  - Irreversible due to scar tissue

Landscape of an MI cont.

Diagnosis of infarcts

- Importance of lead grouping
  - Inferior wall MI: Leads II, III, aVF
  - High Lateral wall MI: Leads I, aVL
  - Low Lateral wall MI: Leads V5, V6
  - Anterior wall MI: V1-V4
  - Septal wall MI: V1, V2
  - Posterior wall MI: V7- V9, or mirror changes V1-V3
  - Right ventricular wall MI: V2R, V3R, V4R

Landscape of an MI cont.

Review Coronary Anatomy

- Right Coronary Artery
  - 55% supply to SA node
  - 90% supply to AV node
  - RA and RV
  - Posterior wall of left ventricle
  - Inferior wall of left ventricle
  - Posterior interventricular septum
  - Left posterior fasicle

Landscape of an MI cont.

Review Coronary Anatomy

- Left Anterior Descending
  - Anterior wall of left ventricle
  - Apex of heart
  - Anterior interventricular septum
  - RBB
  - LAF
  - LPF
  - Bundle of His

Landscape of an MI cont.

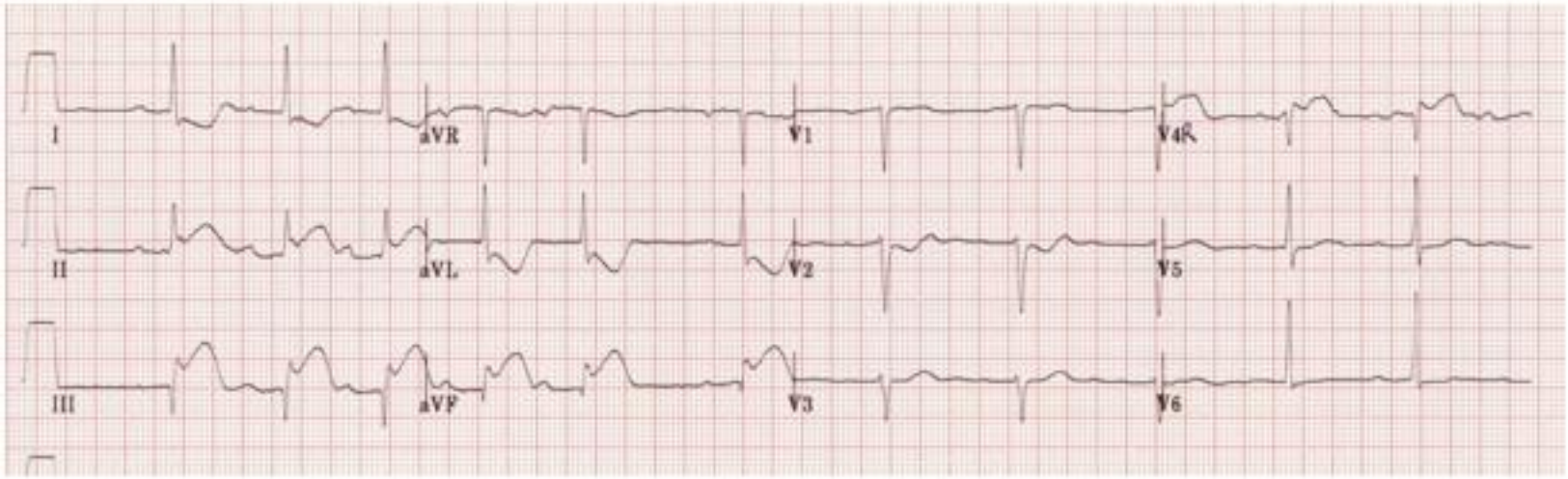
Review Coronary Anatomy

- Left Circumflex
  - 45% of blood SA node
  - 10% of blood to AV node
  - LA
  - Lateral wall of left ventricle
  - Posterior wall of left ventricle
  - Small percentage of population the CX is dominant and supplies the entire left posterior ventricle and interventricular septum

Landscape of an MI
Most common and complications

- Inferior MI
  - Leads II, III, aVF
  - Characterized first by hypodynamic response (bradycardia and hypotension)
  - Transient AV HB
  - Papillary muscle dysfunction leading to Valvular insufficiency
  - CHF
  - A-Fib/A-Flutter
  - Increase parasympathetic tone

What is your diagnosis?



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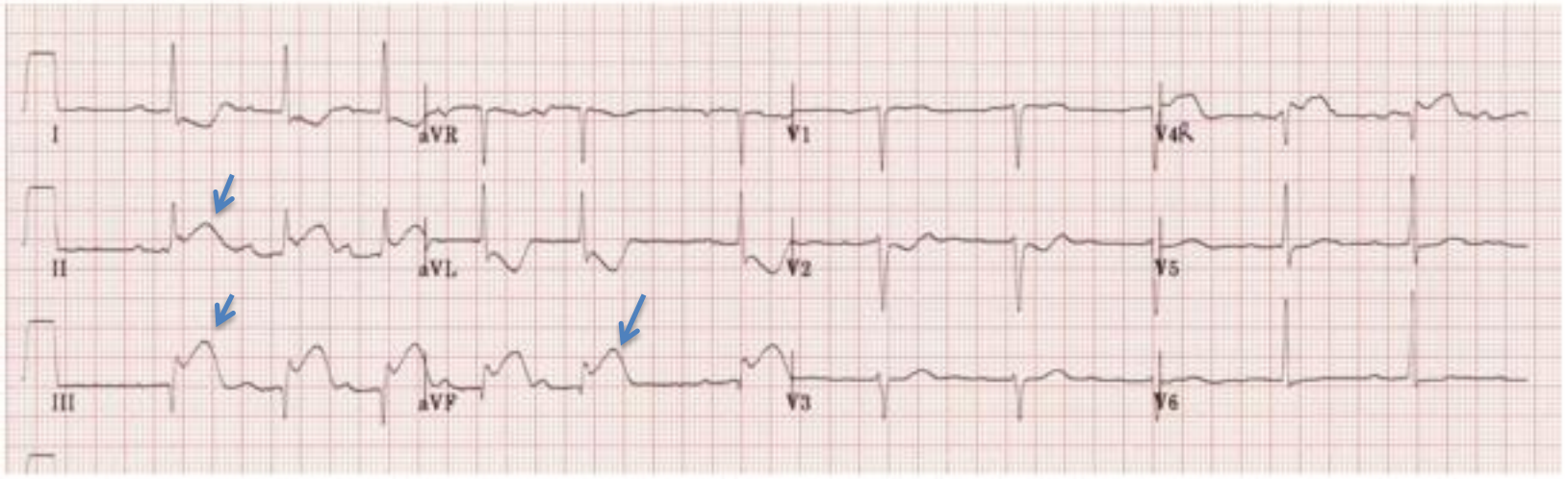
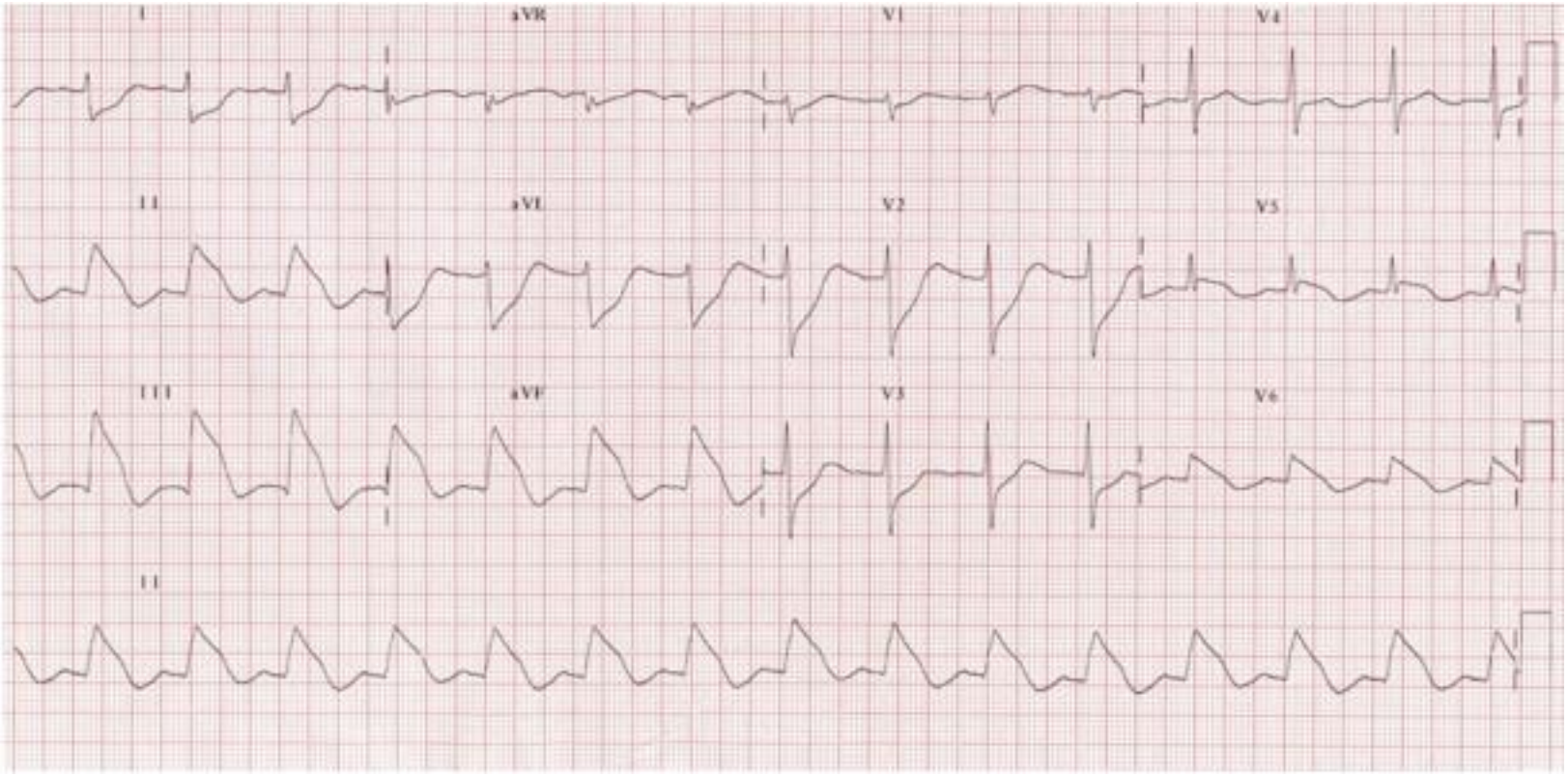
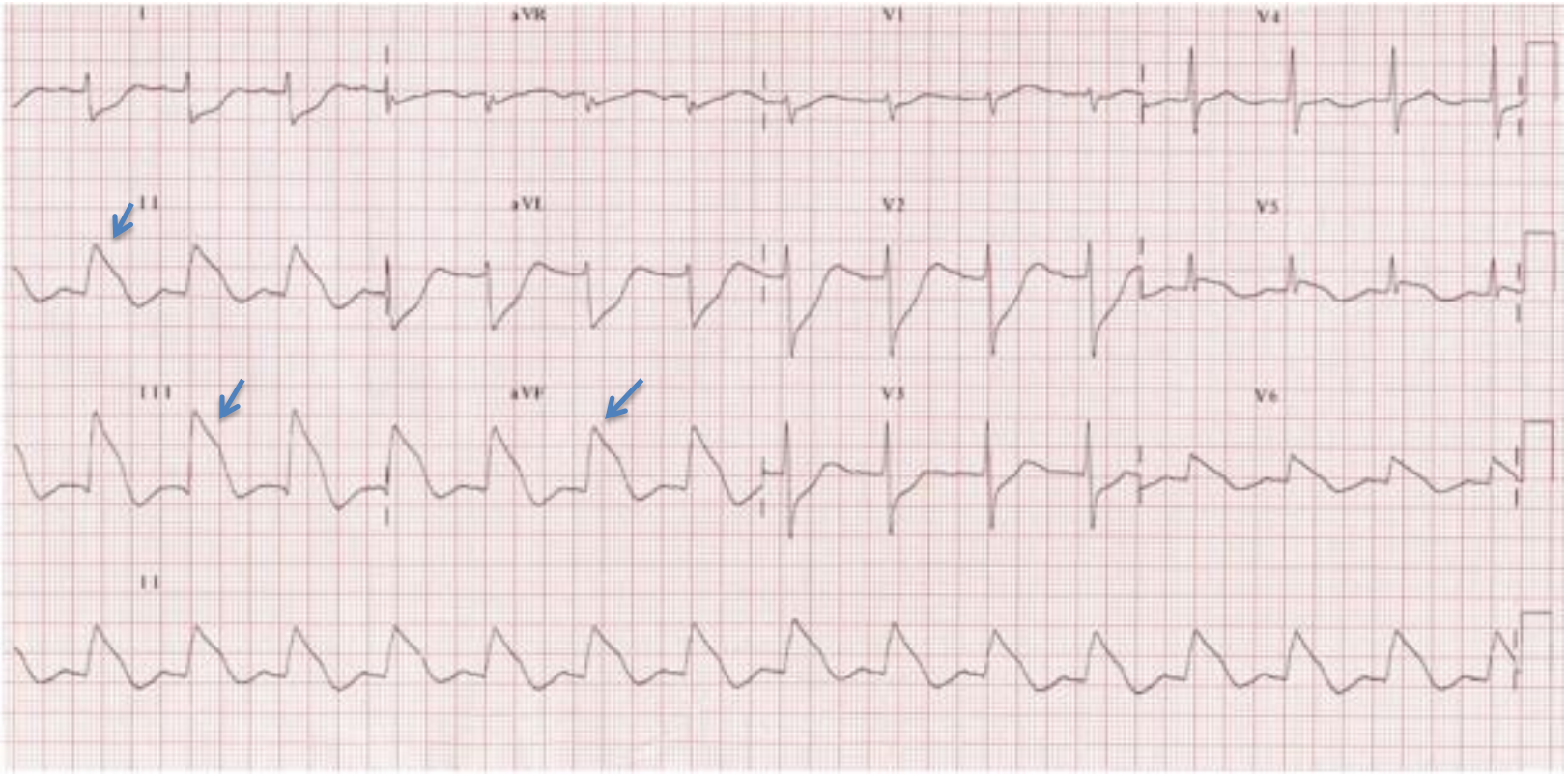


Acute Inferior Wall MI

What is your diagnosis?

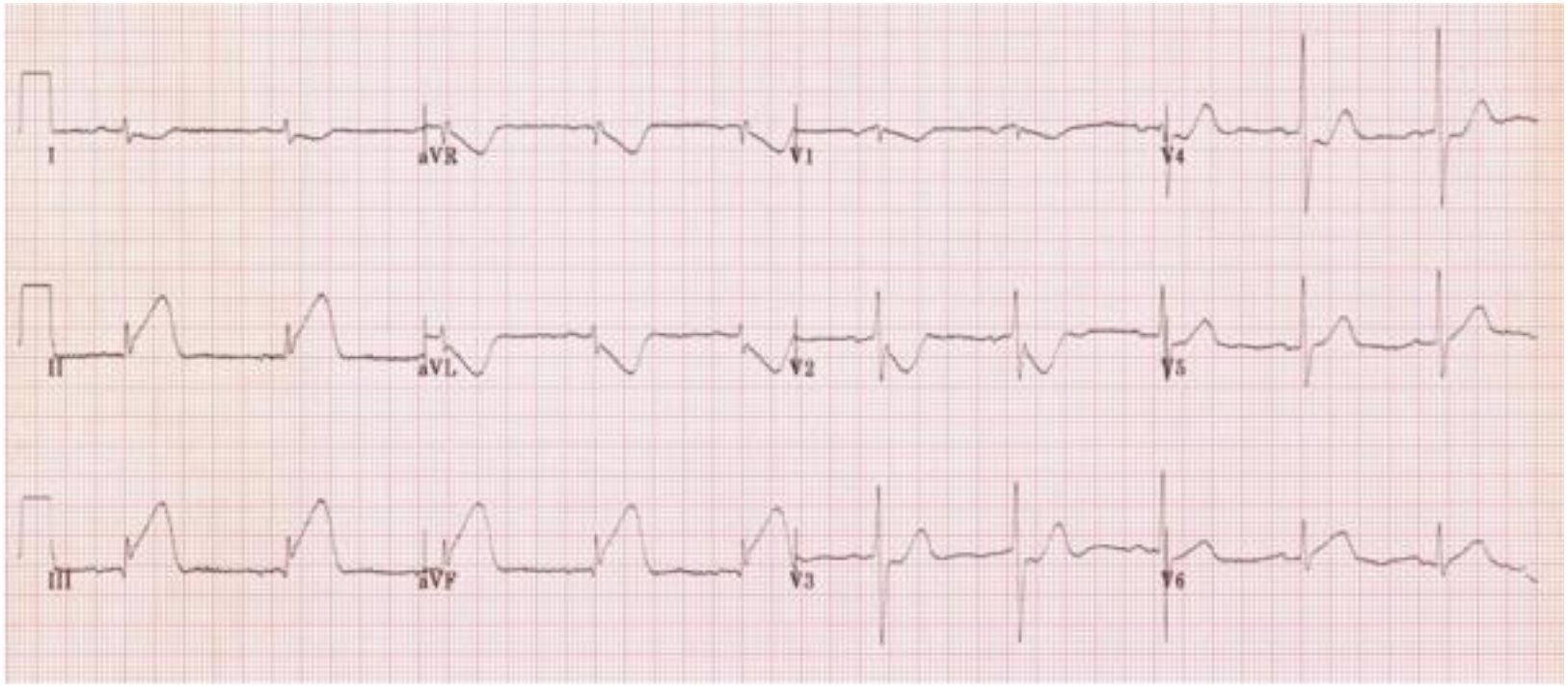


What is your diagnosis?

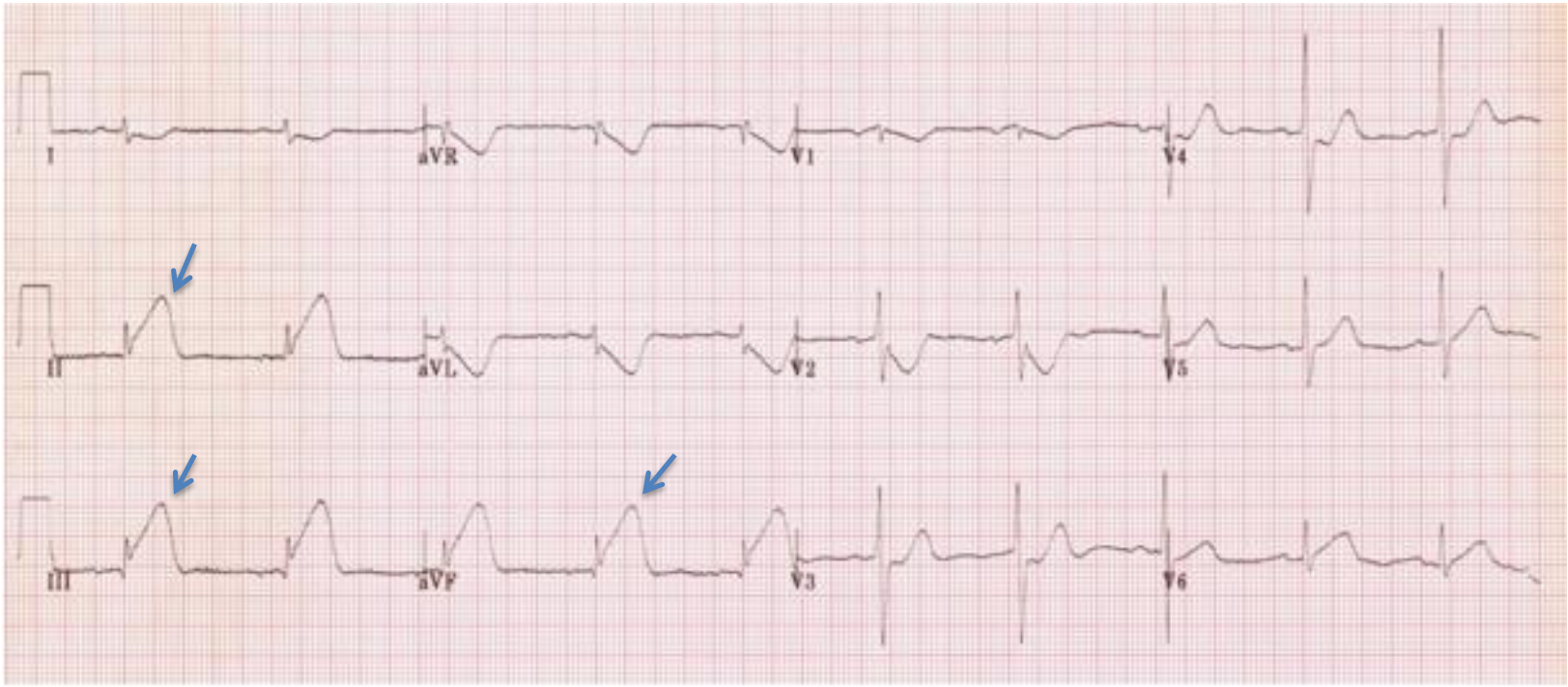


Acute Inferior lateral MI

What is your diagnosis?



What is your diagnosis?

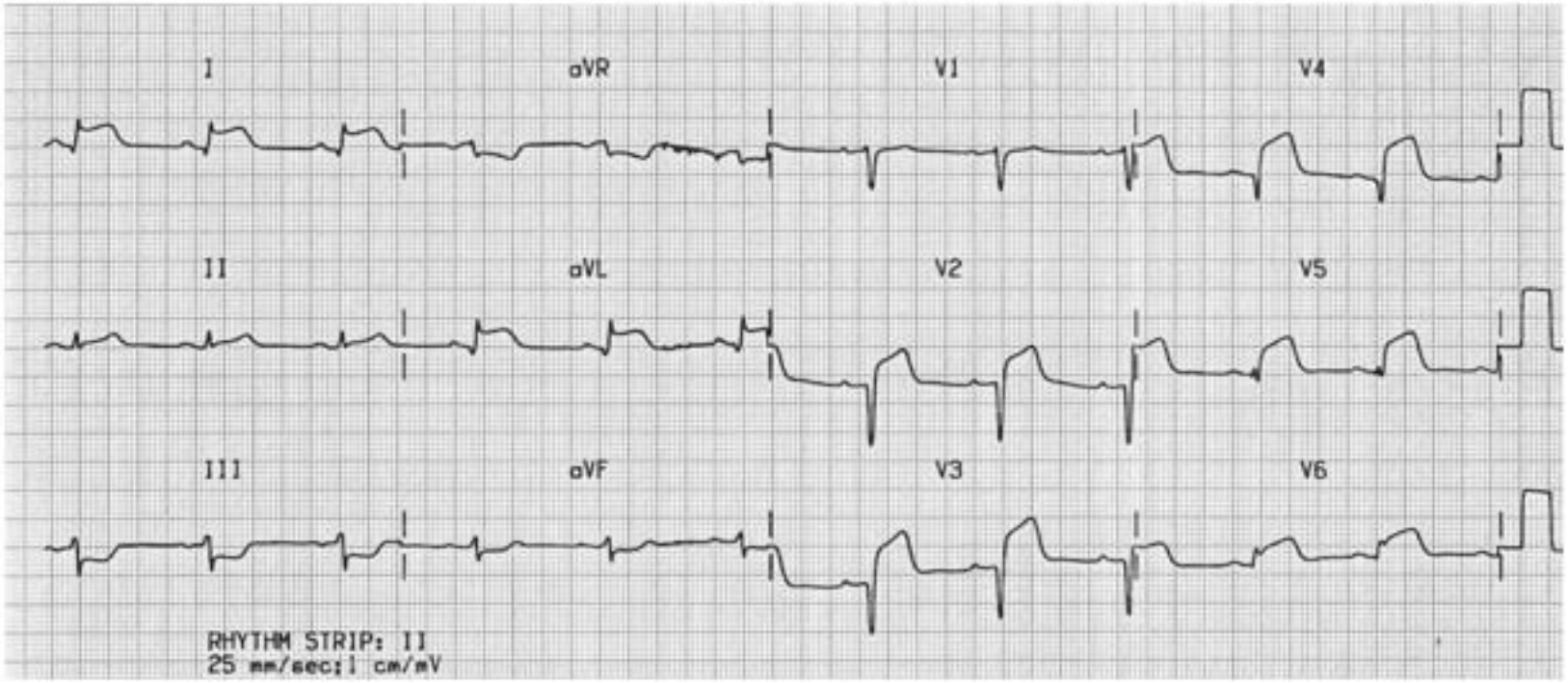


Acute Inferior MI

Landscape of an MI
Most common and complications

- Anterior MI
  - Hyperdynamic response (tachycardia and hypertension)
  - Decreased LV Function
  - CHF
  - Pulmonary Edema
  - Cardiogenic shock
  - Multifascicular BBB and AV blocks
  - Ventricular aneurysm
  - Increased sympathetic stimulation
  - Leads V1-V4

What is your diagnosis?



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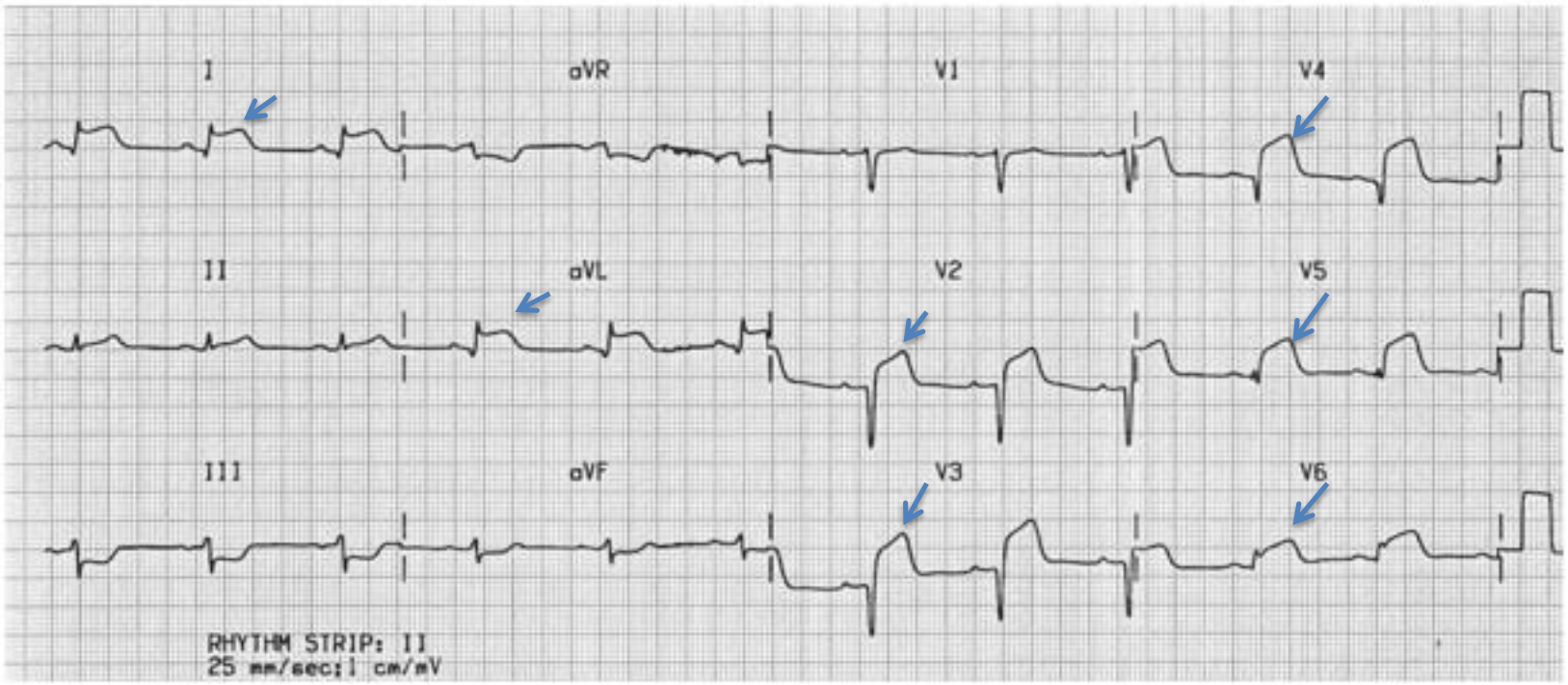
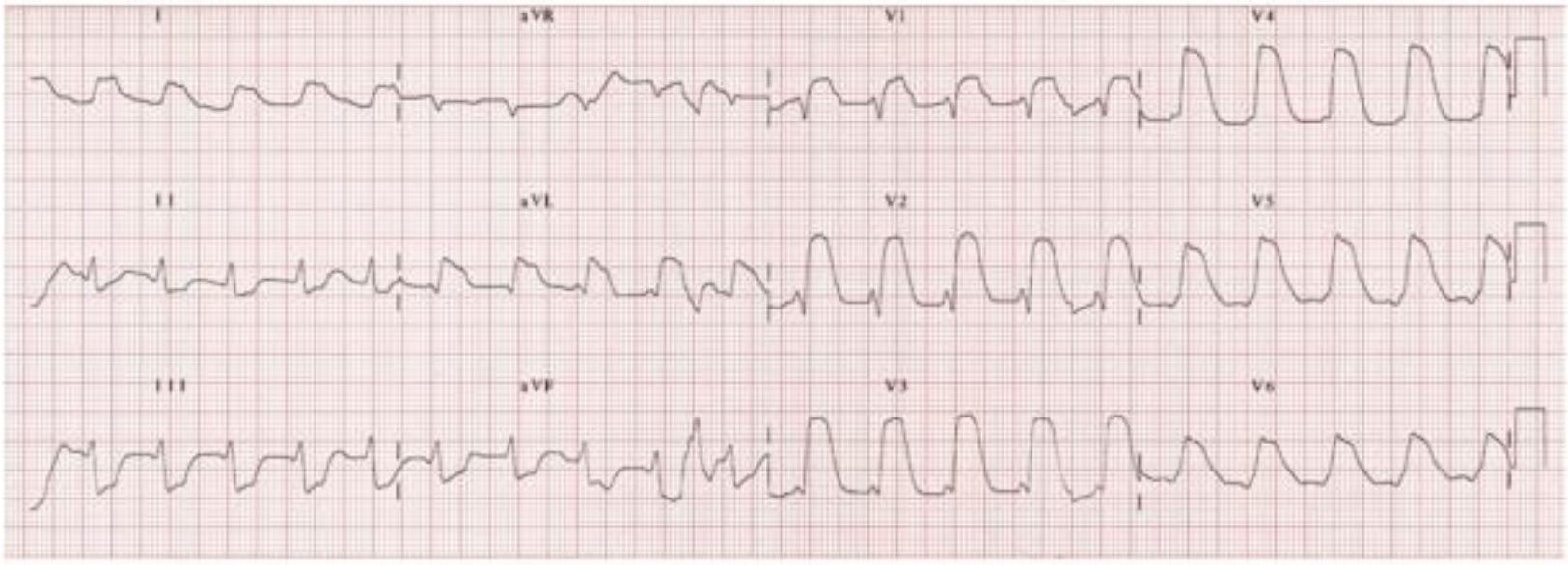
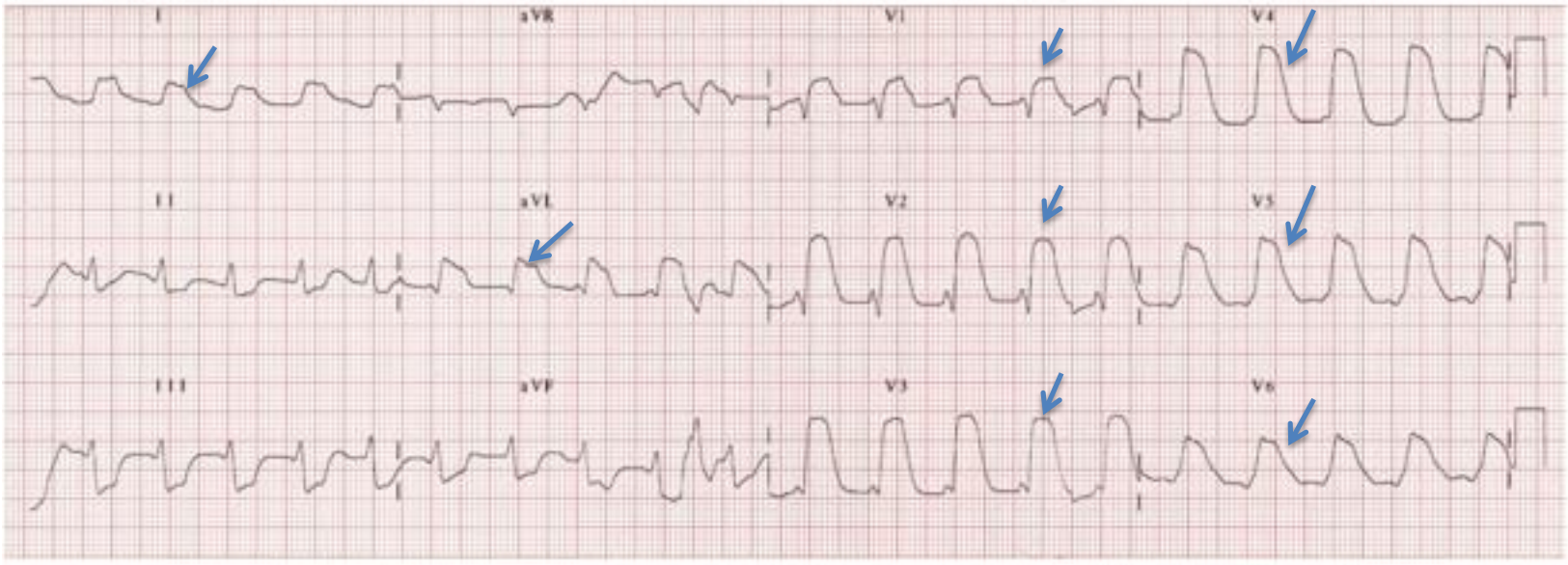


Acute Anterior Lateral MI

What is your diagnosis?

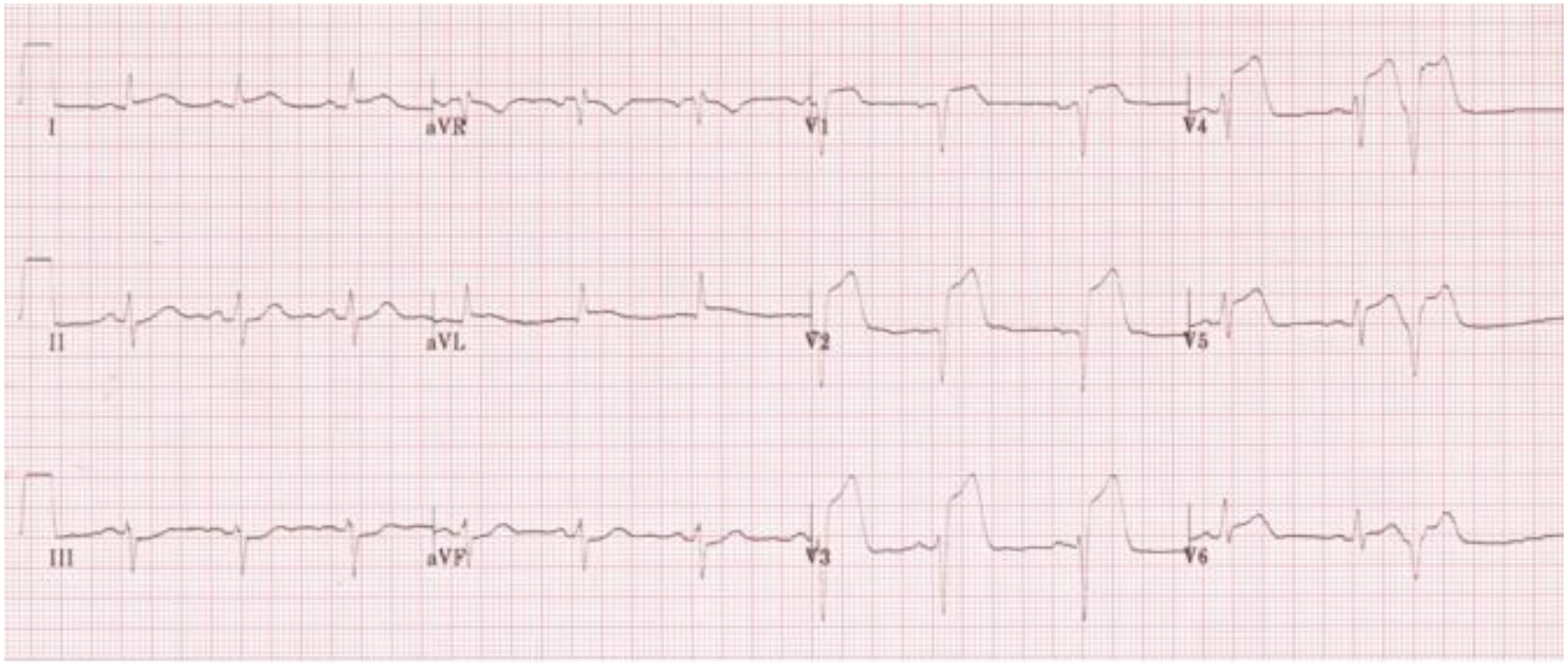


What is your diagnosis?

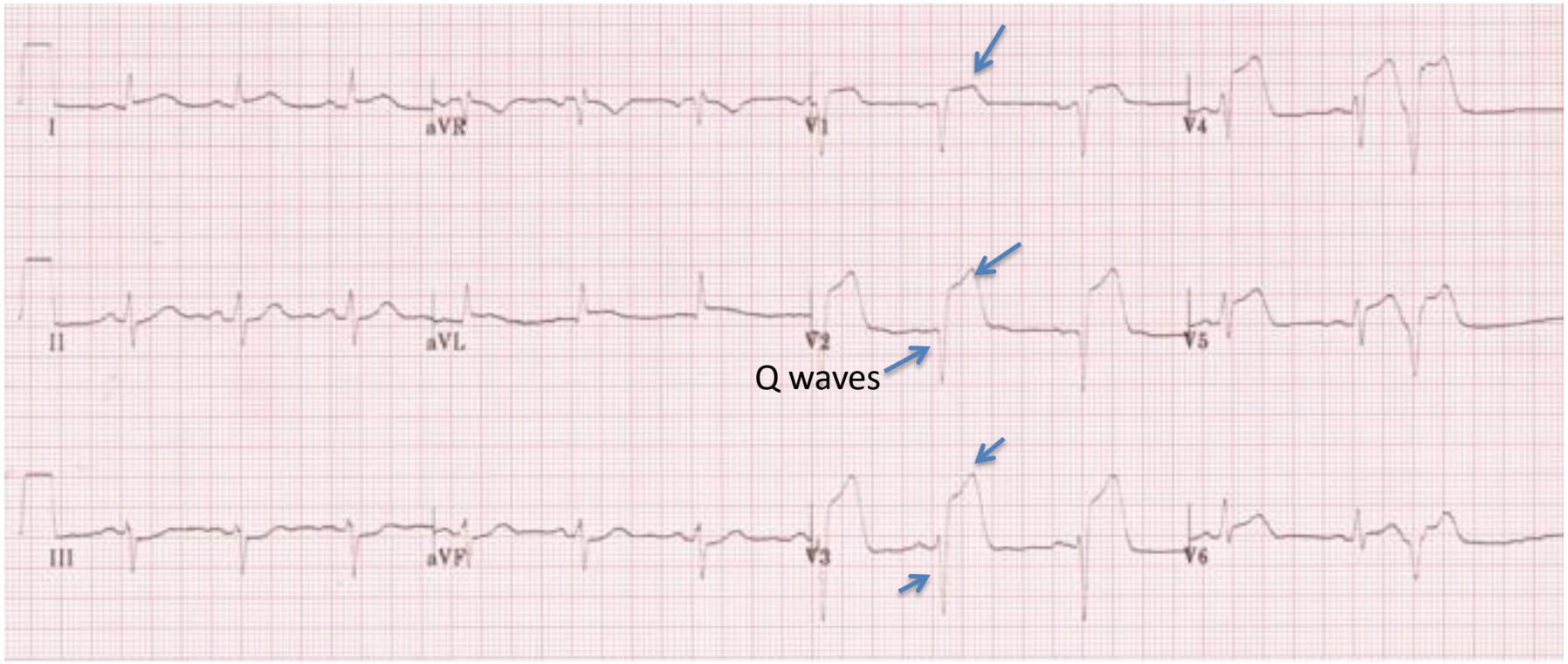


Acute Anterior Lateral MI with Tombstone T waves

What is your diagnosis?

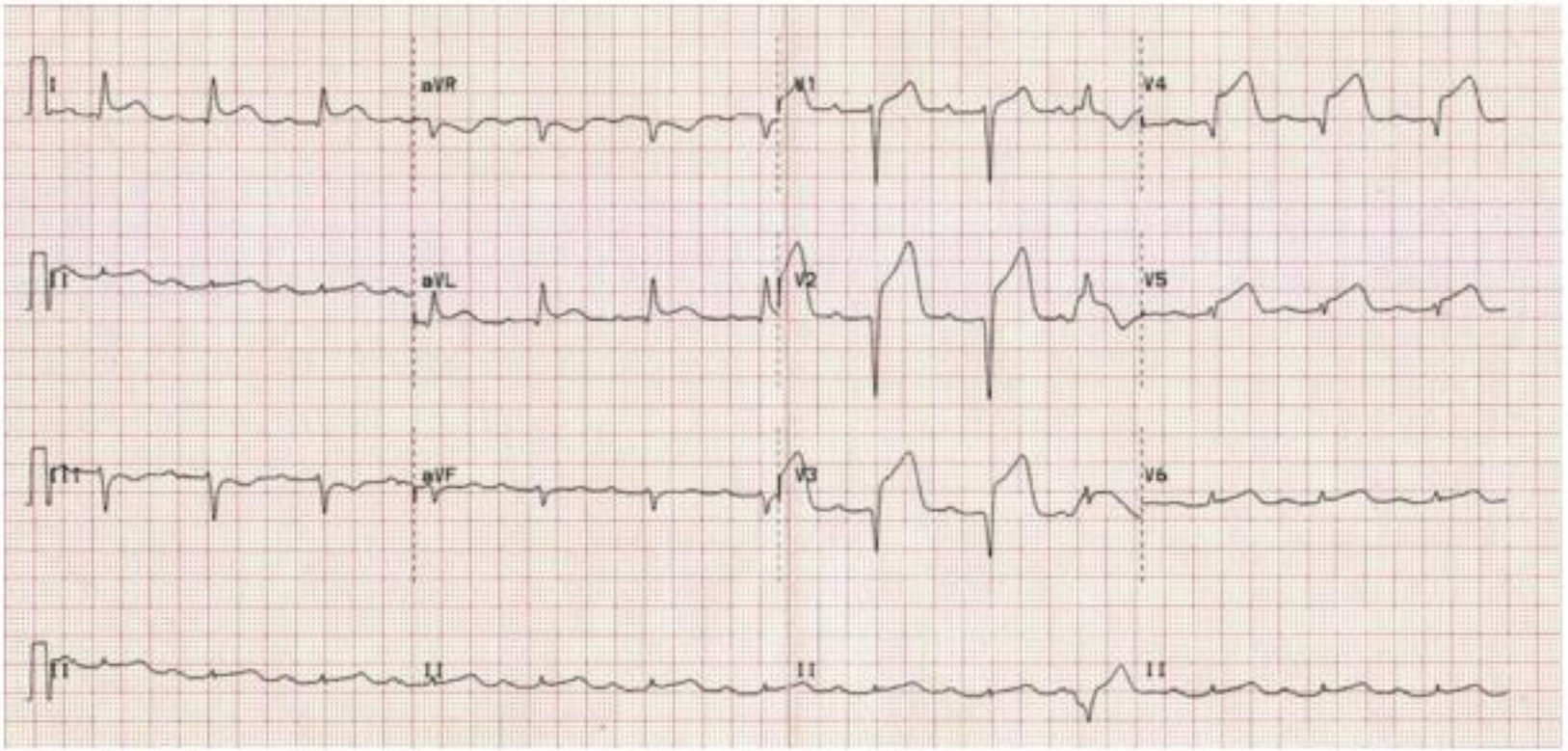


What is your diagnosis?

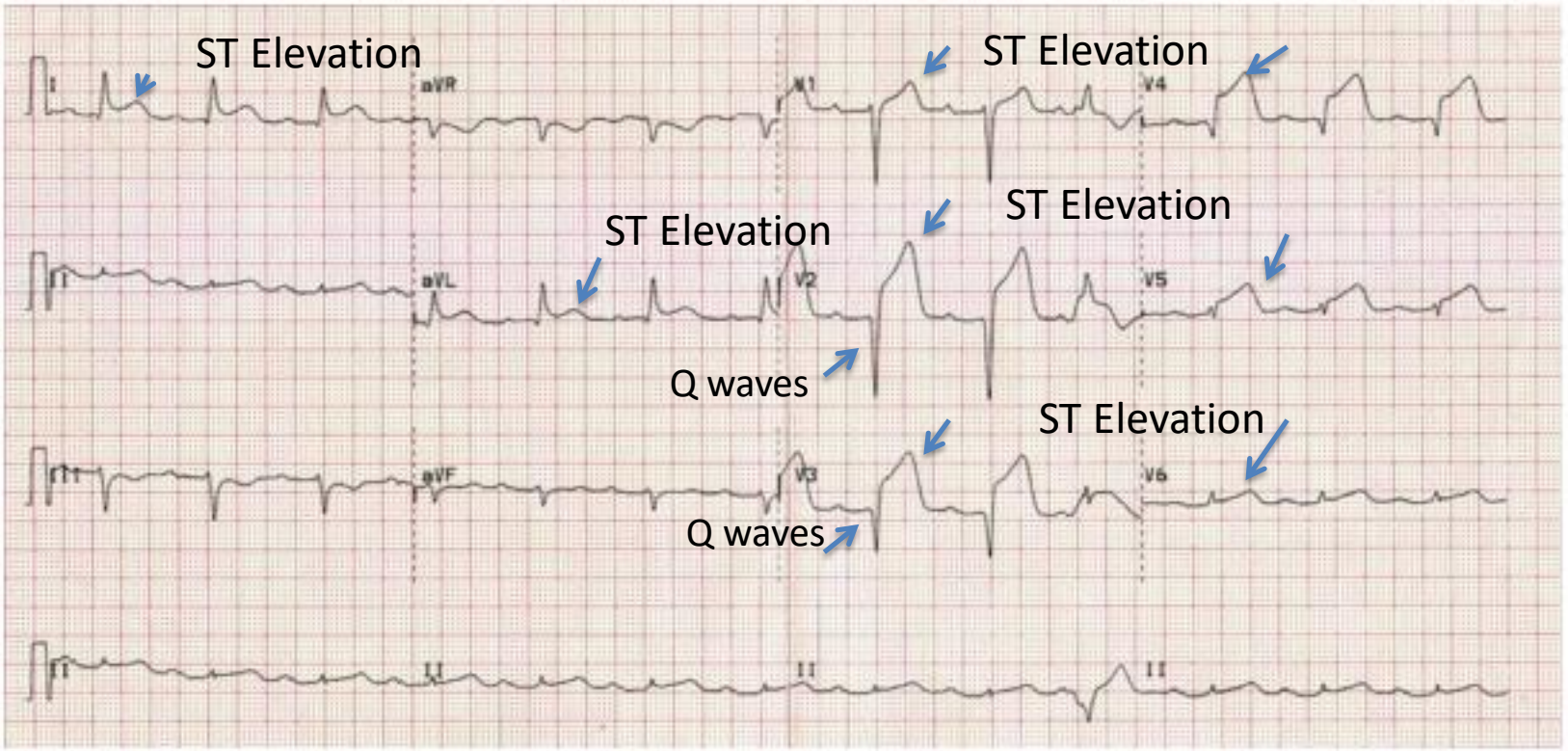


Acute Anterior MI with q waves in V1, V2, V3, V4

What is your diagnosis?



What is your diagnosis?

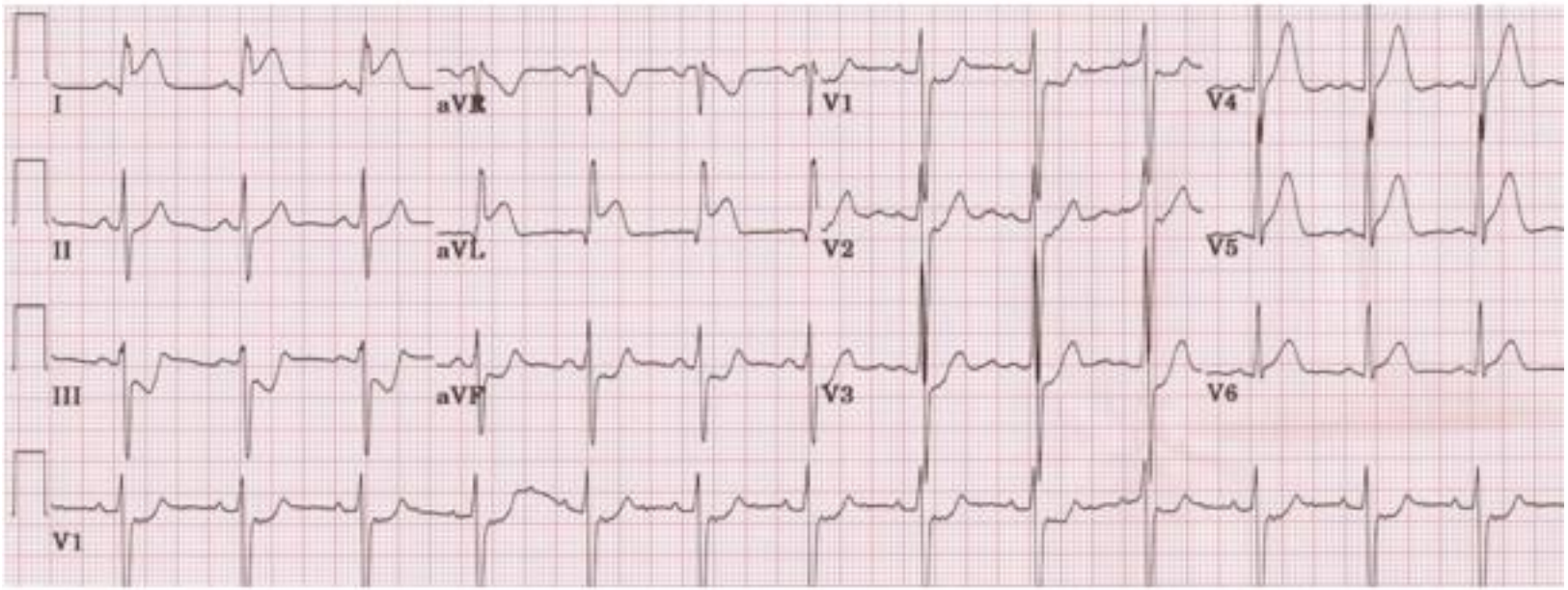


Acute Anterior Lateral MI with q waves in V1-V4

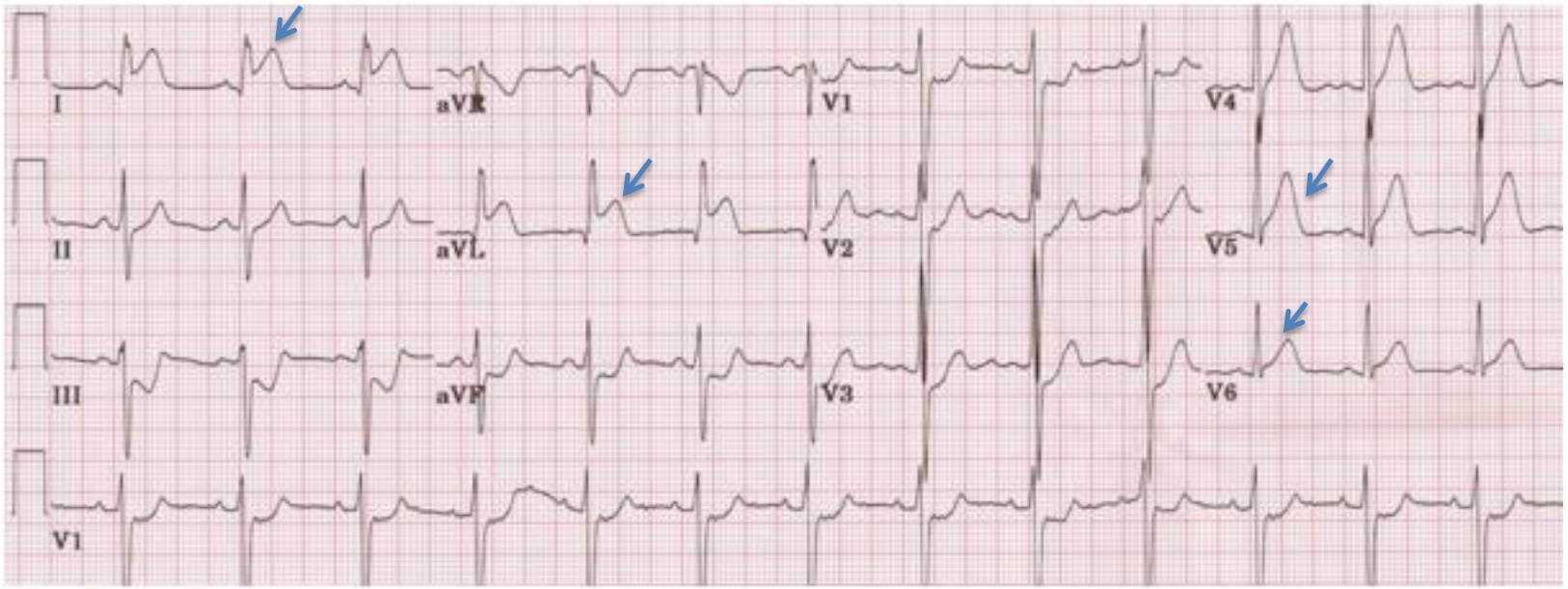
Landscape of an MI
Most common and complications

- Lateral Wall MI
  - 1st and 2nd degree blocks
  - CHF
  - Atrial arrhythmias
  - Posterior wall involvement
  - Changes in Leads I, aVL, V5, V6
  - Reciprocal Changes II, III, aVF

What is your diagnosis?

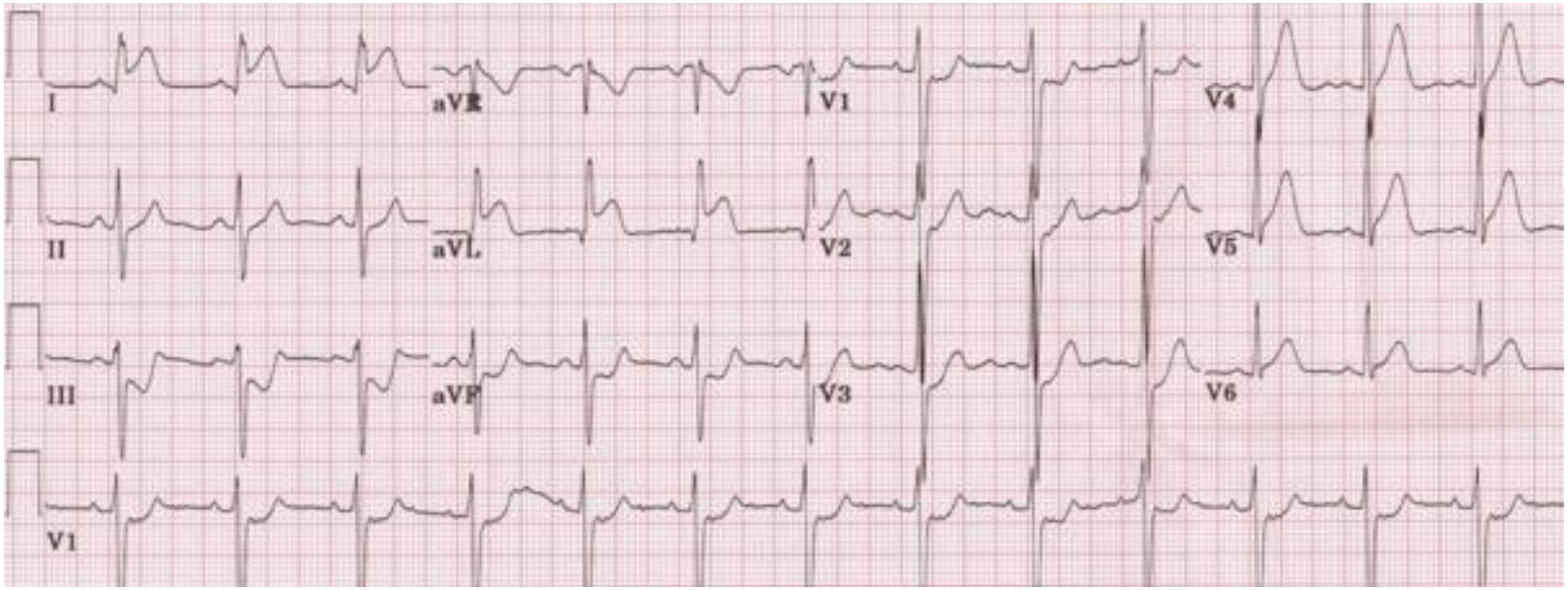


What is your diagnosis?



Acute Lateral MI with reciprocal changes in inferior anterior leads

What is your diagnosis?



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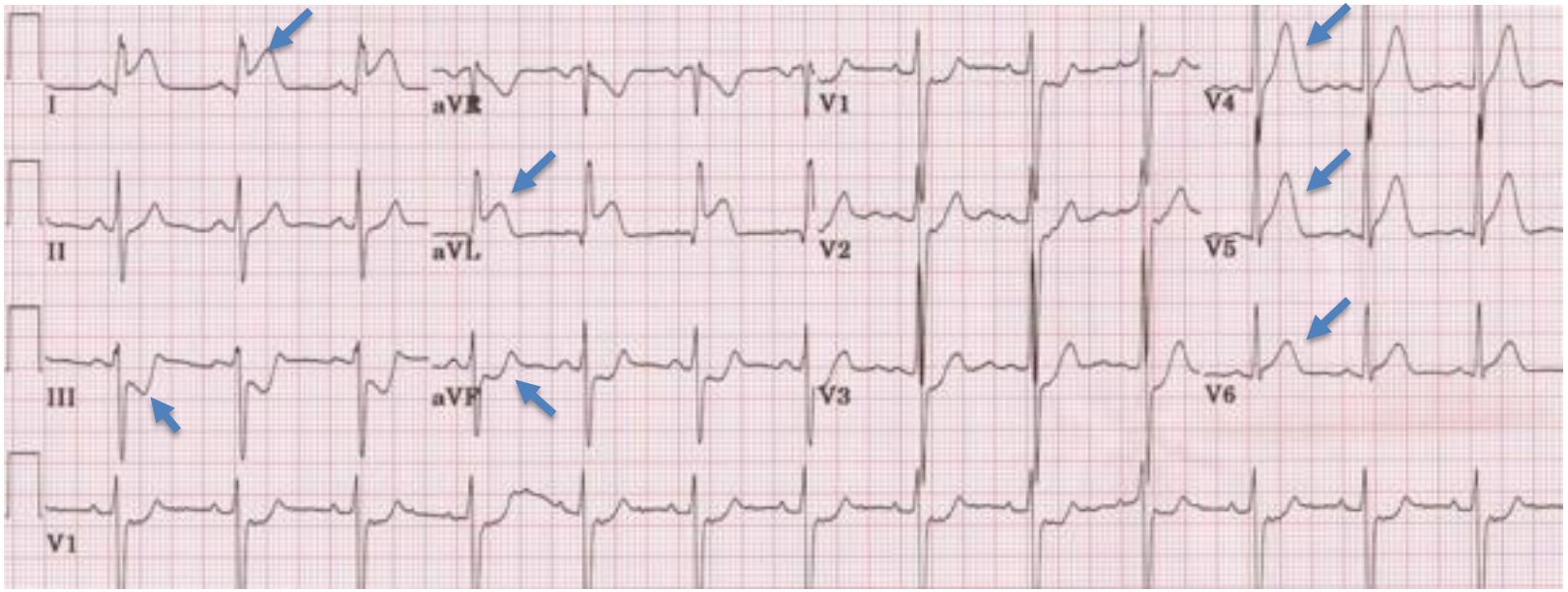
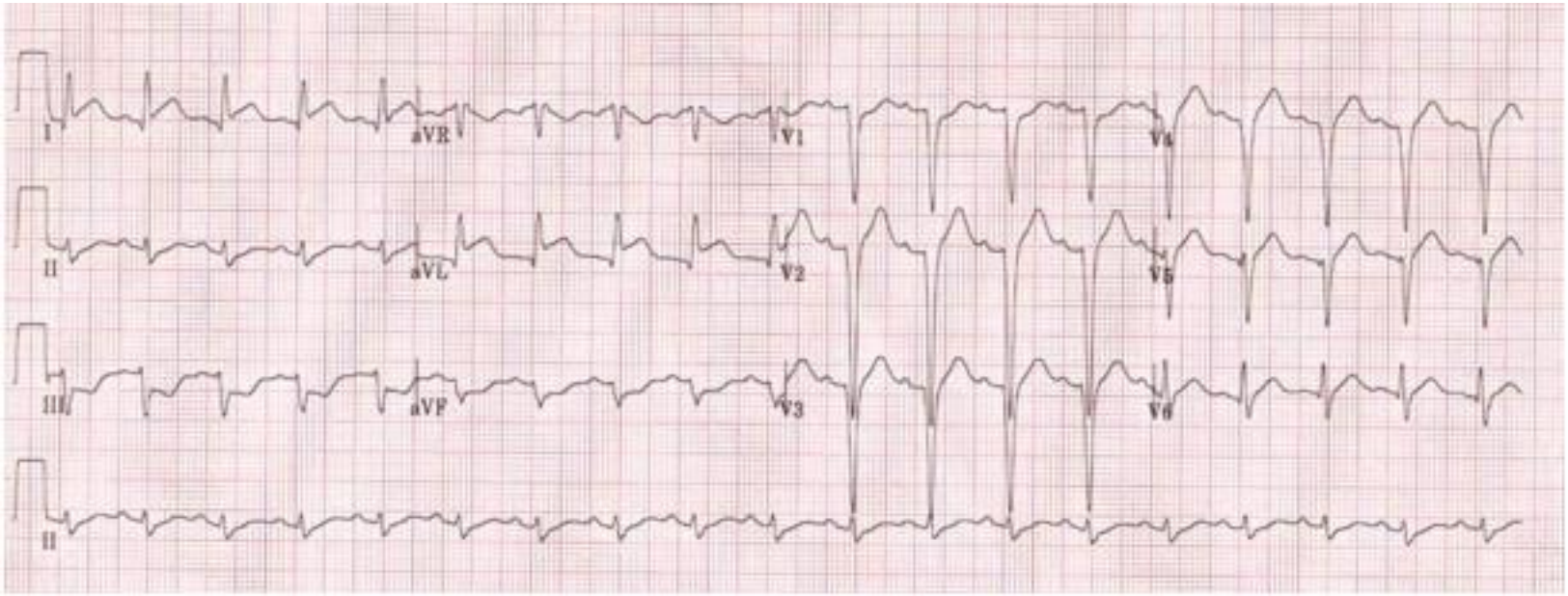
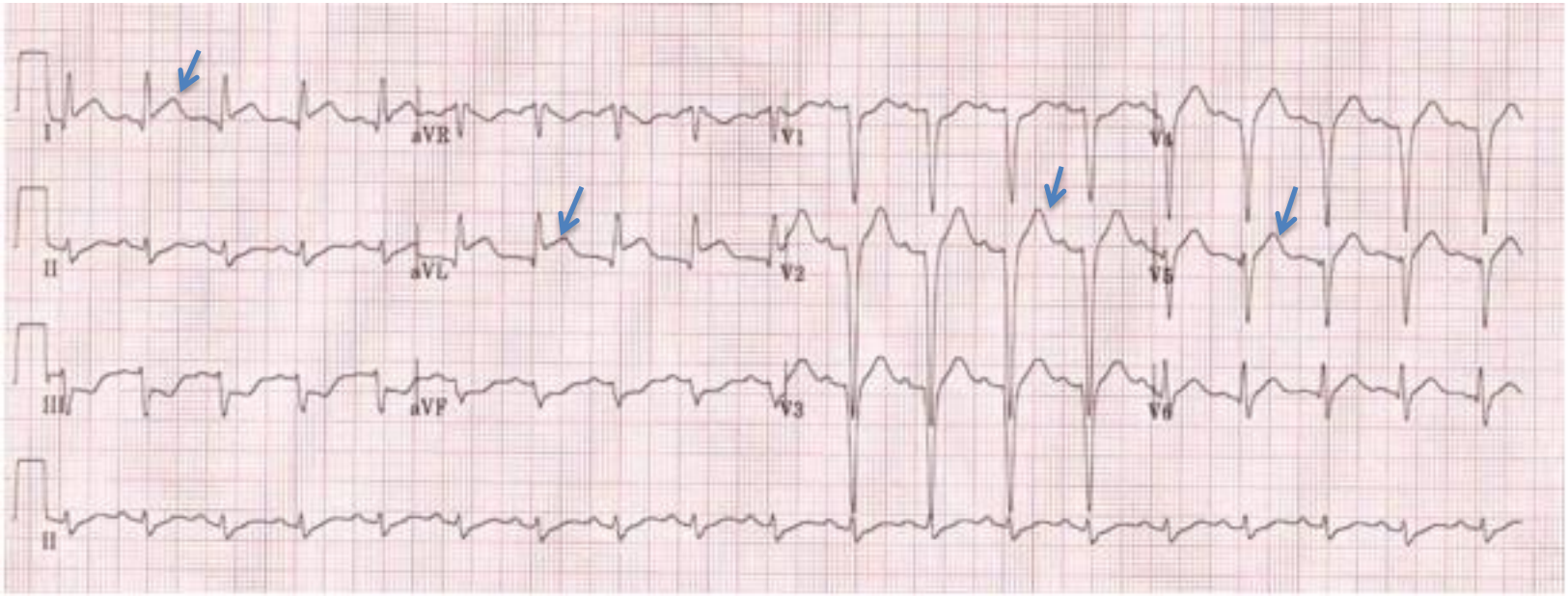


Acute Lateral MI with reciprocal changes inferiorly

What is your diagnosis?

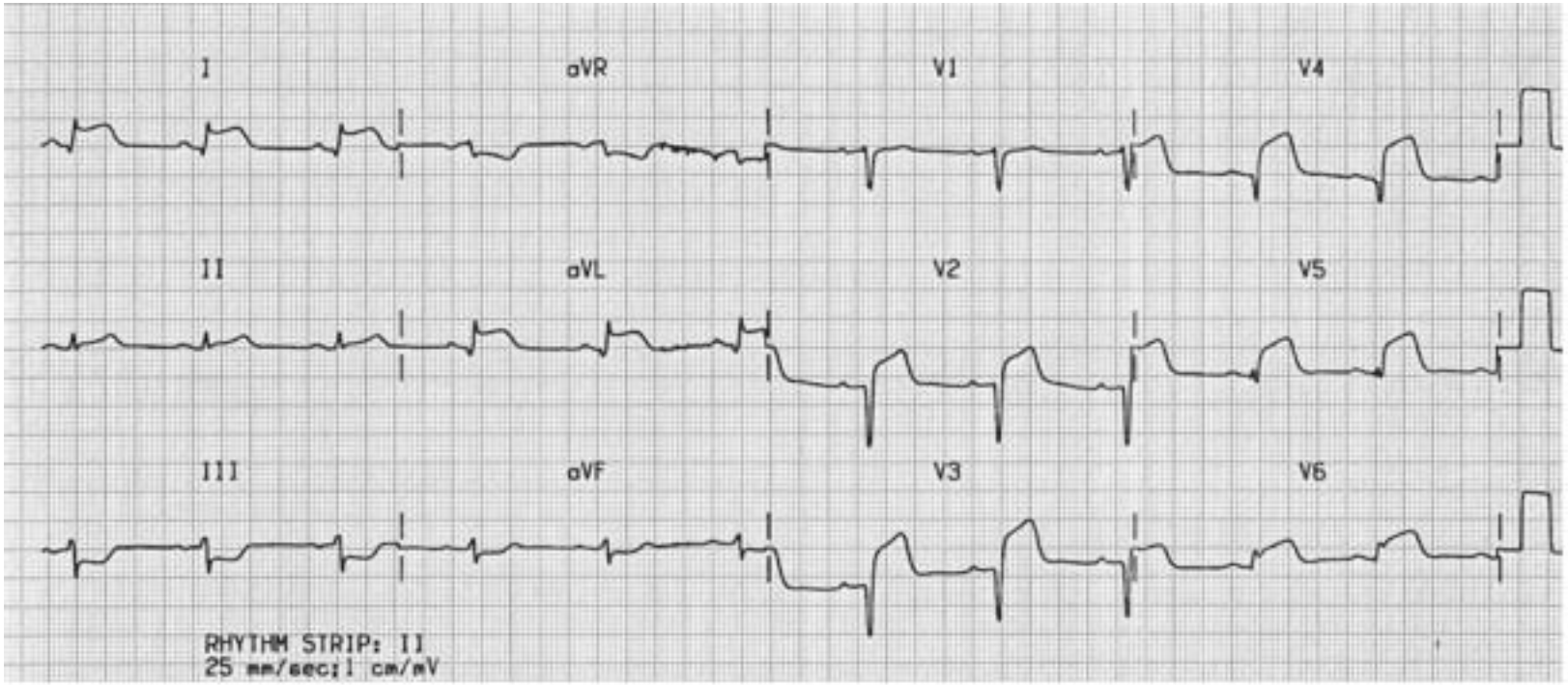


What is your diagnosis?

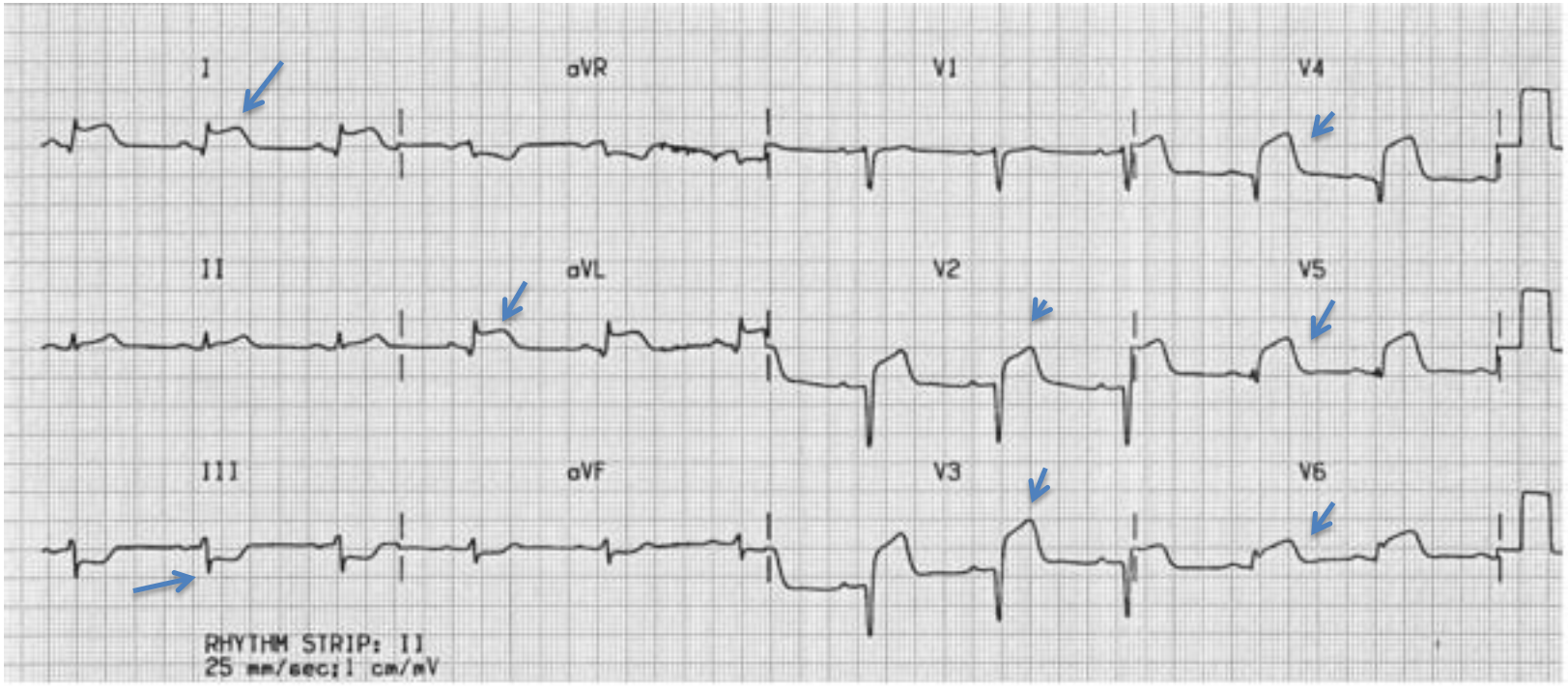


Acute Anterior lateral MI with reciprocal changes in inferior leads

What is your diagnosis?



What is your diagnosis?



Acute Anterior lateral MI with reciprocal changes in inferior leads

Other MI's

- Septal Wall

  Leads involved: V1-V2

  Reciprocal leads: II, III, aVF

  Complications: BBB, hemiblocks

Other MI's

- Posterior MI

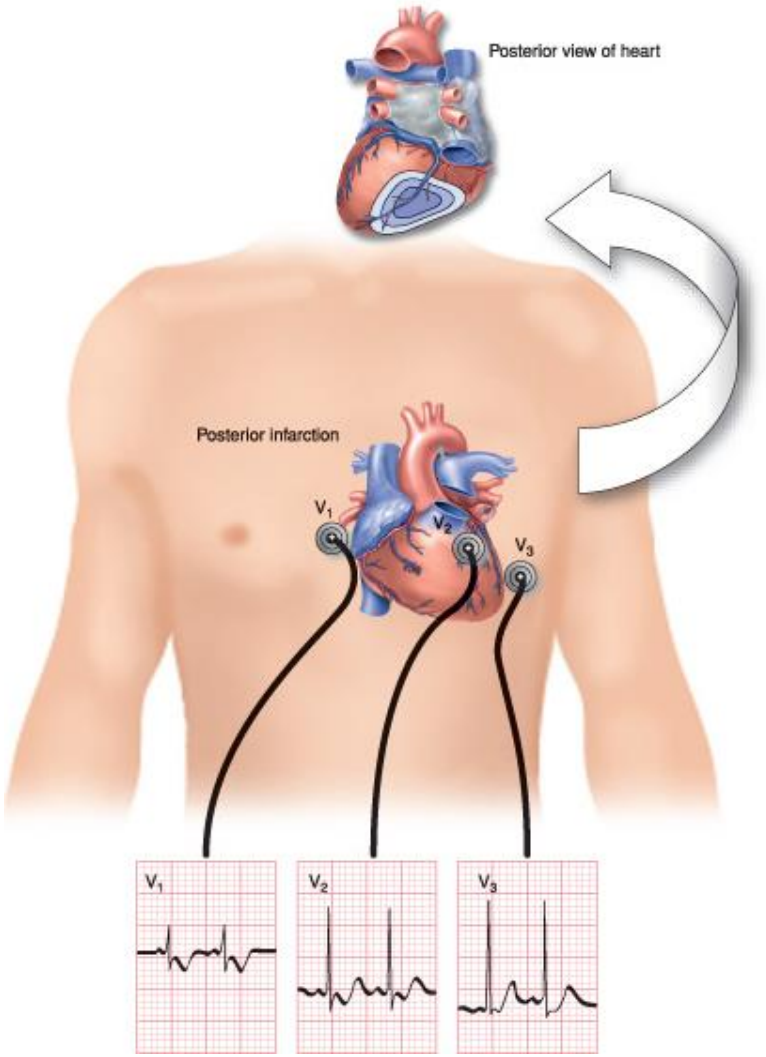
  Indicative leads: Posterior leads with ST, T wave changes (mirror changes, increase in R wave in V1-2

  Reciprocal changes: V1-2

  Complication: same as Inferior MI

Posterior Myocardial Infarction

- Involve posterior surface of the heart
- Look for reciprocal changes in leads V_1 and V_2



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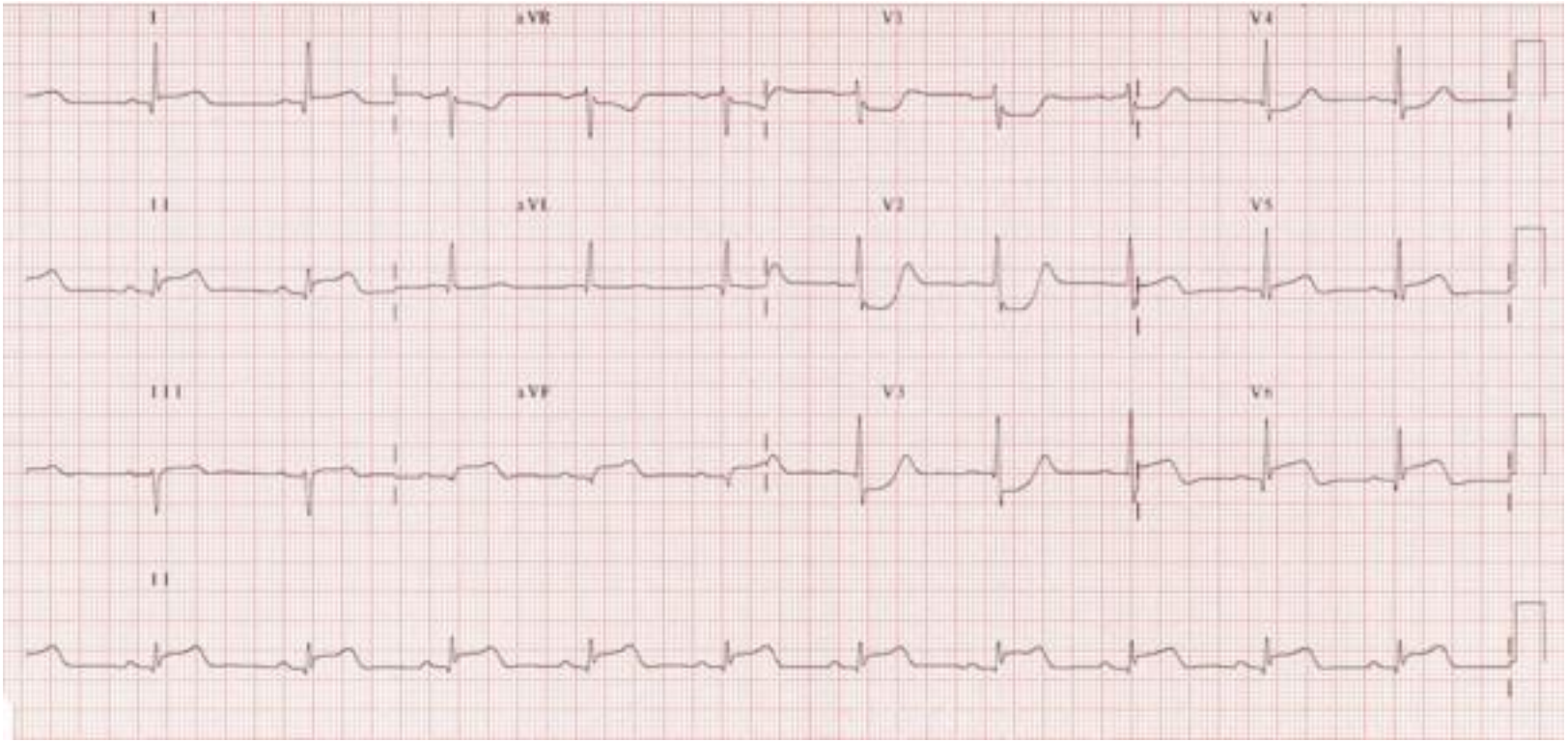
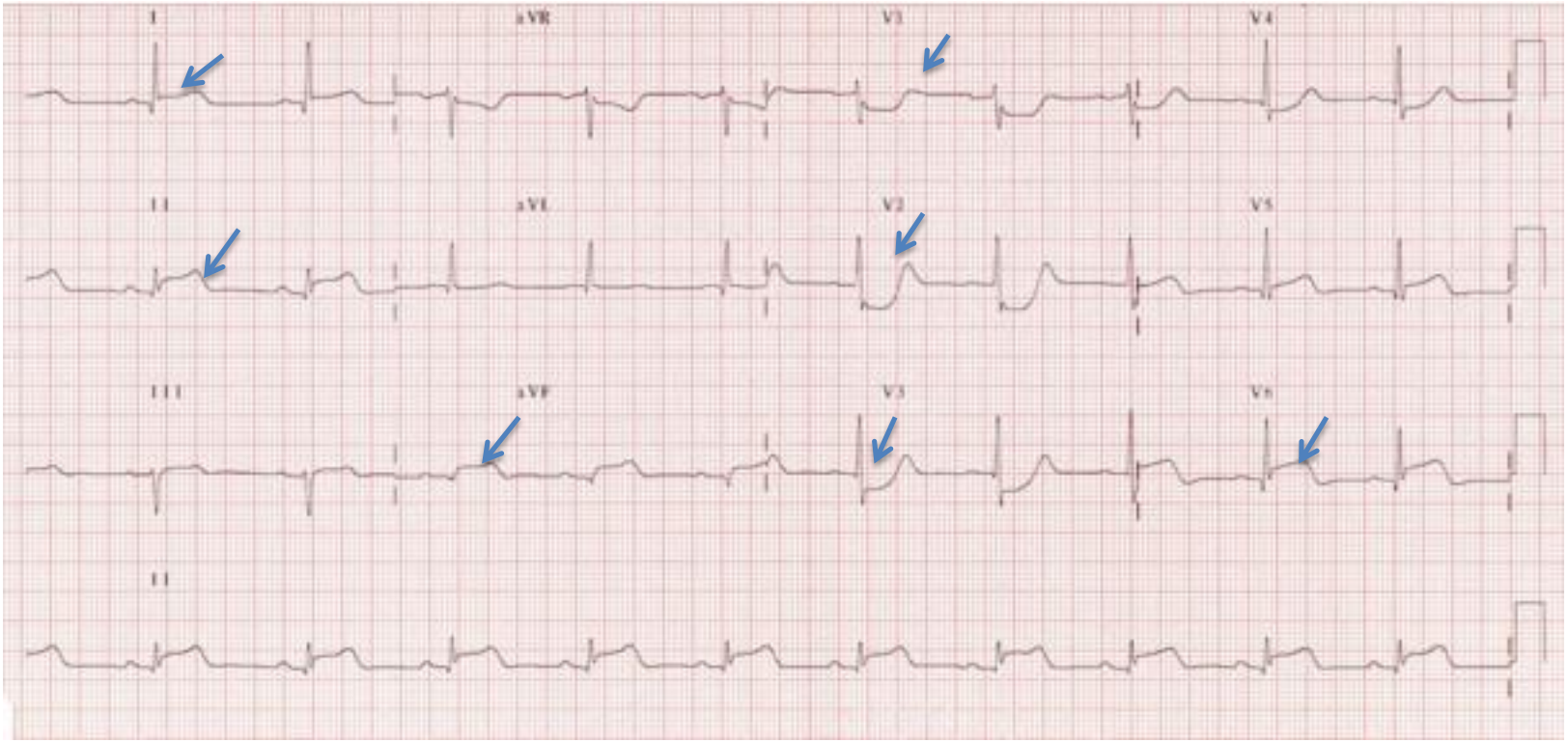
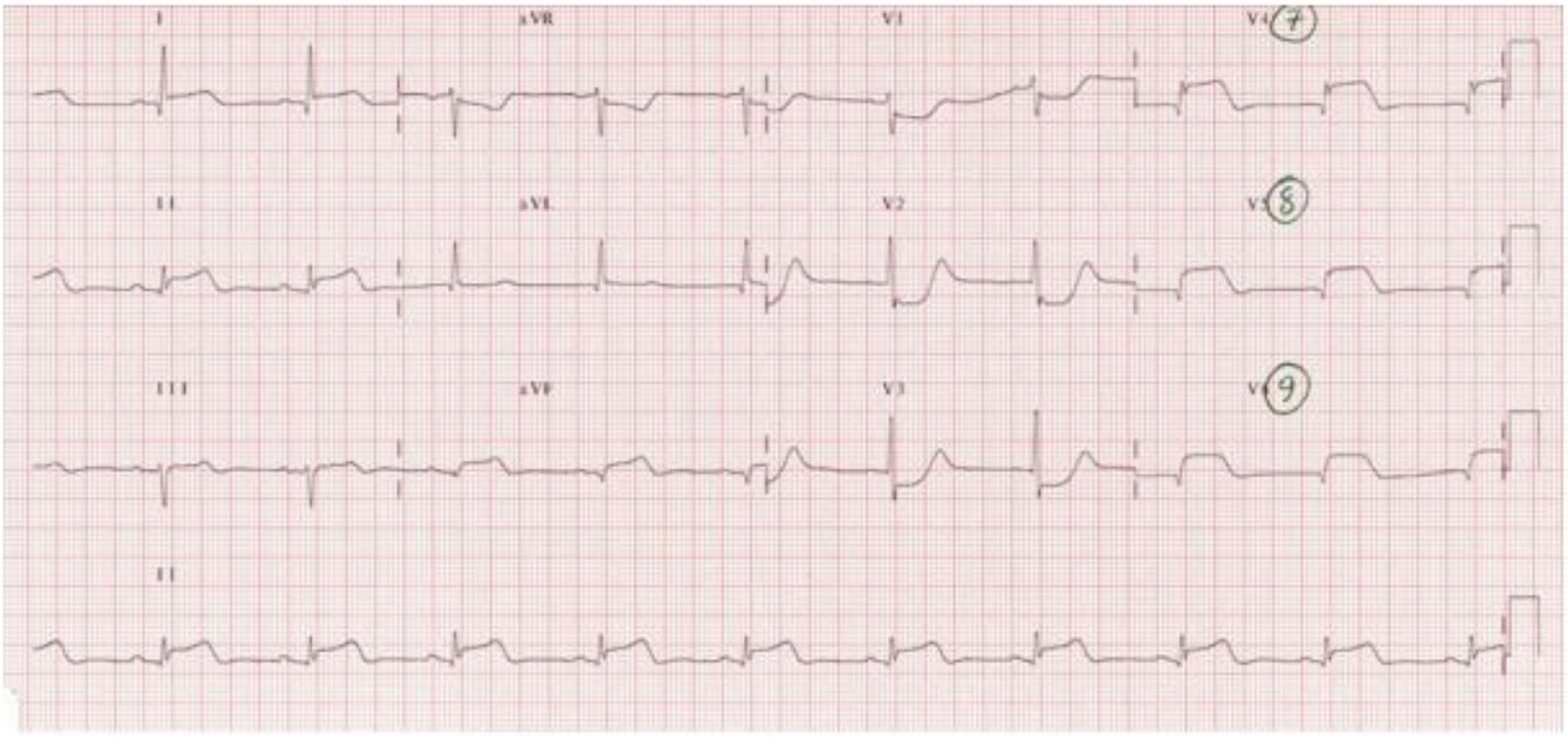


What is your diagnosis?

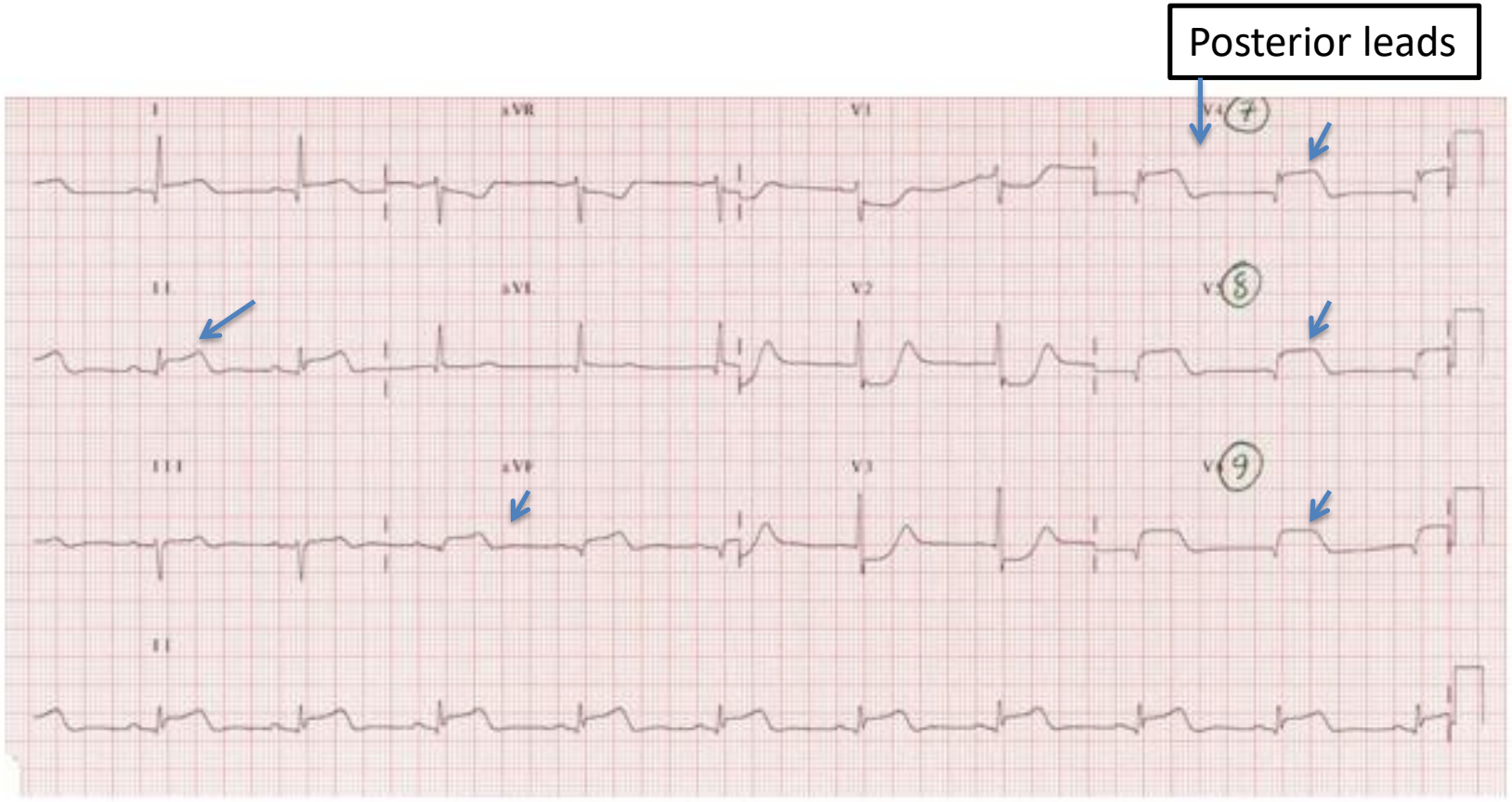


Acute Inferior Posterior MI with lateral involvement
Likely the circumflex region and dominant left circ

What is your diagnosis?

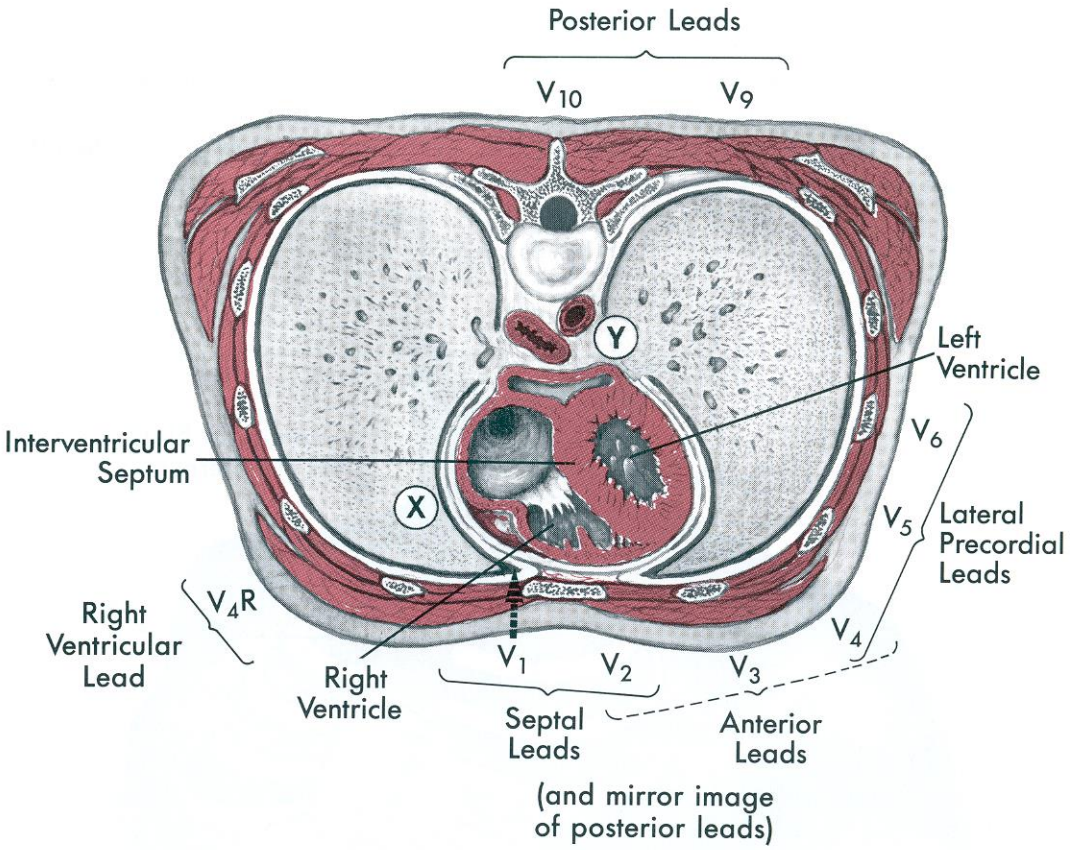


What is your diagnosis?



Acute Inferior Posterior MI

Additional Leads



Other MI's

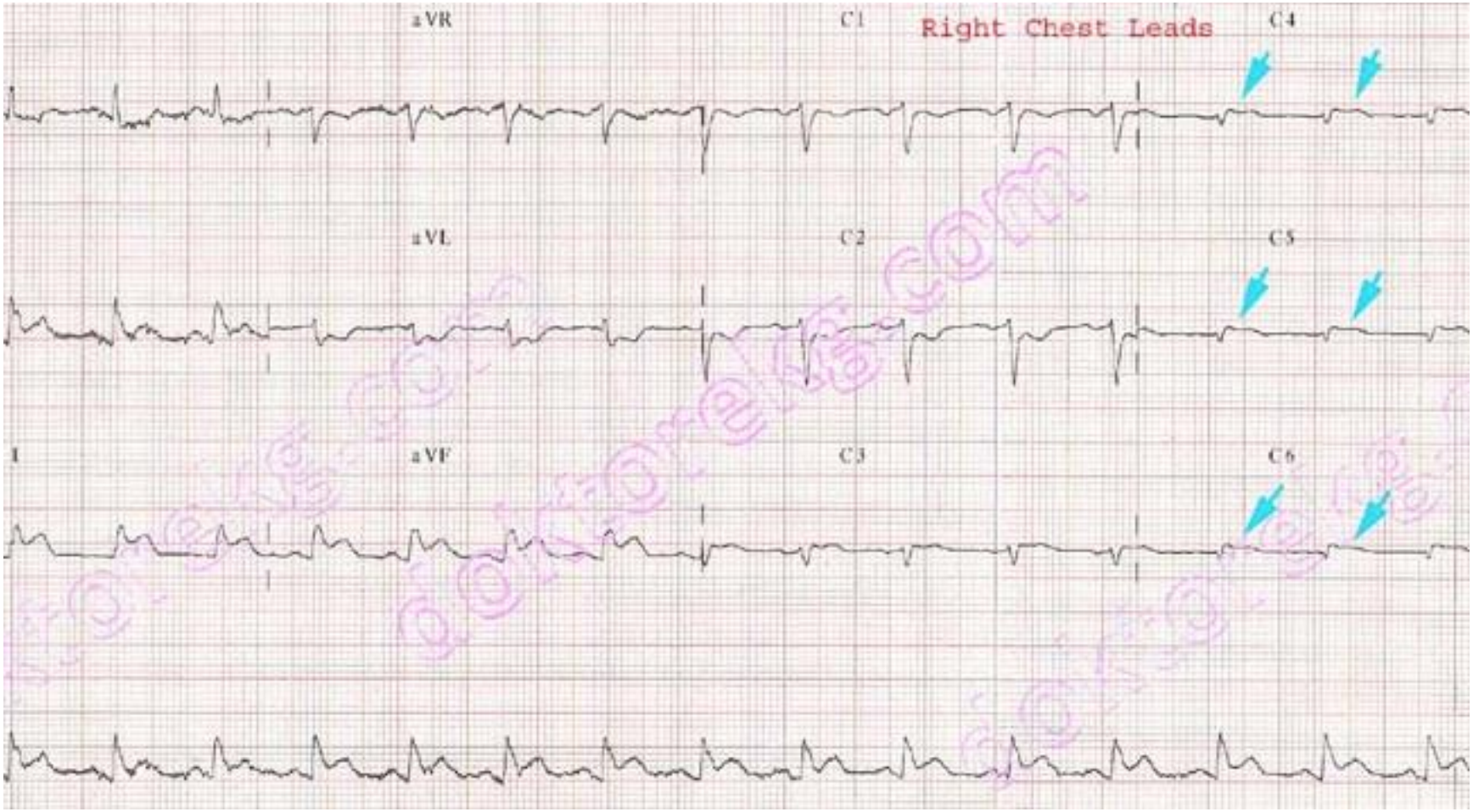
- Right Ventricular Infarct

  Indicative leads: V 3-6R (II, III, aVF)

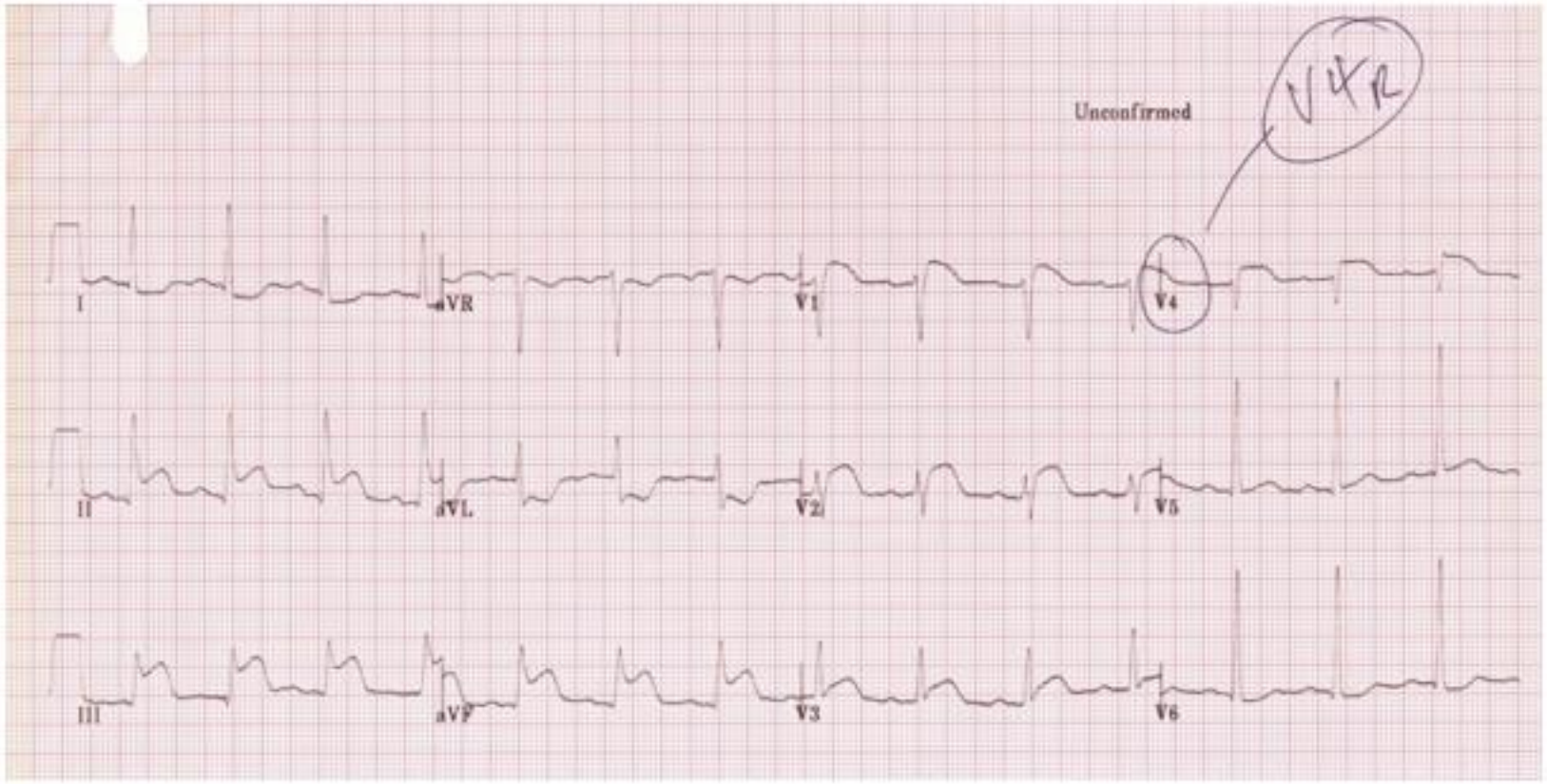
  Reciprocal leads: I aVL

  Complications: Right ventricular failure, same as inferior wall MI

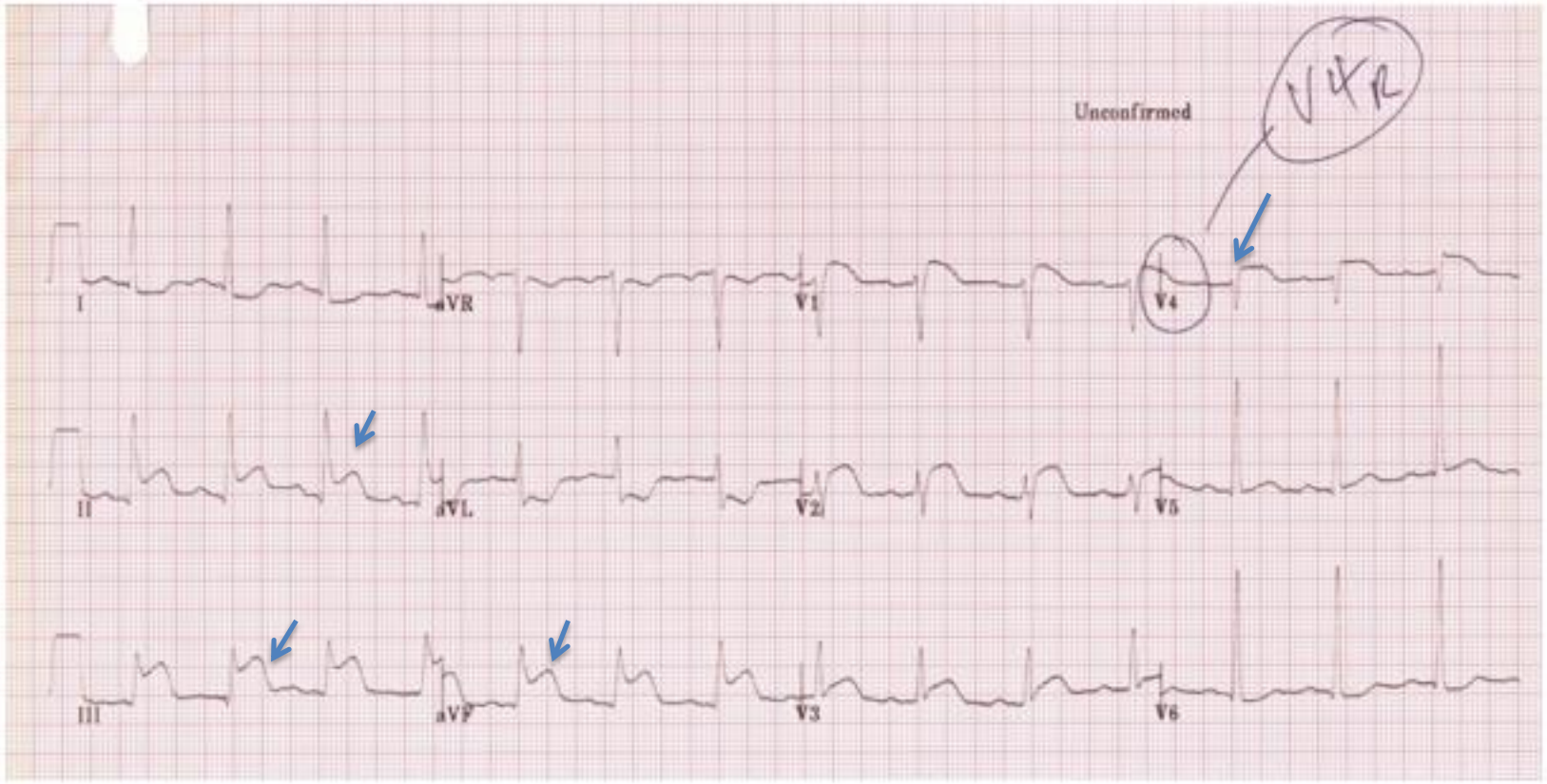
Right sided leads



What is your diagnosis?

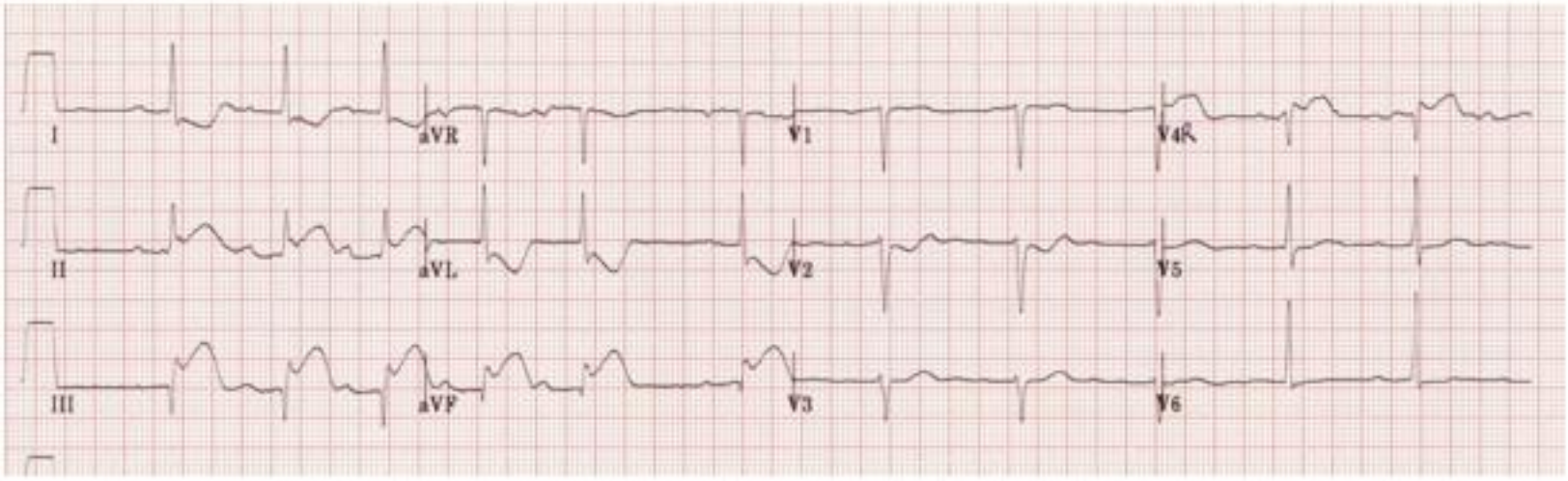


What is your diagnosis?

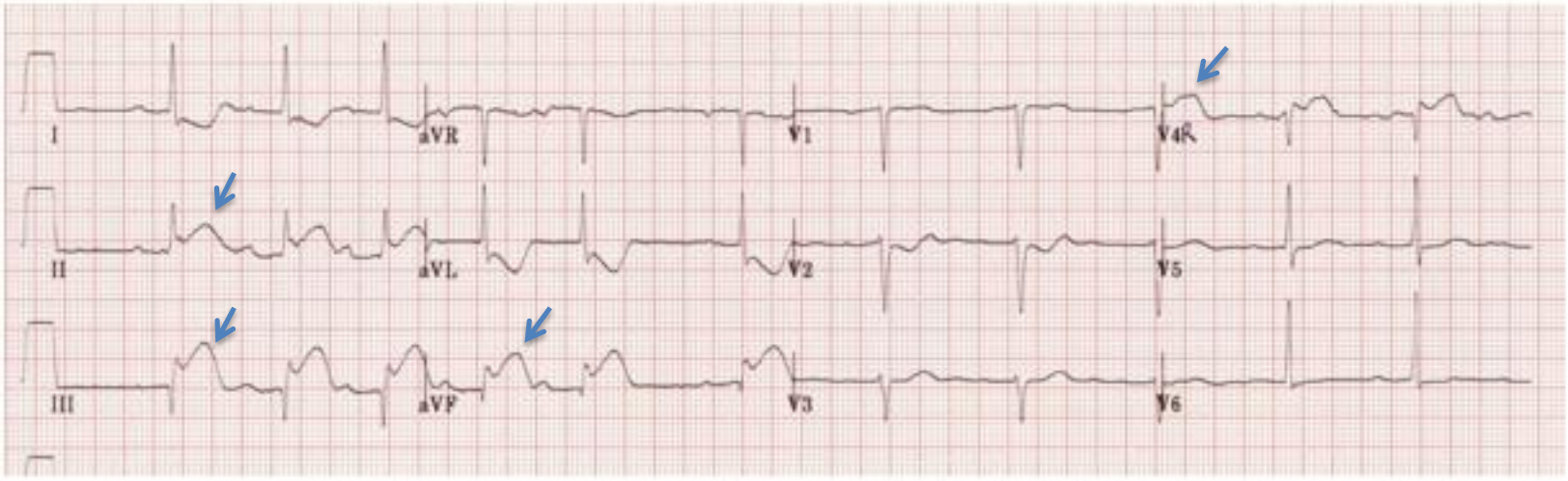


Acute Inferior, RV infarct

What is your diagnosis?



What is your diagnosis?



Acute Inferior MI with RV involvement

ECG
Sensible Approach

- Rate
- Rhythm
- Axis
- Hypertrophy
- 4 **I's**

  Intervals, **I**schemia, **I**njury, **I**nfarction

If possible, always have an old ECG for comparison