12 LEAD ECG: STEMI Recognition

2011 Georgia Office of EMS Updates

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%)

- **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
  - V1, V2=Septal
  - II, III, aVF=Inferior
  - V3, V4=Anterior
  - I, aVL, V5, V6=Lateral
Anatomical Localization

- Lead “Groups” on a 12 Lead

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<tr>
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Limb Leads       Chest Leads

Anatomical Localization

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

<table>
<thead>
<tr>
<th>High Lateral</th>
<th>aVR</th>
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<th>Anterior</th>
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<td>Inferior</td>
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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

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Anatomical Localization

• Lateral Wall
• Leads V5 and V6
  – Left lateral chest
  – Lateral wall of left ventricle

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Anatomical Localization

• Lateral Wall
• Leads I, aVL, V5, and V6
  – ST elevation suspect lateral wall injury

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Anatomical Localization

• Inferior Wall

• Leads II, III, and aVF
  – View from Left Leg
  – Inferior wall of left ventricle


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Anatomical Localization

• Inferior Wall
  – Portion resting on diaphragm
  – ST elevation suspect inferior injury


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Anatomical Localization

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

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Anatomical Localization

• Anterior Wall
• Leads V3, V4
  - Views anterior wall of left ventricle
  - Electrode on anterior chest

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Anatomical Localization

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

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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

Note: The complexes above are color-coded for each of the zones.
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

Additional ECG Leads

• Right-sided Leads
• Known as V₄R, V₅R, V₆R
• Attach patient to ECG normally, then move V₄, V₅, and V₆ to mirror image on right side of chest.
• Right-sided leads show ST elevation in a right-side infarct.
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 V₁ to V₃ (reciprocal change from posterior ST elevation).
  – Obtain by moving V₄, V₅, and V₆ to spots for V₇, V₈, V₉.
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

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

Answer #3

- Anteroseptal MI
- ST segment elevation in leads V1-V4
Answer #4

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