

12 LEAD ECG: STEMI Recognition

2011 Georgia Office of EMS Updates



EMT-Paramedic to Paramedic Update



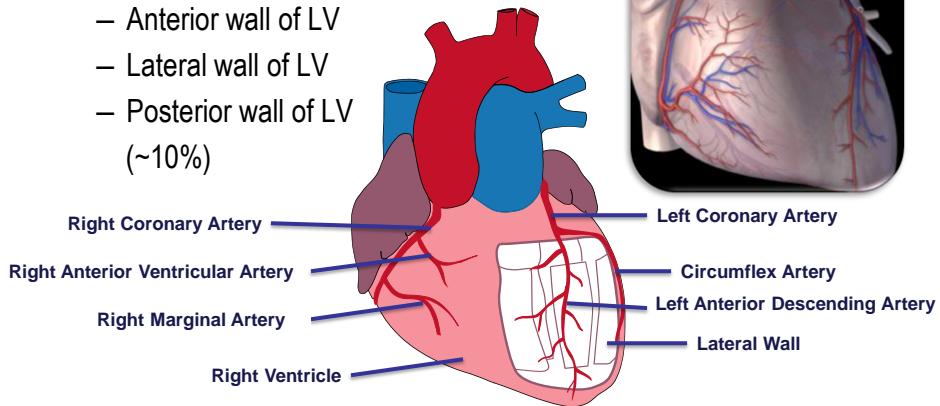
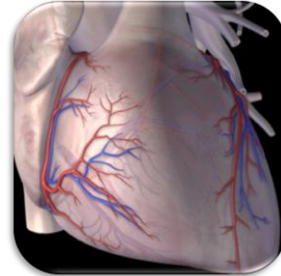
Objectives

- Anatomy Review
 - Vascular Anatomy
 - Electrical Anatomy
- ECG Waveform Components
- ECG Leads
- 12-Lead ECG Format
- Anatomical Localization
- Reciprocal Changes
- Additional ECG Leads
- Practice



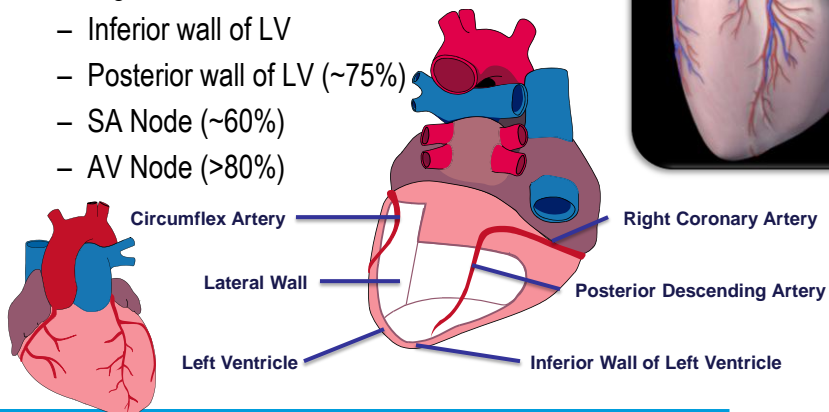
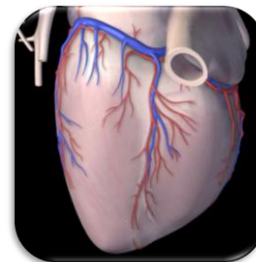
Vascular Anatomy

- Left Coronary Artery
 - Septal wall of LV
 - Anterior wall of LV
 - Lateral wall of LV
 - Posterior wall of LV (~10%)

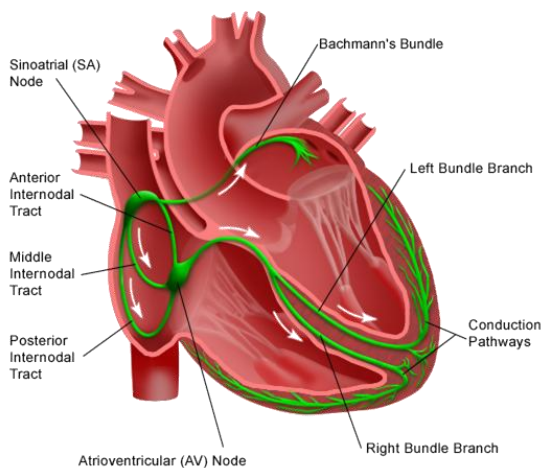


Vascular Anatomy

- Right Coronary Artery
 - Right Ventricle
 - Inferior wall of LV
 - Posterior wall of LV (~75%)
 - SA Node (~60%)
 - AV Node (>80%)

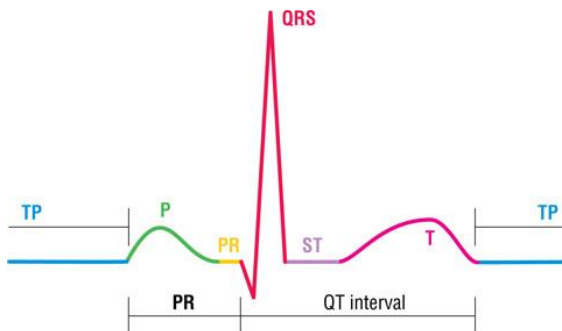


Electrical Anatomy



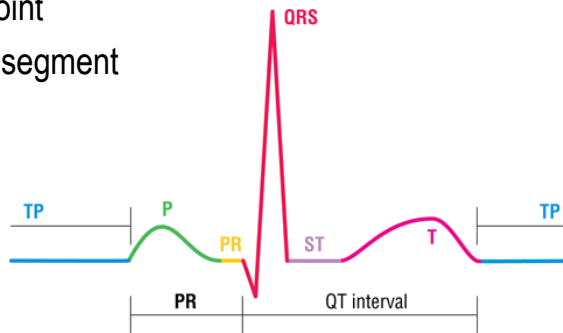
ECG Waveform Components

- **Wave:** Deflection from baseline that represents a cardiac event
- **Segment:** Specific portion of the complex as represented on ECG
- **Interval:** Distance, measured as time, between two cardiac events



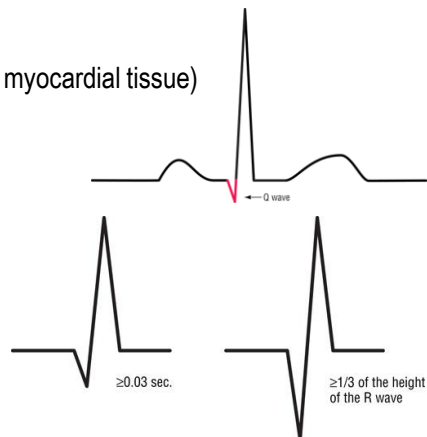
ECG Waveform Components

- Critical waveform components of AMI recognition
 - Q wave
 - J point
 - ST segment



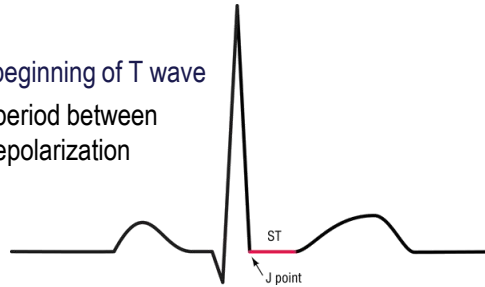
ECG Waveform Components

- **Q waves**
 - Physiologic (insignificant/normal)
 - Pathologic (significant/sign of dead myocardial tissue)
- Physiologic Q wave
 - Commonly found in I, aVL, and V₆
 - Measures less than 0.03 sec
- Pathologic Q wave
 - Indication of MI over region involved
 - Measures 0.03 sec or wider
 - Height equal to or greater than 1/3 height of R wave



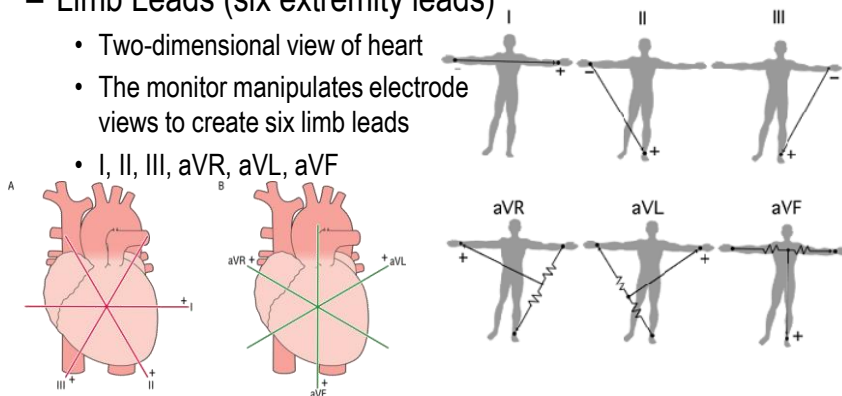
ECG Waveform Components

- **J point**
 - Junction between end of QRS and beginning of ST segment
 - Where QRS stops & makes a sudden sharp change of direction
 - Reference point for assessment of ST segment elevation
- **ST segment**
 - Segment between J-point and beginning of T wave
 - Represents electrically neutral period between ventricular depolarization and repolarization



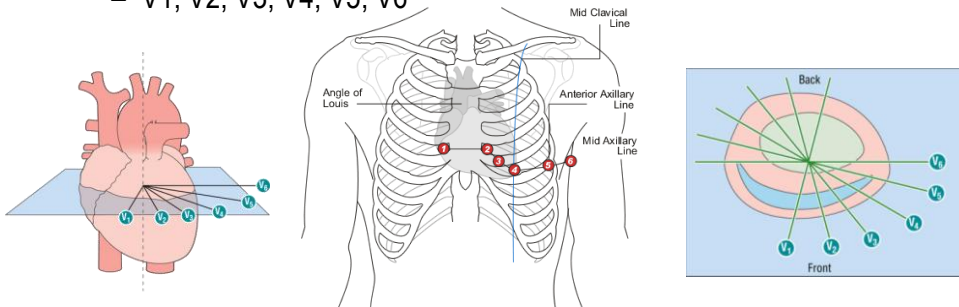
ECG Leads

- Electrical “pictures” of the heart from various angles
 - Limb Leads (six extremity leads)
 - Two-dimensional view of heart
 - The monitor manipulates electrode views to create six limb leads
 - I, II, III, aVR, aVL, aVF



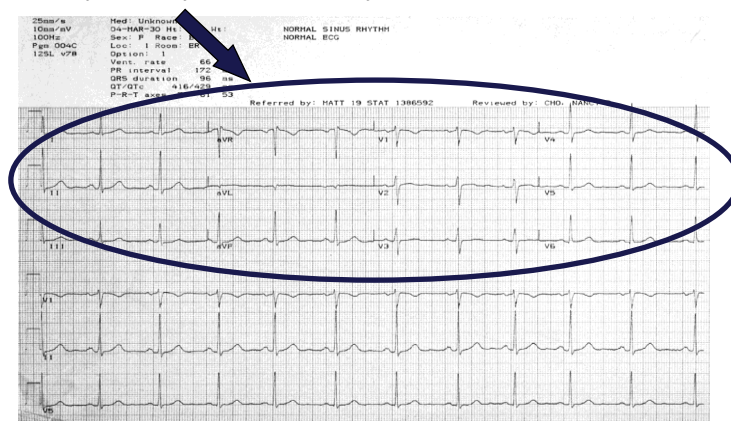
ECG Leads

- Precordial Leads (six chest leads)
 - Precordial leads are on a plane perpendicular to the limb leads.
 - Results in a three-dimensional view of the heart
 - V1, V2, V3, V4, V5, V6



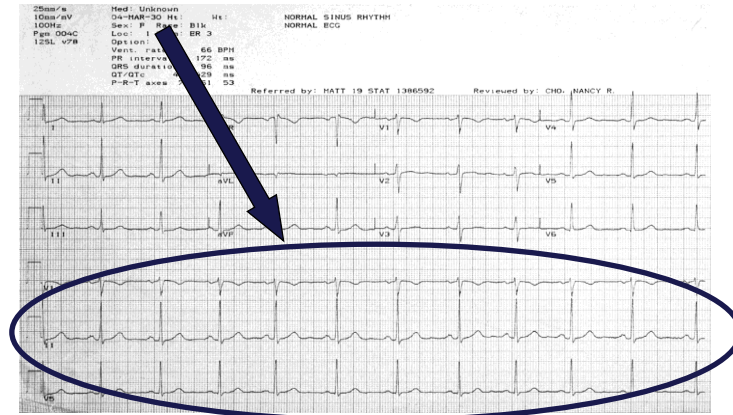
THE 12-LEAD ECG FORMAT

- Leads typically produce by pre-hospital monitors



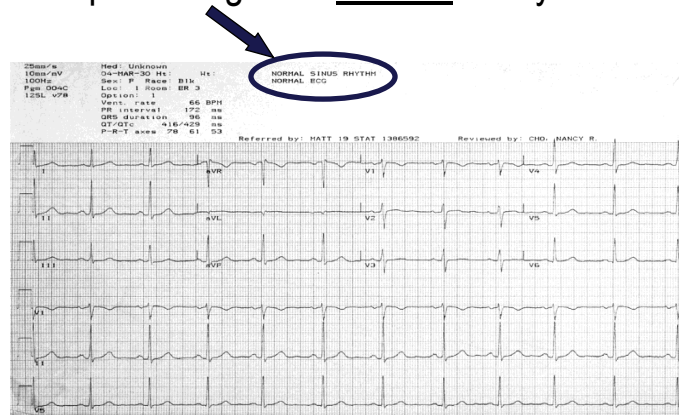
THE 12-LEAD ECG FORMAT

- Leads not typically produced by pre-hospital monitors



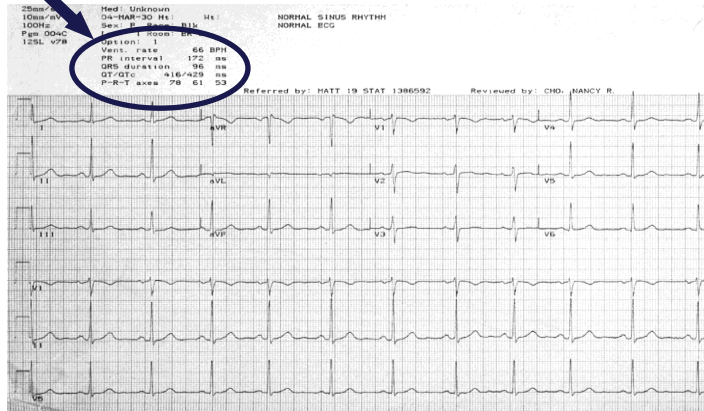
THE 12-LEAD ECG FORMAT

- The computer diagnosis IS NOT always accurate!



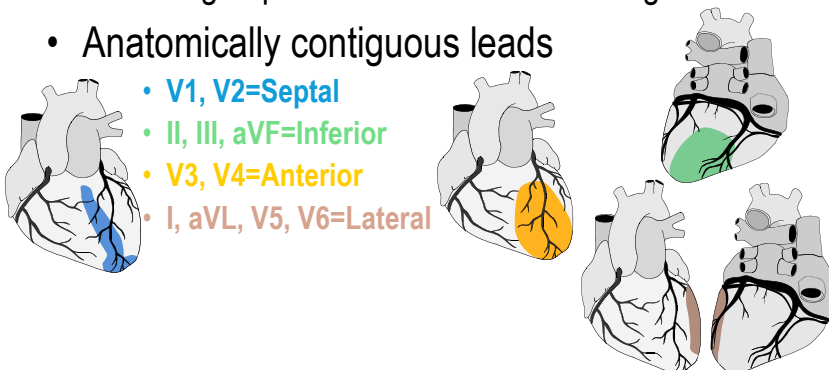
THE 12-LEAD ECG FORMAT

- The computer IS very precise at measuring intervals and durations



Anatomical Localization

- Identify contiguous leads
 - Lead groups that “look” at the same region of the heart
- Anatomically contiguous leads



Anatomical Localization

- Lead "Groups" on a 12 Lead

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

Limb Leads

Chest Leads



Anatomical Localization

- Use the acronym: **Hi, I See All Leads** to help remember lead groupings.

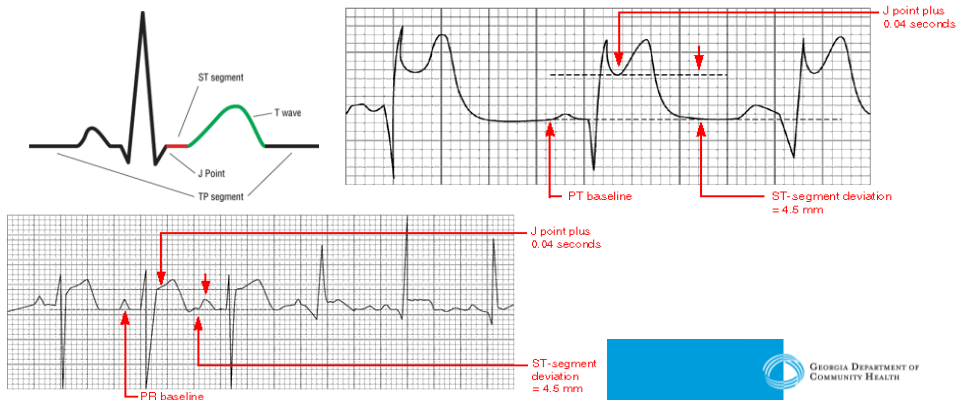
High Lateral	aVR	Septal	Anterior
Inferior	High Lateral	Septal	Lateral
Inferior	Inferior	Anterior	Lateral

<u>H</u>i,	aVR	<u>S</u>ee	<u>A</u>ll
<u>I</u>	<u>H</u>i,	<u>S</u>ee	<u>L</u>eads
<u>I</u>	<u>I</u>	<u>A</u>ll	<u>L</u>eads



STEMI=ST segment Elevation Myocardial Infarction

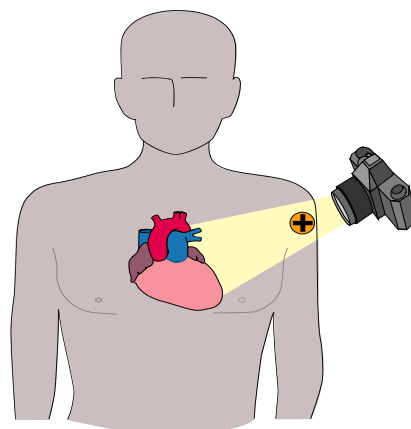
- Locate the J point and ST segment
- Determine if the ST segment is elevated one millimeter or more above the TP Segment in contiguous leads



Anatomical Localization

- “High” Lateral Wall
- Leads I and aVL
 - View from Left Arm ⊕
 - Lateral wall of left ventricle

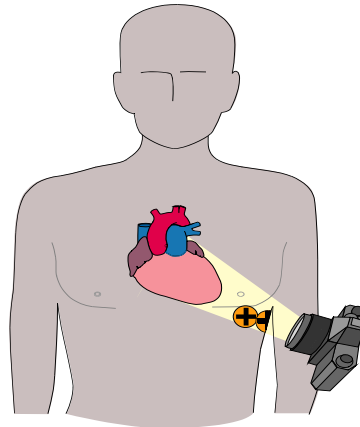
I	aVR	V1	V4
II	aVL	V2	V5
III	aVF	V3	V6



Anatomical Localization

- Lateral Wall
- Leads V5 and V6
 - Left lateral chest ⊕
 - lateral wall of left ventricle

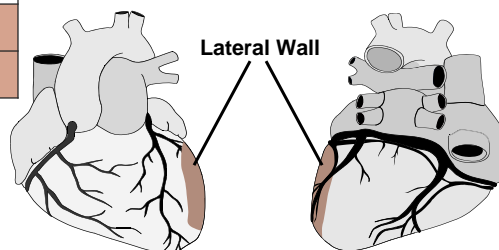
I	aVR	V1	V4
II	aVL	V2	V5
III	aVF	V3	V6



Anatomical Localization

- Lateral Wall
- Leads I, aVL, V5, and V6
 - ST elevation ☐ suspect lateral wall injury

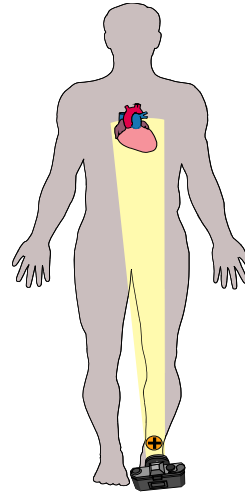
I	aVR	V1	V4
II	aVL	V2	V5
III	aVF	V3	V6



Anatomical Localization

- Inferior Wall
- Leads II, III, and aVF
 - View from Left Leg ⊕
 - inferior wall of left ventricle

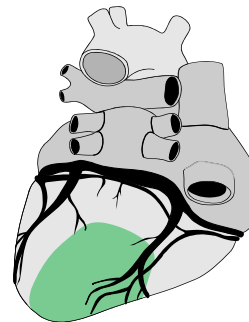
I	aVR	V1	V4
II	aVL	V2	V5
III	aVF	V3	V6



Anatomical Localization

- Inferior Wall
 - portion resting on diaphragm
 - ST elevation suspect inferior injury

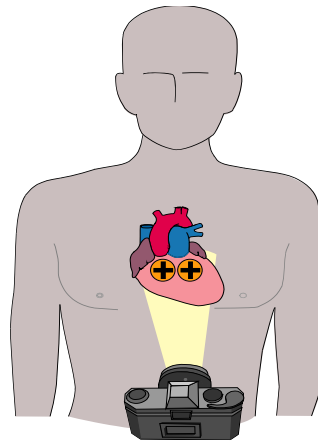
I	aVR	V1	V4
II	aVL	V2	V5
III	aVF	V3	V6



Anatomical Localization

- Septal Wall
- Leads V1, V2
 - Along sternal borders
 - Views septal wall

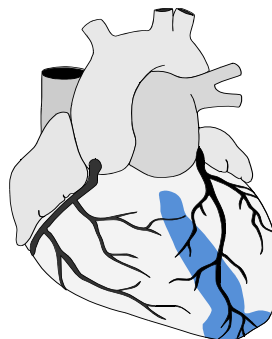
I	aVR	V1	V4
II	aVL	V2	V5
III	aVF	V3	V6



Anatomical Localization

- Septal Wall
- Leads V1, V2
 - ST elevation suspect septal injury

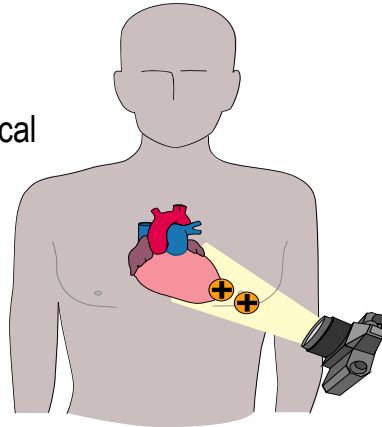
I	aVR	V1	V4
II	aVL	V2	V5
III	aVF	V3	V6



Anatomical Localization

- Anterior Wall
- Leads V3, V4
 - Views anterior wall of left ventricle
 - ⊕ electrode on anterior chest

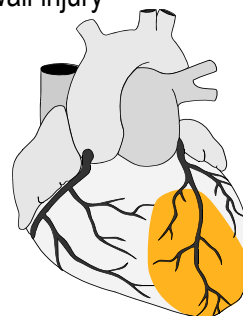
I	aVR	V1	V4
II	aVL	V2	V5
III	aVF	V3	V6



Anatomical Localization

- Anterior Wall
- Leads V3, V4
 - ST segment elevation suspect anterior wall injury

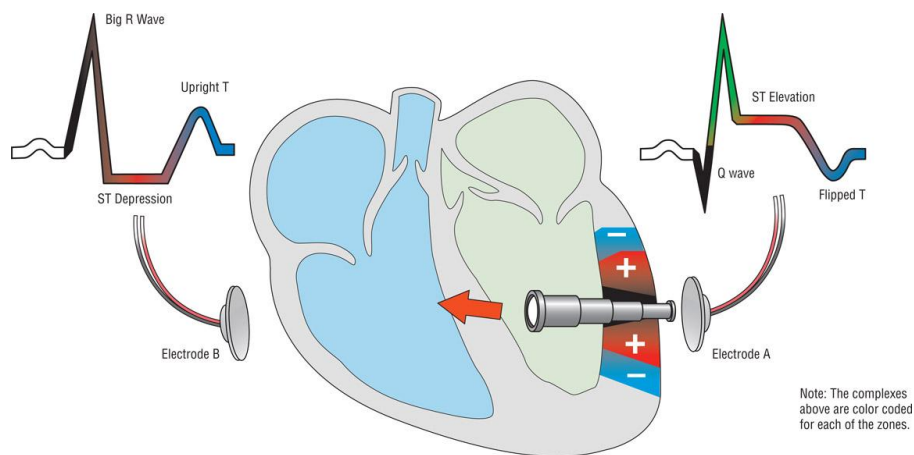
I	aVR	V1	V4
II	aVL	V2	V5
III	aVF	V3	V6



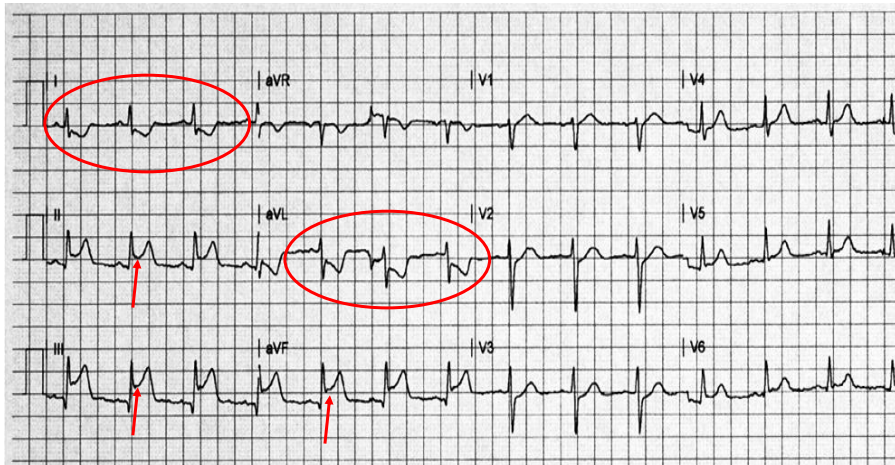
Reciprocal Changes

- Mirror image that occurs when two electrodes view the AMI from opposite angles
- Not all AMI's result in reciprocal changes
- Strong confirmation if present and may indicate more severe damage
 - Inferior MI → ST Depression in I, aVL, pos V3,V4
 - Lateral MI → ST Depression in II, III, aVF
 - Posterior MI → ST Depression in V1, V2, V3

Reciprocal Changes



Reciprocal Changes

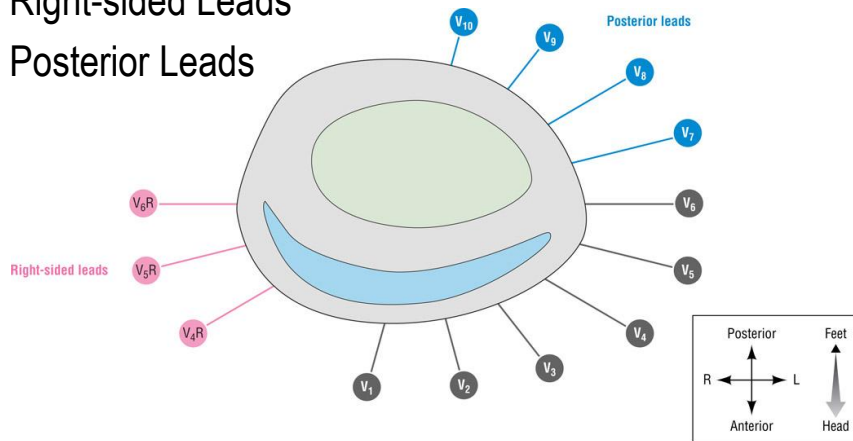


Additional ECG Leads

- Extra precordial leads may be used to evaluate additional regions not viewed with a typical 12 Lead.
- They help diagnose posterior and right ventricular infarcts, which occur frequently in combination with inferior infarcts.
- Posterior leads V_7 to V_{10} are helpful in diagnosing posterior wall AMIs.
- Right-sided leads aid in diagnosis of right ventricular infarction.
- Direct changes occurring in right ventricle are clearly seen in V_4R , V_5R , and V_6R .

Additional ECG Leads

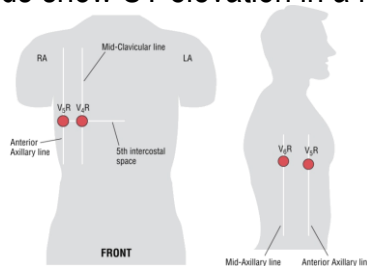
- Right-sided Leads
- Posterior Leads



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Additional ECG Leads

- Right-sided Leads
- Known as V_{4R} , V_{5R} , V_{6R}
- Attach patient to ECG normally, then move V_4 , V_5 , and V_6 to mirror image on right side of chest.
- Right-sided leads show ST elevation in a right-side infarct.



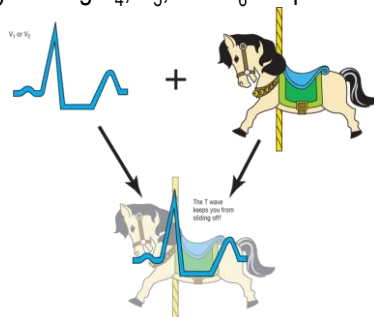
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IMPORTANT

- Inferior MI with RV involvement results in a preload dependency to maintain cardiac output.
- Any reduction in preload, e.g. nitroglycerin administration, can result in profound hypoperfusion and hemodynamic instability.
- Every time that an inferior infarct is suspected, a right-sided ECG should be obtained prior to nitrate, morphine, or beta blocker administration.

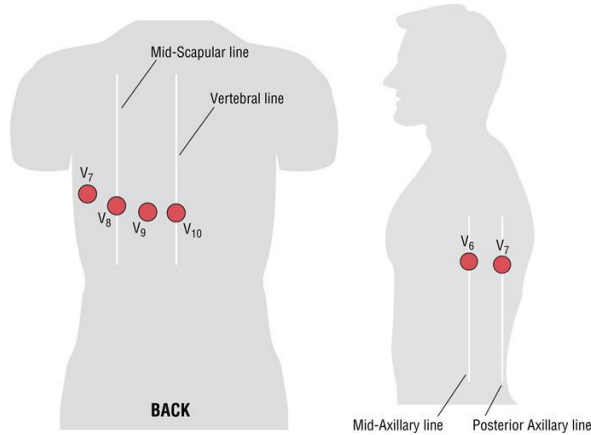
Additional ECG Leads

- Posterior leads are used in diagnosis of posterior AMI.
 - Obtain in any patient with ST segment depression in leads V_1 to V_3 (reciprocal change from posterior ST elevation).
 - Obtain by moving V_4 , V_5 , and V_6 to spots for V_7 , V_8 , V_9 .



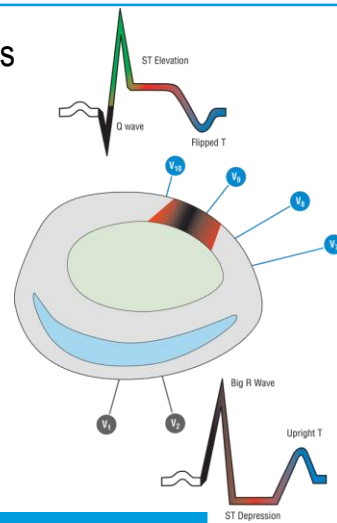
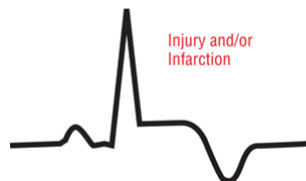
Additional ECG Leads

- Posterior ECG Lead Placement

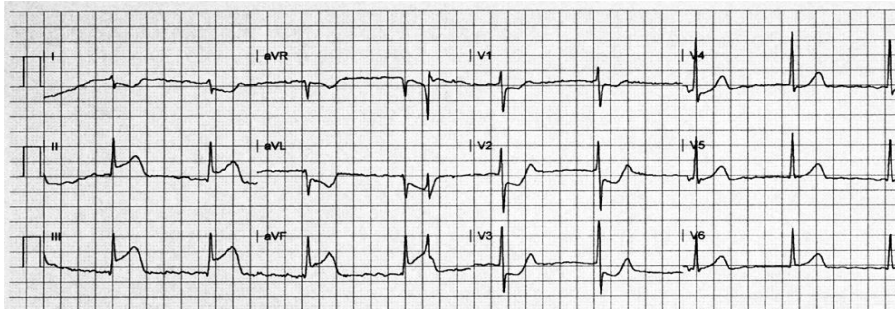


Additional ECG Leads

- Posterior leads show direct changes consistent with AMI:
 - ST elevation
 - Flipped T waves
 - Q waves



Practice #1

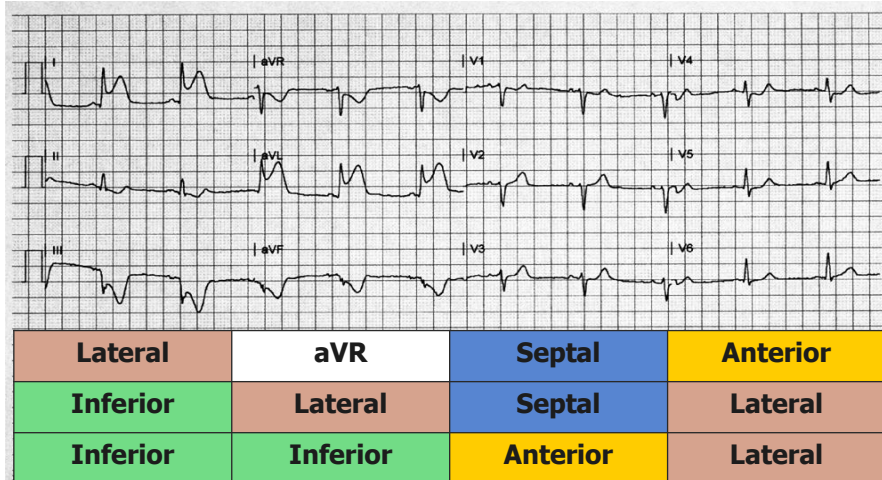


Lateral	aVR	Septal	Anterior
Inferior	Lateral	Septal	Lateral
Inferior	Inferior	Anterior	Lateral

Answer #1

- Inferior MI
 - ST segment elevation in leads II, III, and aVF
 - Reciprocal ST segment depression in leads I, aVL
- Posterior involvement
 - Carousel ponies in V1-V3

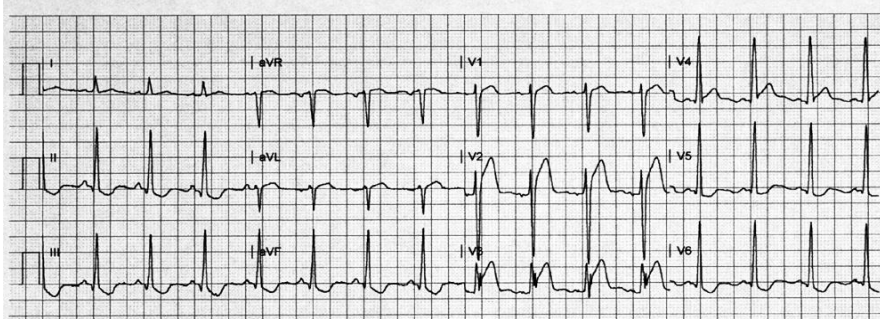
Practice #2



Answer #2

- High Lateral MI
- ST segment elevation in leads 1 and aVL
- Reciprocal ST segment depression in II, III, aVF

Practice #3

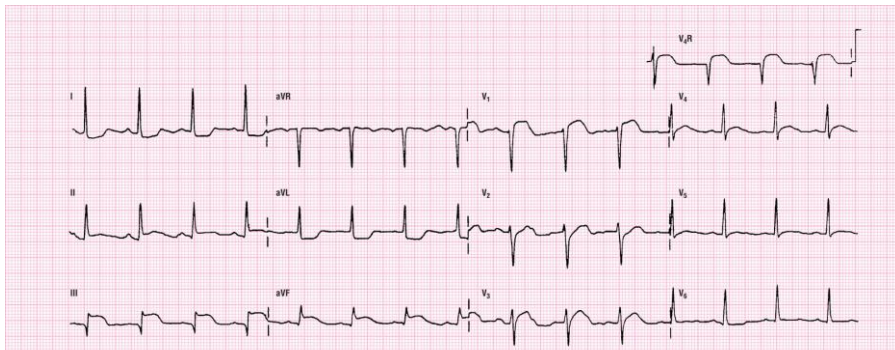


Lateral	aVR	Septal	Anterior
Inferior	Lateral	Septal	Lateral
Inferior	Inferior	Anterior	Lateral

Answer #3

- Anteroseptal MI
- ST segment elevation in leads V1-V4

Practice #4



Lateral	aVR	Septal	Anterior
Inferior	Lateral	Septal	Lateral
Inferior	Inferior	Anterior	Lateral

Answer #4

- Inferior MI with Right Ventricular Involvement
- Reciprocal depression in leads I and aVL
- ST elevation in lead V4R

The End!