



# 12 Lead ECGs:

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## Ischemia, Injury & Infarction Part 1

*McHenry Western Lake County  
EMS*



# Ischemia, Injury & Infarction

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- Definitions
- Injury/Infarct Recognition
- Localization & Evolution
- Reciprocal Changes
- The High Acuity Patient

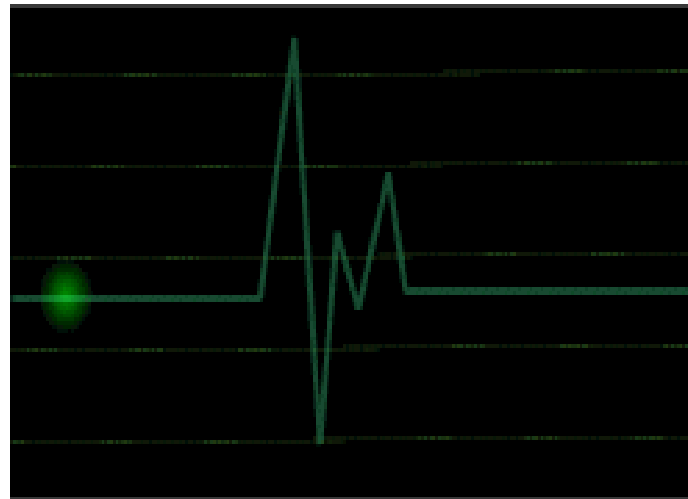


# The Three I's

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- Ischemia
  - lack of oxygenation
  - ST segment depression or T wave inversion
- Injury
  - prolonged ischemia
  - ST segment elevation
- Infarct
  - death of tissue
  - may or may not show a Q wave

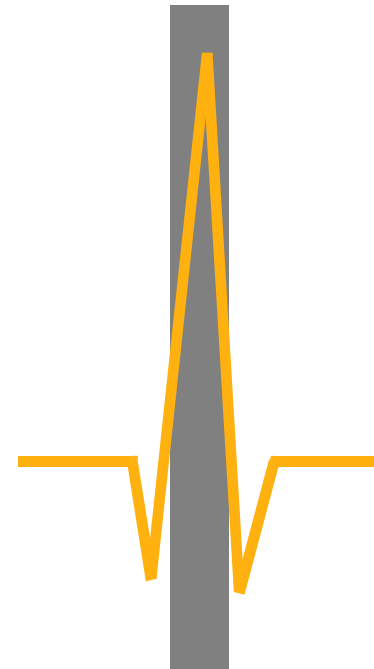
# Review of Waveform Components



# Waveform Components

## R Wave

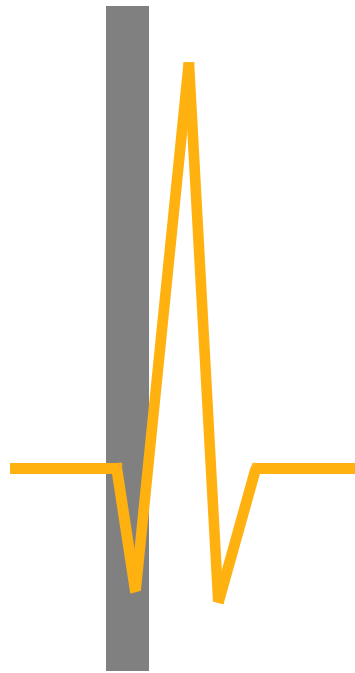
- First positive deflection
- R wave includes the down stroke returning to the baseline



# Waveform Components

## Q Wave

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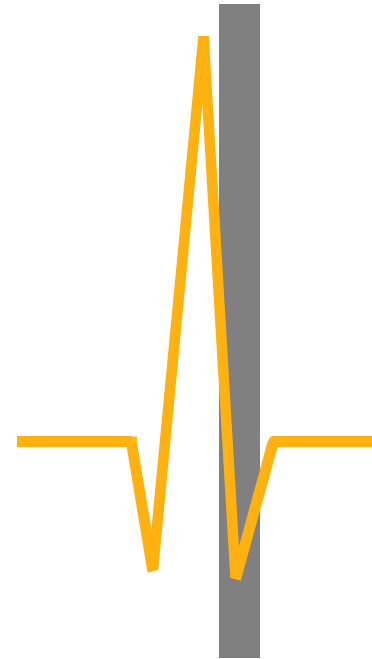


- First negative deflection before the R wave
- Q wave includes the negative down stroke and return to baseline

# Waveform Components

## S Wave

- Negative deflection following the R wave
- S wave includes departure from and return to baseline





# Waveform Components

## QRS

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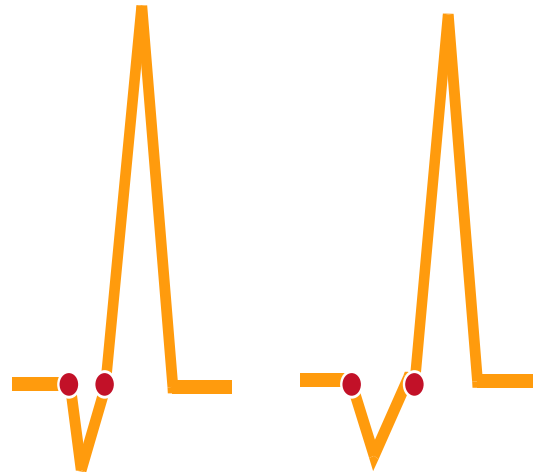
- Q waves
  - Can occur normally in several leads
    - Normal Q waves called physiologic
  - Physiologic Q waves
    - $< .04$  sec (40ms)
  - Pathologic Q
    - $> .04$  sec (40ms)



# Waveform Components

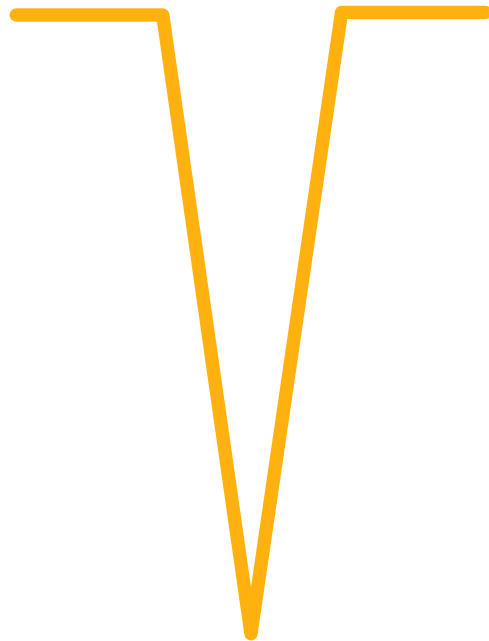
## QRS

- Q wave
  - Measure width
  - Pathologic if greater than or equal to 0.04 seconds (1 small box)



# Waveform Components

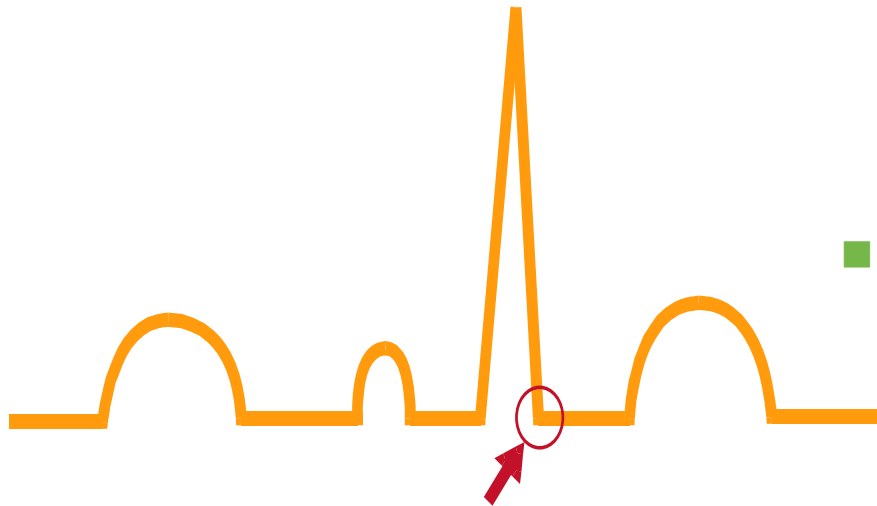
## QS Complex



- Entire complex is negatively deflected
- No R wave is present

# Waveform Components

## J-Point

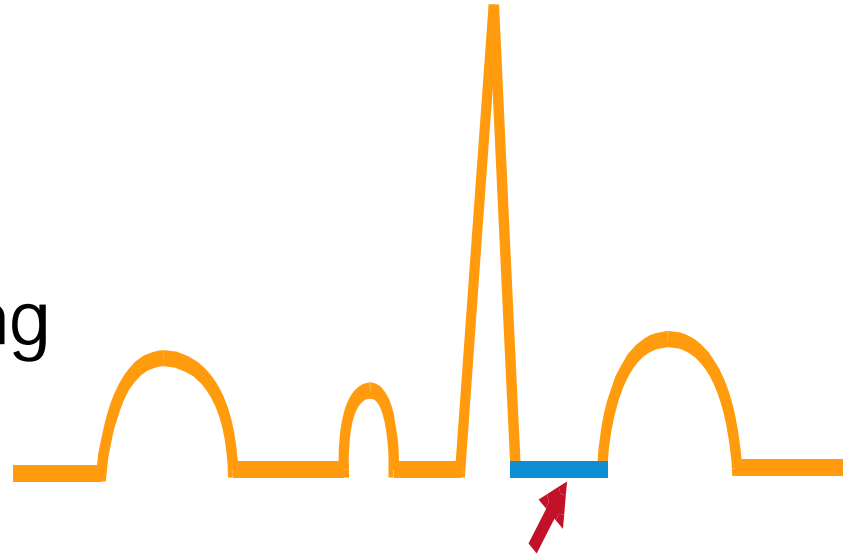


- Junction between the end of QRS and beginning of ST segment
- Where QRS stops and makes a sudden sharp change in direction

# Waveform Components

## ST Segment

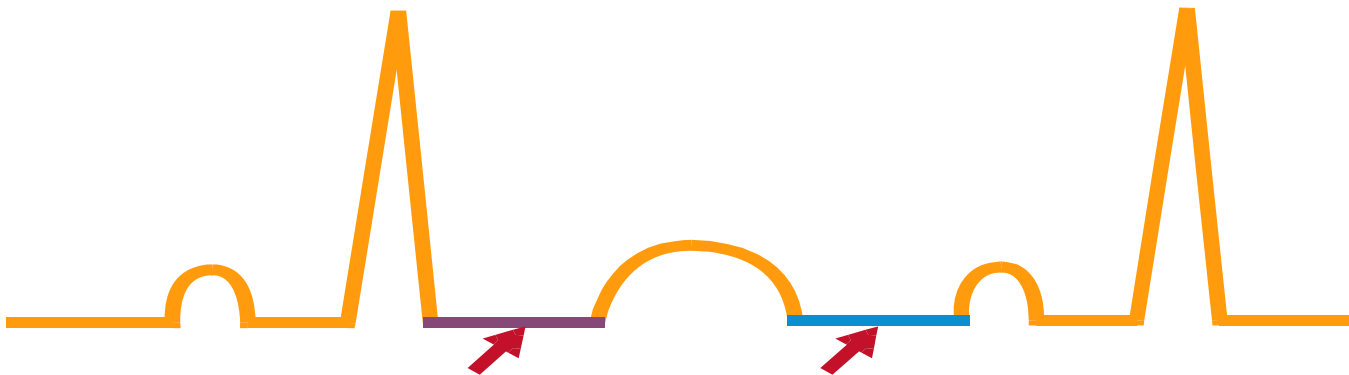
- Segment between J-Point and beginning of T wave



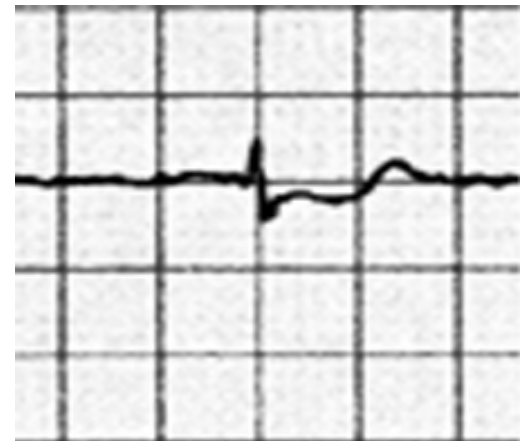
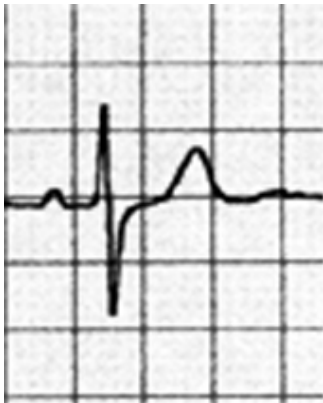
# Waveform Components

## ST Segment

- Need reference point
  - Compare to TP segment
  - DO NOT use PR segment as reference!

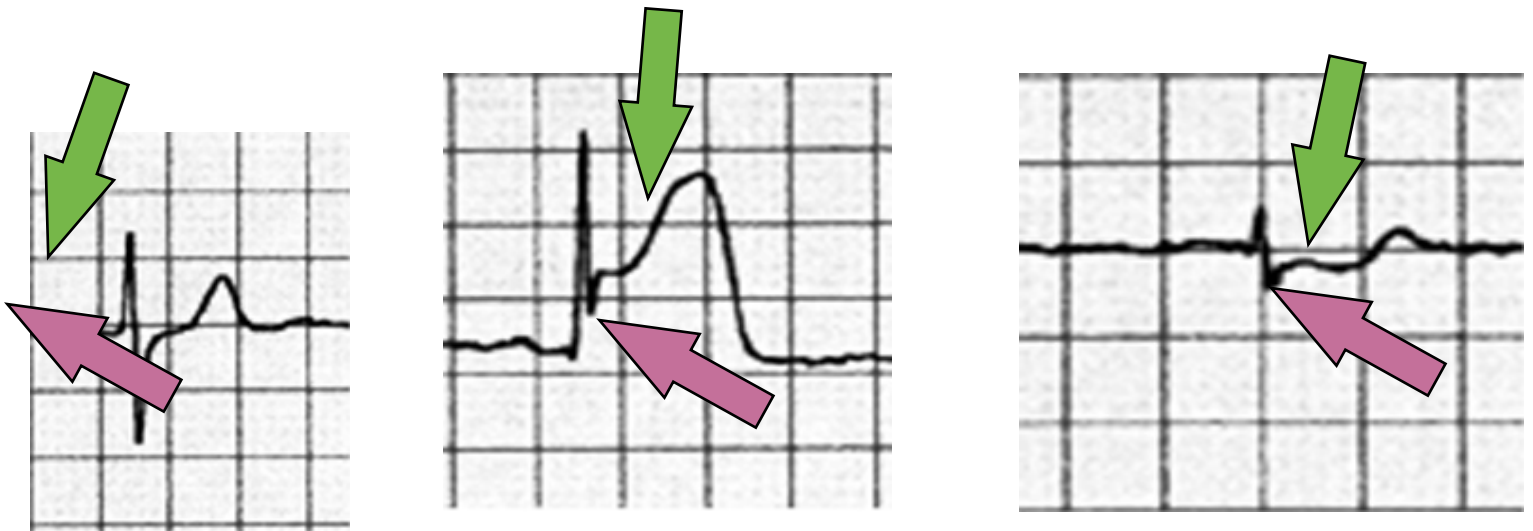


# Waveform Components Practice



**Find the J Point and ST segment**

# Waveform Components Practice

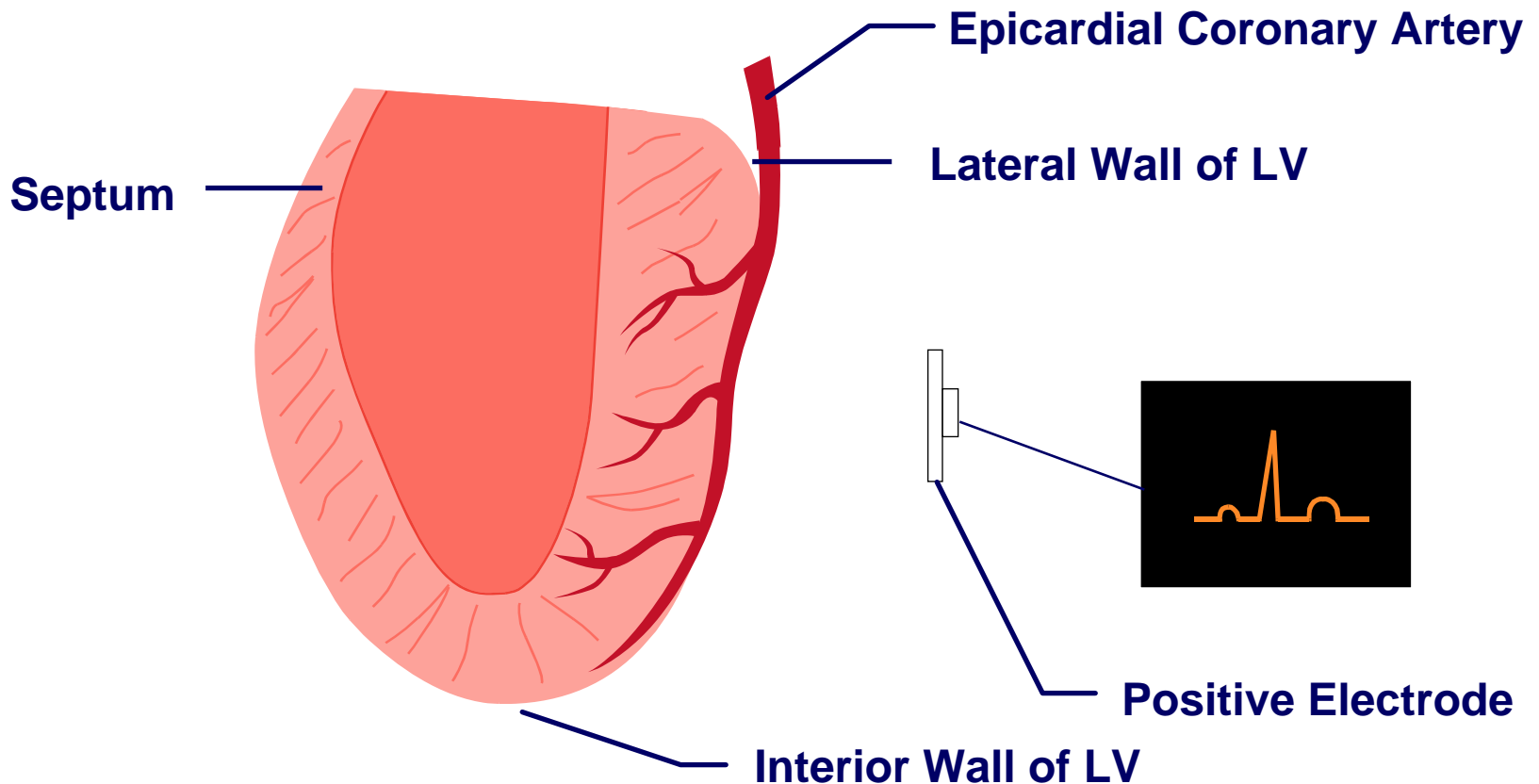


**J POINTS**

**ST SEGMENT**

# Injury/Infarct Recognition

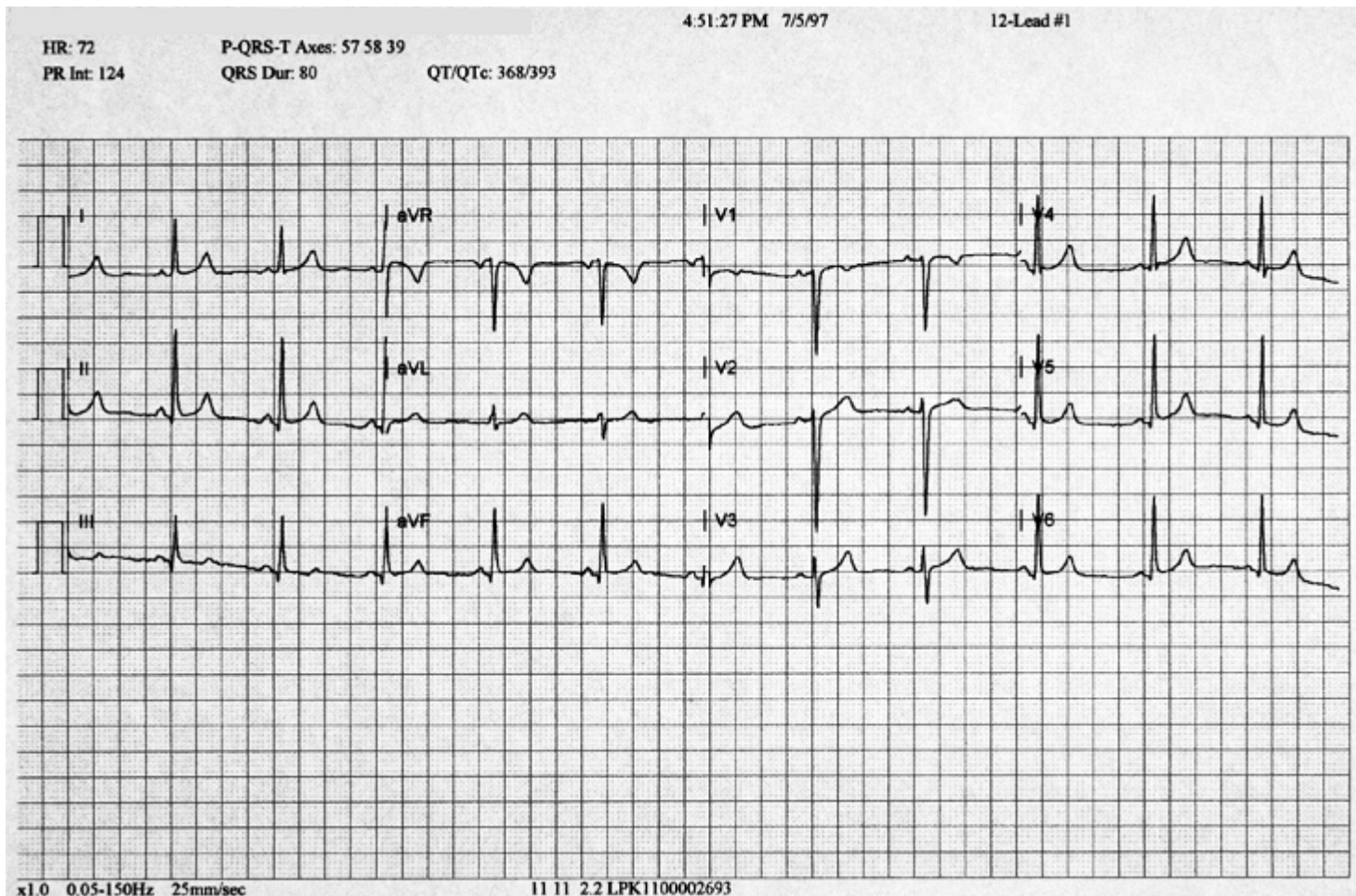
## Well Perfused Myocardium





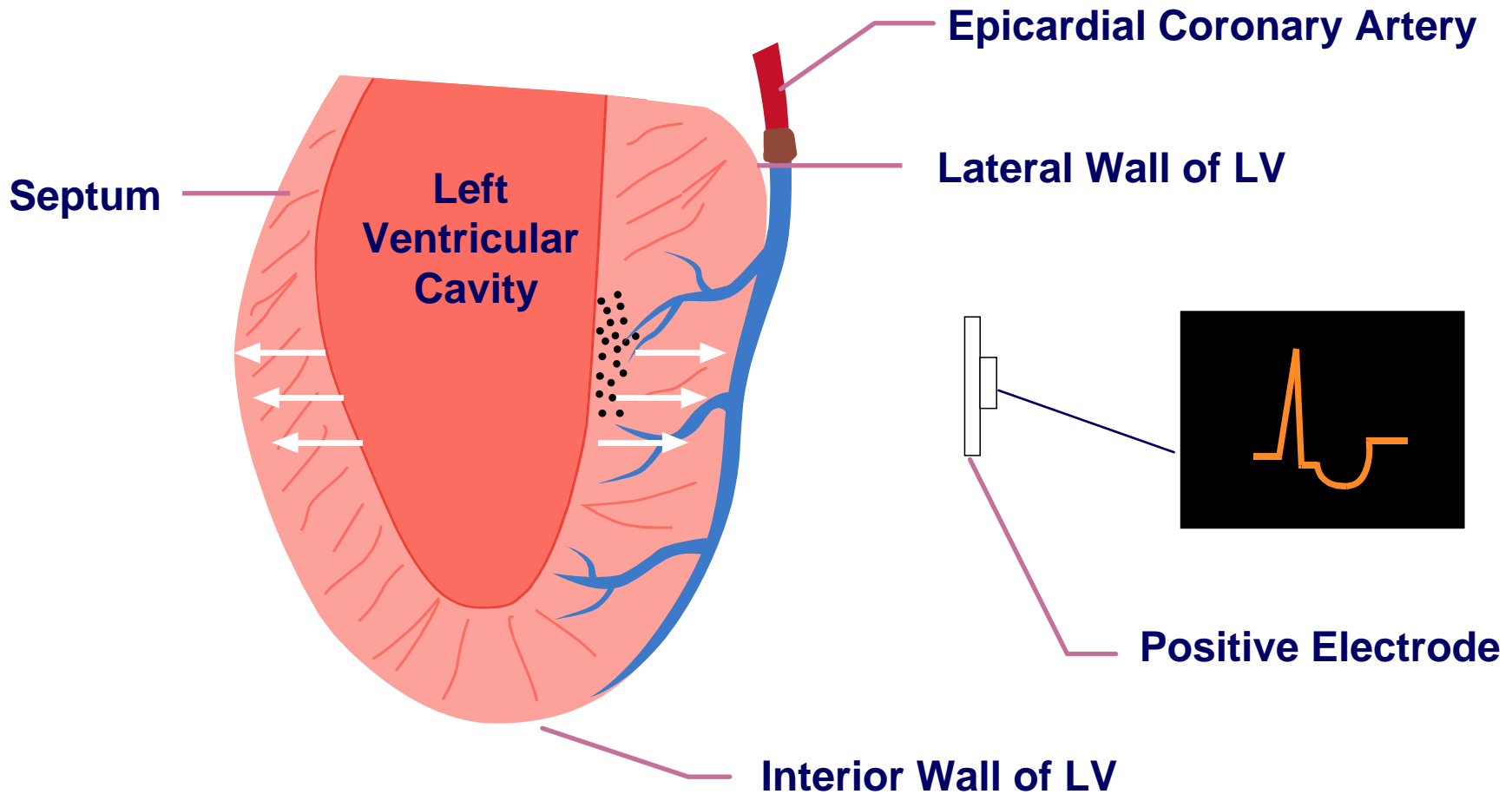
# Injury/Infarct Recognition

## Normal ECG



# Injury/Infarct Recognition

## Ischemia





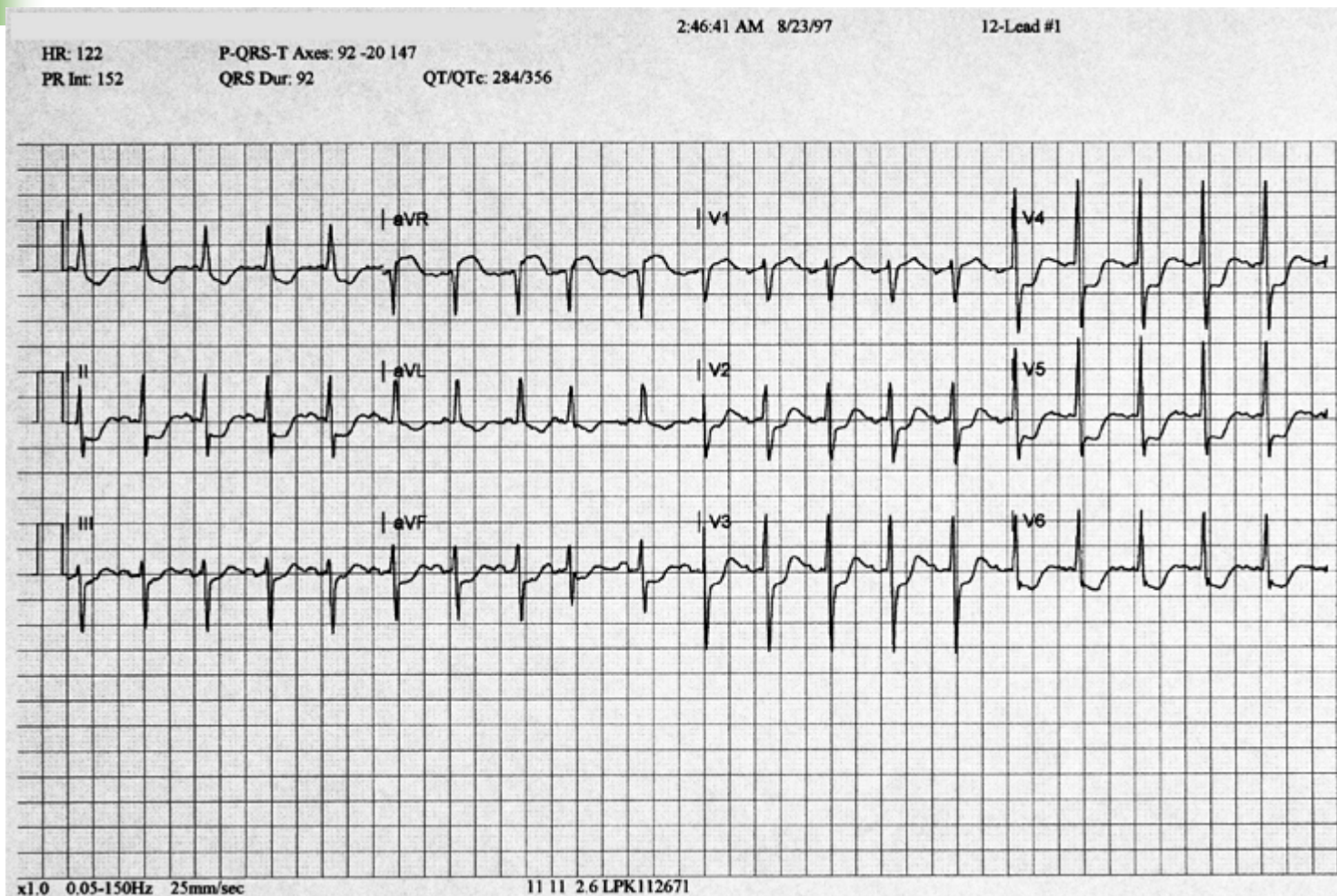
# Injury/Infarct Recognition

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- Ischemia
  - Inadequate oxygen to tissue
  - Represented by ST depression or T inversion
  - May or may not result in infarct or Q waves

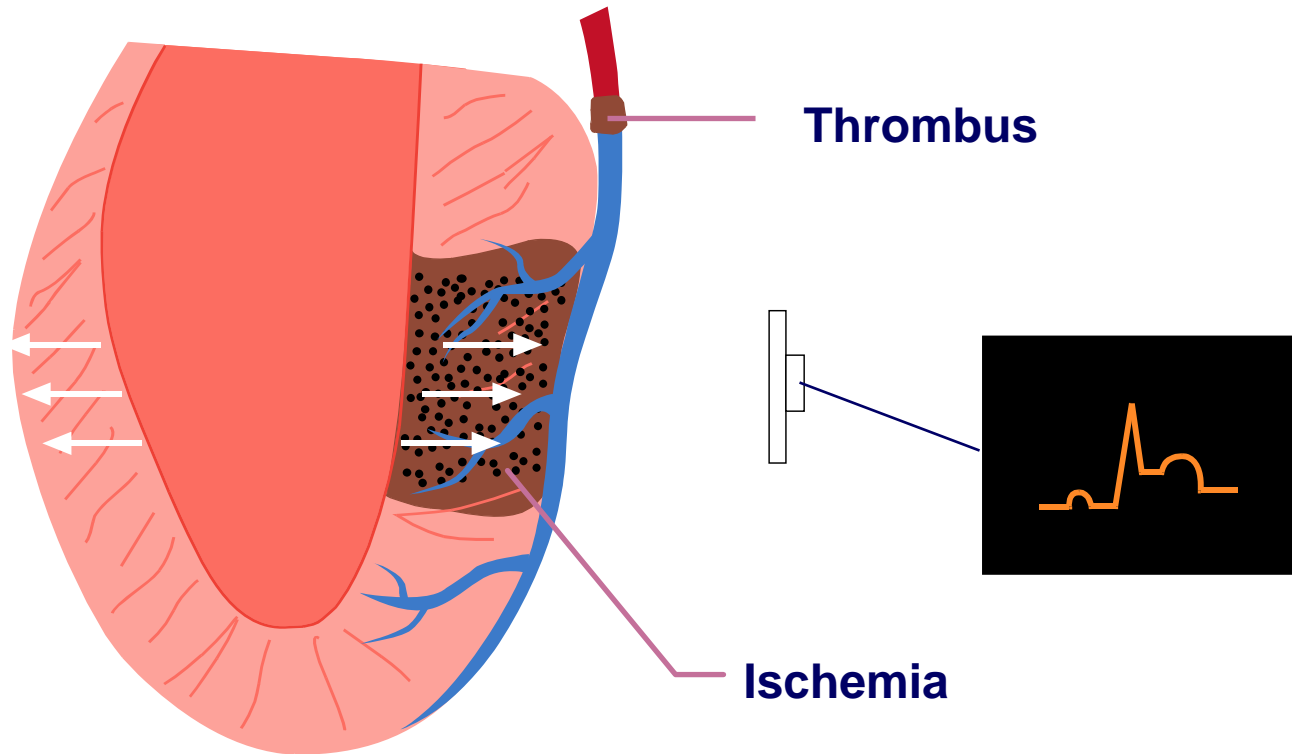
# Injury/Infarct Recognition

## ST Segment Depression



# Injury/Infarct Recognition

## Injury



# Injury/Infarct Recognition

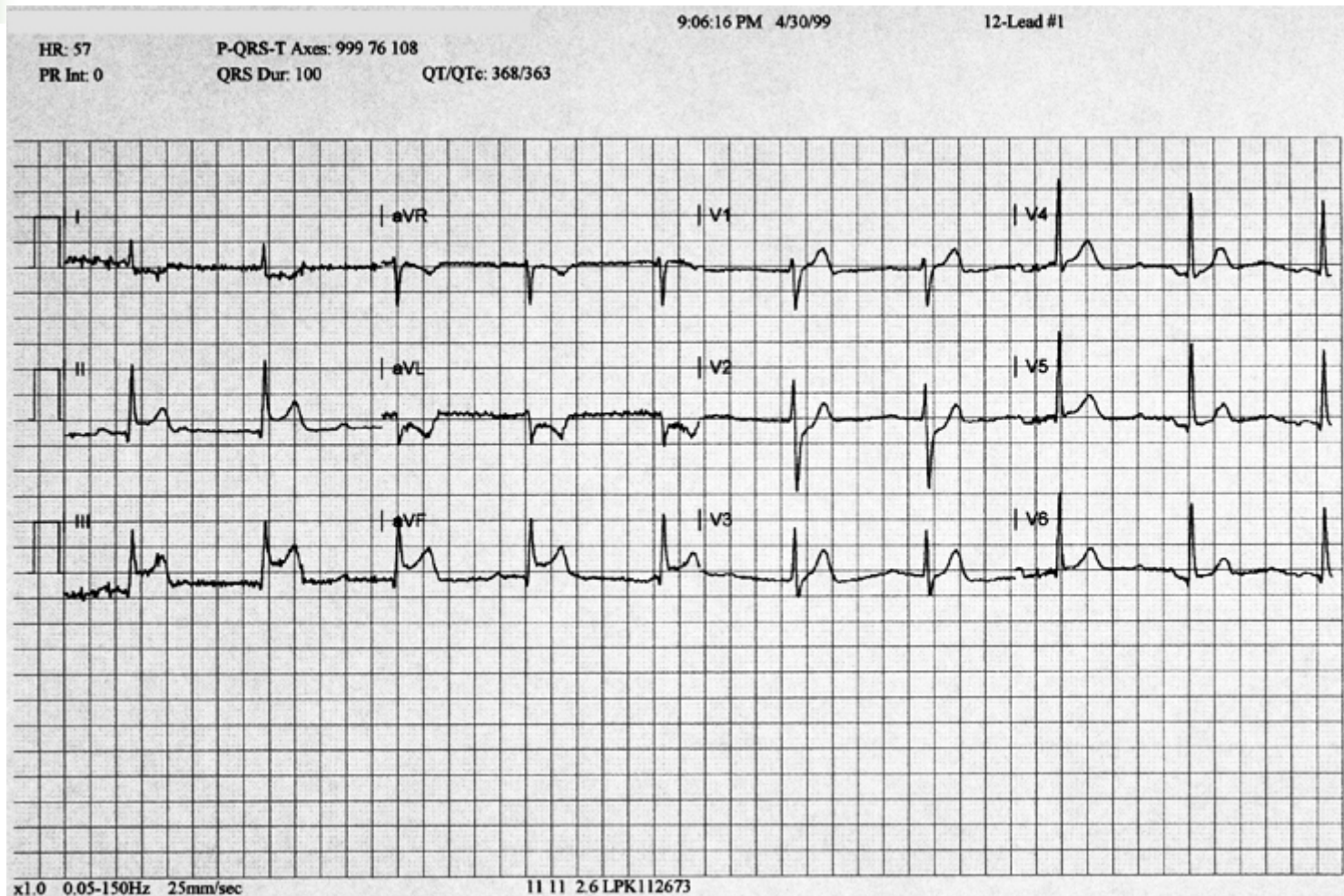


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- Injury
  - Prolonged ischemia
  - Represented by ST elevation
    - referred to as an “injury pattern”
  - Usually results in infarct
    - may or may not develop Q wave

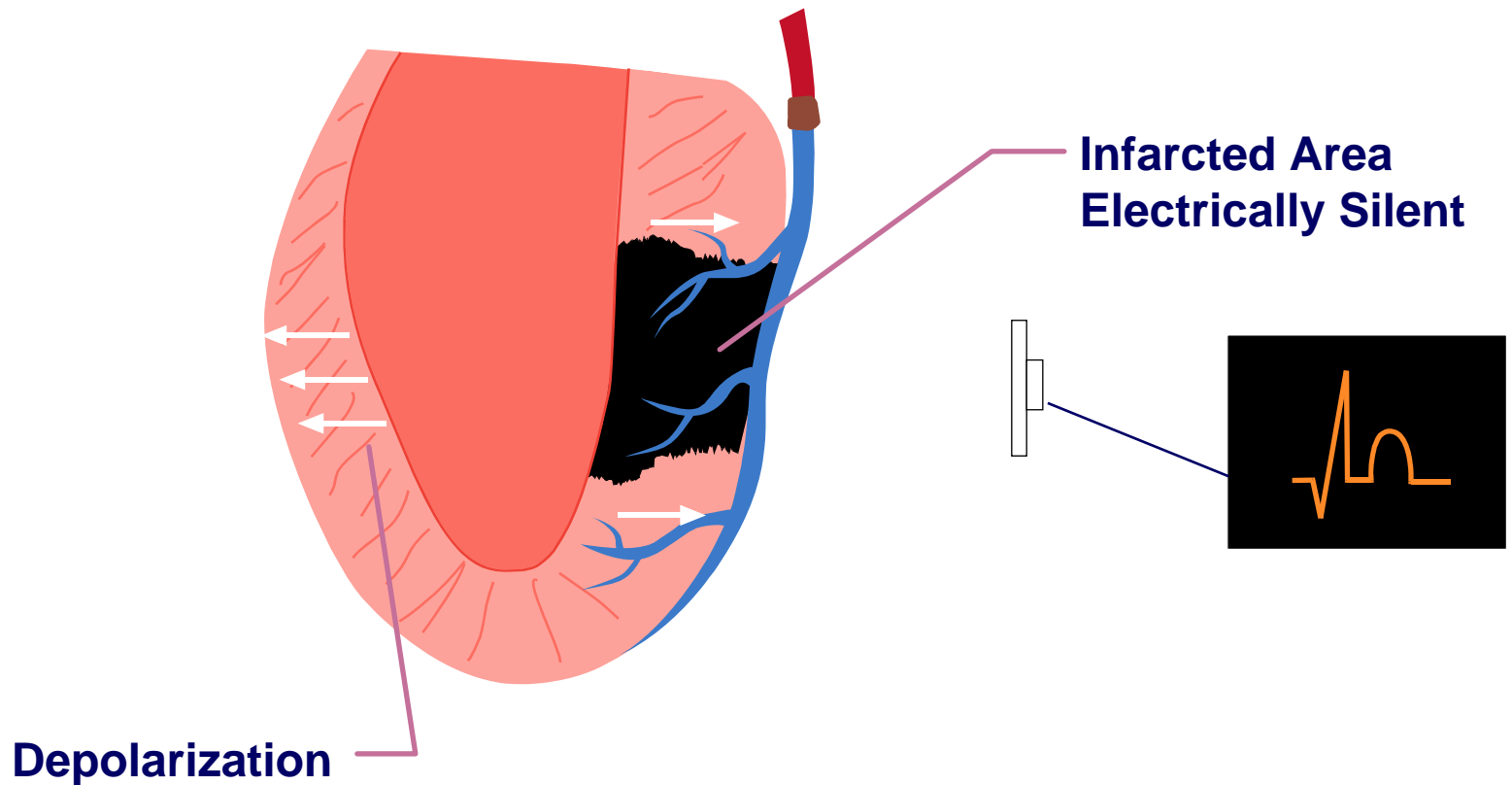
# Injury/Infarct Recognition

## ST Segment Elevation



# Injury/Infarct Recognition

## Infarct







# Injury/Infarct Recognition

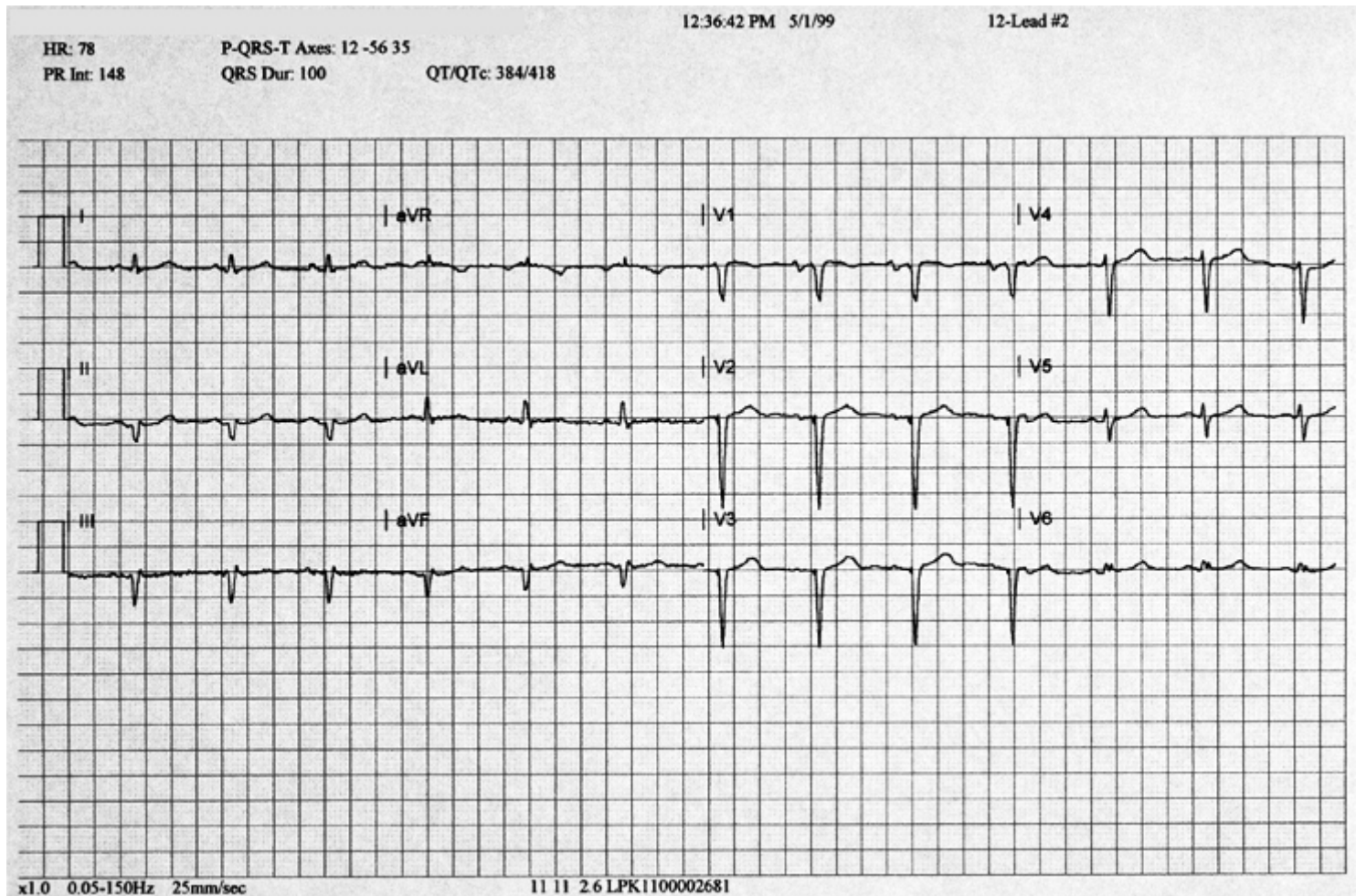
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- Infarct

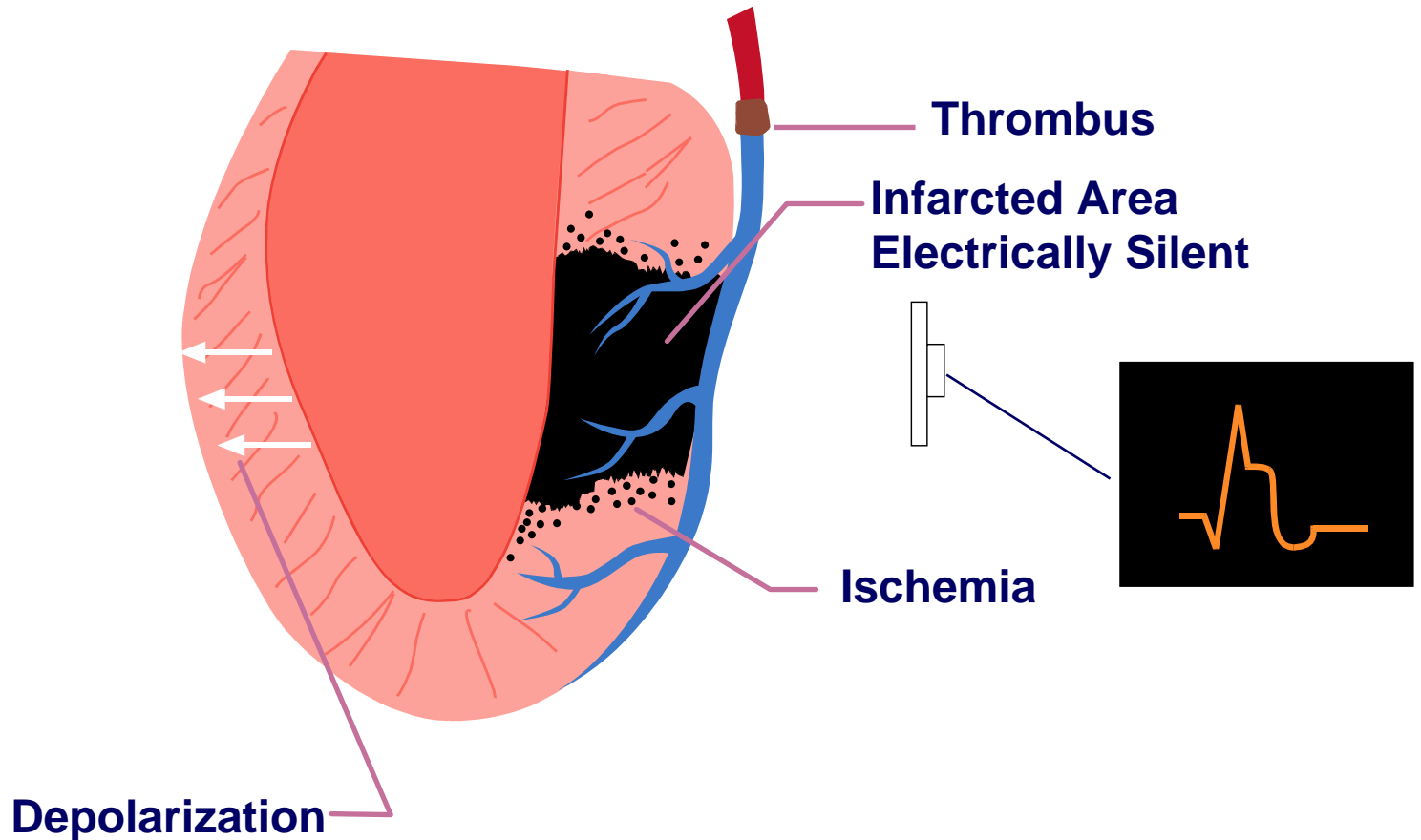
- Death of tissue
- Represented by Q wave
- Not all infarcts develop Q waves

# Injury/Infarct Recognition

## Q Waves

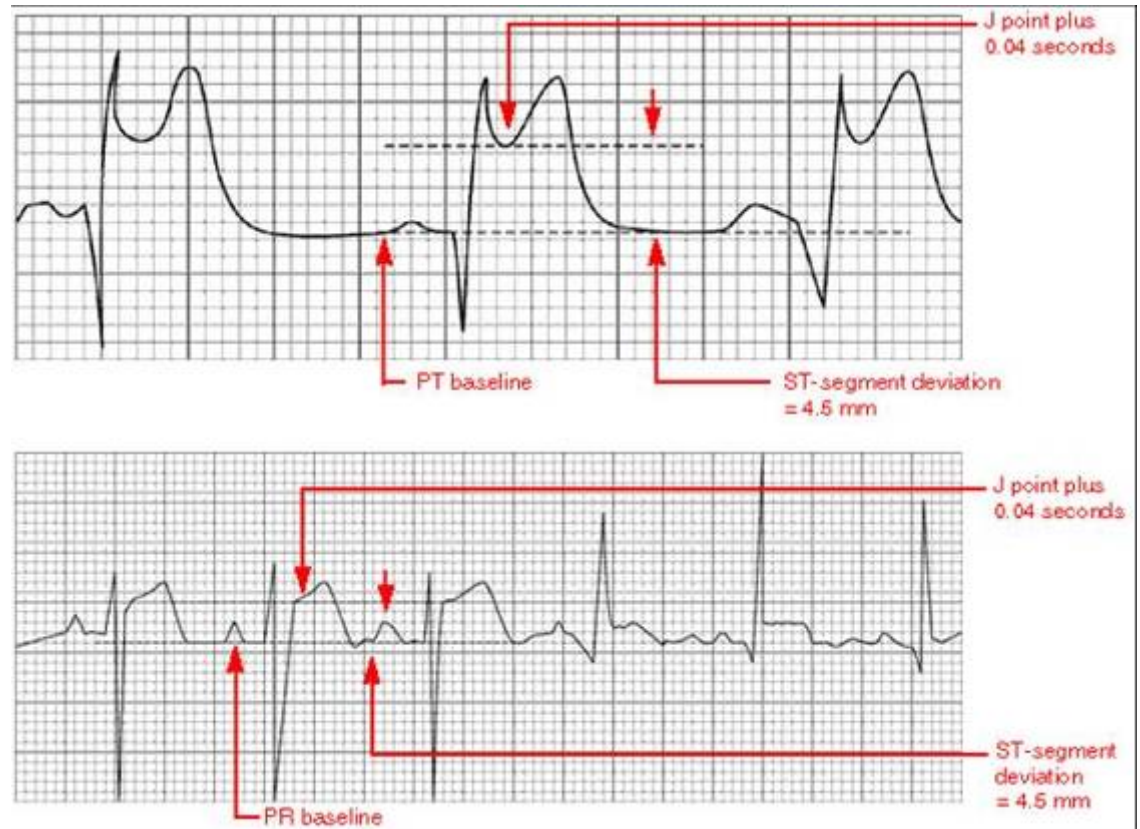


# Injury/Infarct Recognition



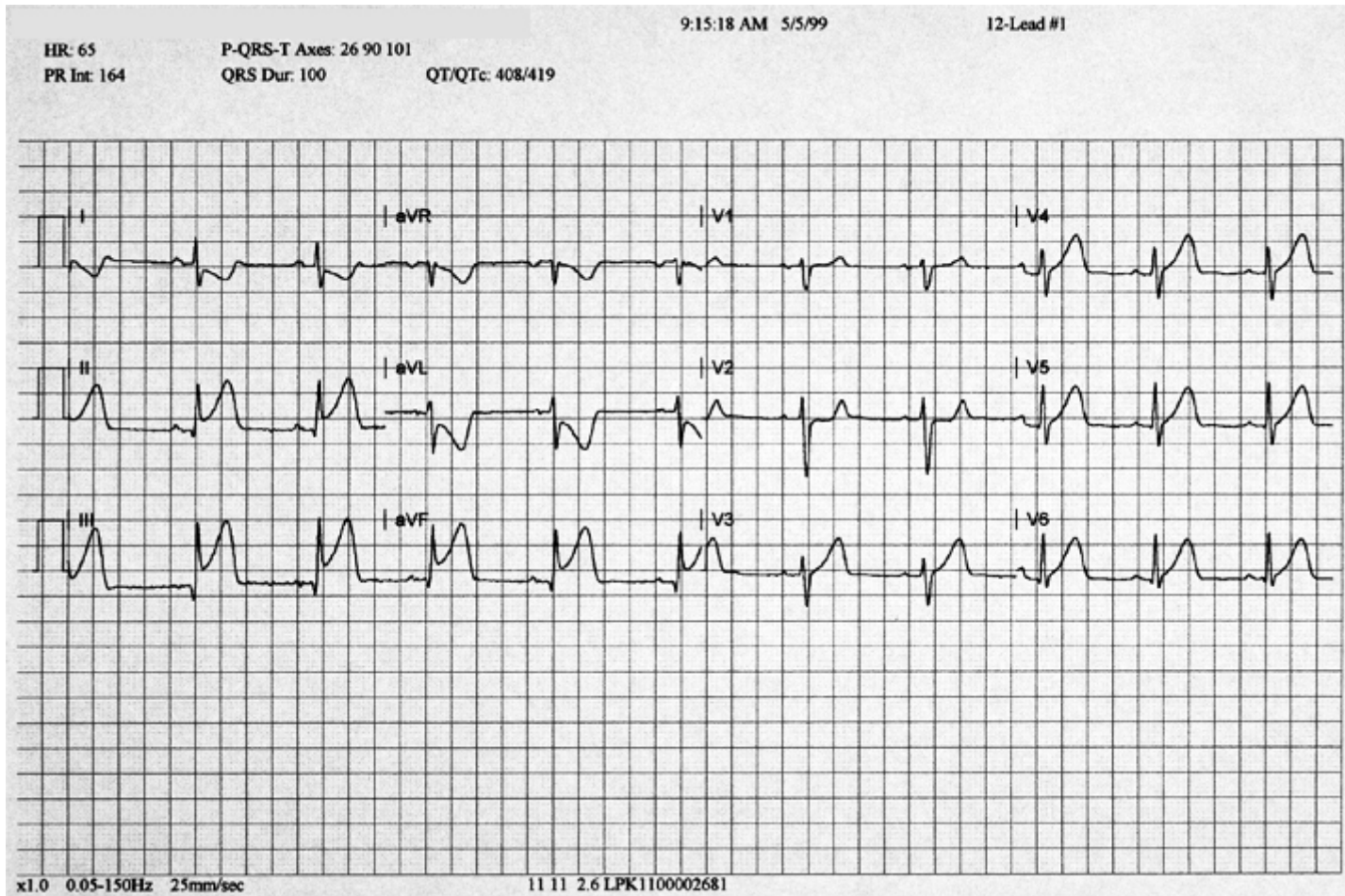
# Injury/Infarct Recognition

- What to Look for:
  - ST segment elevation
  - Present in two or more anatomically contiguous leads

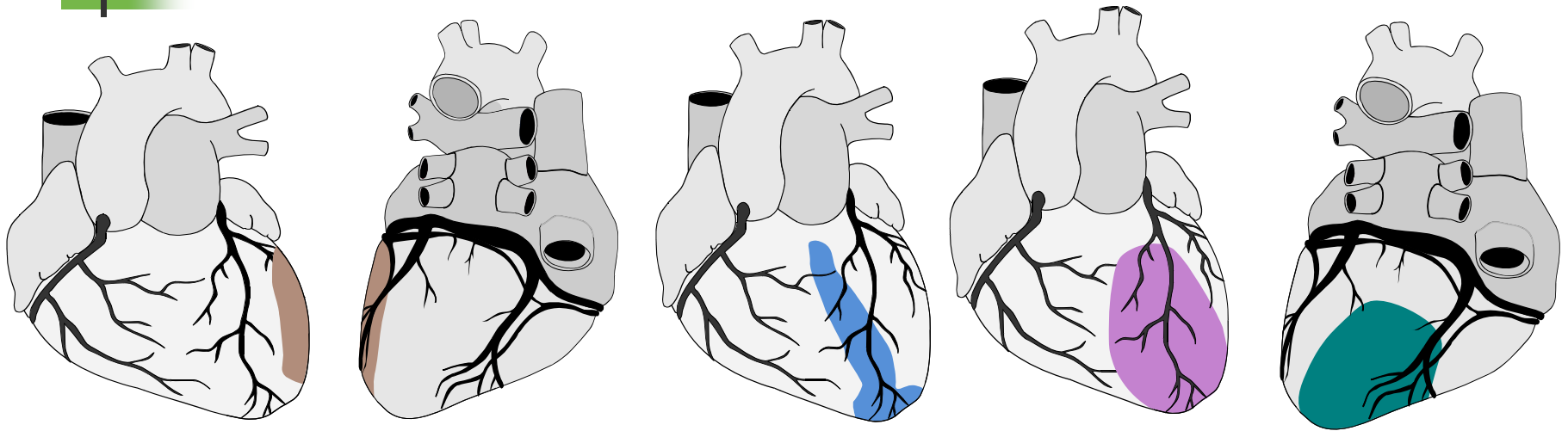


# Injury/Infarct Recognition: Practice

*Look at J points and ST segments*



# Localization



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

**Inferior: II, III, AVF**

**Septal: V1, V2**

**Anterior: V3, V4**

**Lateral: I, AVL, V5, V6**



# Localization

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Which coronary arteries are most likely associated with each group of contiguous leads?

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



Please continue to part 2 of  
this presentation

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Thanks!