Content Description

This presentation will provide a basic introduction to 12 lead ECG interpretation. Emphasis will be on normal 12 lead patterns and patterns of myocardial ischemia, injury, and infarction. Small group work will allow participants to apply information to case studies.

Learning Objectives

At the end of this session and small group work, the participant will be able to:

1. Interpret a normal 12-lead ECG.

2. Differentiate patterns of ischemia, injury, and infarction as seen on 12-lead ECGs.

3. Apply information to the analysis of 12-lead ECG case studies.

Summary of Key Points/Outline

I. Issues related accurate 12 lead ECGs
   A. Patient preparation for 12 lead ECG
   B. Proper lead placement

II. Polarity of leads

III. Patterns of leads
   A. I, aVL
   B. II, III, aVF
   C. V1-6

IV. PQRST morphology across 12 leads

V. Patterns of Ischemia
   A. ST segment changes
   B. T wave changes

VI. Patterns of Injury
   A. ST segment changes
   B. T wave changes

VII. Patterns of Infarction
    A. ST segment changes
    B. T wave changes
    C. Q waves
VIII. Reciprocal changes
IX. Relationship of patterns of ECG changes to coronary arteries and other cardiac structures
X. Case Study Analyses

Bibliography/Webliography


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12 lead ECG Workshop

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* Interpret a normal 12-lead ECG.
* Differentiate patterns of ischemia, injury, and infarction.
* Apply information to analysis of 12-lead ECG case studies.

“the patient needs a 12-lead”

Improving the accuracy of the 12-Lead ECG

- Patient preparation
  » Positioning
  » Skin preparation
  » Gauze
  » Alcohol

Improving the accuracy of a 12-lead ECG: Lead Placement

- Four limb leads
  - Left arm
  - Left leg
  - Right arm
  - Right leg (ground)

Improving the accuracy of a 12-lead ECG

- Dealing with lead placement “challenges”
  - Hair: shave v. clip?
  - Diaphoresis
  - Anatomy
- Implications of incorrect lead placement

Improving the accuracy of a 12-lead ECG

- Dealing with ECG tracing “challenges”
  - Internal factors (patient)
  - External factors (environment)
What do those 12 leads look like?

- Frontal Plane
  - Bipolar (+ and -) limb leads
    » Lead I
    » Lead II
    » Lead III

- Augmented (a) limb leads (unipolar: +)
  » aVR
  » aVL
  » aVF
What do those 12 leads look like?

- Horizontal plane (unipolar: +)
  - V_1
  - V_2
  - V_3
  - V_4
  - V_5
  - V_6

What are those 12 leads looking at?

- Inferior wall of left ventricle
What are those 12 leads looking at?

- Lateral wall of left ventricle (high)
  - RA and LA

- Ventricular septal wall
  - V₁ and V₂

- Anterior wall of left ventricle
  - (V₂, V₃, and V₄)

- Lateral wall of left ventricle (low)
  - V₅ and V₆
So … moving beyond the basics

- Linking patterns of leads, coronary arteries, areas of the myocardium, and other (not so obvious) cardiac structures
- Differentiating patterns of ischemia, injury, and infarction

Patterns of Ischemia, Injury, Infarction

- Ischemia
  - ST segment depression
  - T wave inversion

62 y.o. male presents with “chest tightness.”
Initial ECG
Patterns of Ischemia, Injury, Infarction

- **Injury: ST segment elevation**
- **Infarction: Hyperacute stage**
  - ST segment elevation
  - T wave inversion
  - Reciprocal changes
    - V1 through V6, I, and aVL
    - II, III, aVF
    - I, aVL, V5, V6

- **Acute Infarction**
  - Development of a pathologic Q wave (wide, >25% of height of R wave)
  - Resolution of Acute Infarction
    - ST segment returns to baseline
    - T wave usually resumes upright position
    - Pathologic Q wave persists for life
Case Study: ECG #1

The patient is a 48 yo male firefighter who presented to the ED with intermittent, midsternal, chest pain that developed today while fighting a fire. He puts on the call light and tells you “I’m having that pain again.”

Review the 12 Lead ECG and complete the following information:

1. Basic (underlying) Rate and Rhythm:

2. R wave progression: Normal or Abnormal
   - If abnormal, describe:

3. Pathologic Q waves present? Yes No
   - If yes, identify leads:

4. ST segments (circle all that apply): Isoelectric Depressed Elevated
   - If depressed, identify leads:
   - If elevated, identify leads:

5. T waves: Normal or Abnormal
   - If abnormal, identify leads and describe:

6. Reciprocal changes present? Yes No
   - If yes, identify leads:

7. Interpretation:

Think about the coronary arteries involved; treatment strategies, including monitoring; and possible complications that would apply to this patient.
Case Study: ECG #2

The patient is a 52 yo black female who presents with left arm pain and SOB. PMH: IDDM, HTN. She was brought to the ED by a coworker when these symptoms developed at lunch. Patient tells you that the pain started on her way to work that morning.

Review the 12 Lead ECG and complete the following information:

1. Basic (underlying) Rate and Rhythm:

2. R wave progression: Normal or Abnormal
   If abnormal, describe:

3. Pathologic Q waves present? Yes No
   If yes, identify leads:

4. ST segments (circle all that apply): Isoelectric Depressed Elevated
   If depressed, identify leads:
   If elevated, identify leads:

5. T waves: Normal or Abnormal
   If abnormal, identify leads and describe:

6. Reciprocal changes present? Yes No
   If yes, identify leads:

7. Interpretation:

Think about the coronary arteries involved; treatment strategies, including monitoring; and possible complications that would apply to this patient.
Case Study: ECG #3

The patient is an 80 yo female who was admitted from the nursing home because of new onset confusion and agitation. Patient is normally oriented to person and place. Patient is unable to tell you if she has chest pain. B/P: 96/50 (baseline: 136/70), RR: 26 (baseline: 18), T: 98.8, Pulse Ox: 91% (RA), peripheral pulses are weak. The patient’s daughter is in route to the hospital.

Review the 12 Lead ECG and complete the following information:

1. Basic (underlying) Rate and Rhythm:

2. R wave progression: Normal or Abnormal
   
   If abnormal, describe:

3. Pathologic Q waves present? Yes No
   
   If yes, identify leads:

4. ST segments (circle all that apply): Isoelectric Depressed Elevated
   
   If depressed, identify leads:
   
   If elevated, identify leads:

5. T waves: Normal or Abnormal
   
   If abnormal, identify leads and describe:

6. Reciprocal changes present? Yes No
   
   If yes, identify leads:

7. Interpretation:

Think about the coronary arteries involved; treatment strategies, including monitoring; and possible complications that would apply to this patient.
Case Study: ECG #4

A 65 yo male presents with a history of intermittent substernal chest pain over the past 4-5 d. He states he saw his PCP today and was sent to the hospital with his ECG. He denies pain at this time. PMH: hyperlipidemia, BMI>30, prostate cancer (in remission).

Review the 12 Lead ECG and complete the following information:

1. Basic (underlying) Rate and Rhythm:

2. R wave progression: Normal or Abnormal
   If abnormal, describe:

3. Pathologic Q waves present? Yes No
   If yes, identify leads:

4. ST segments (circle all that apply): Isoelectric Depressed Elevated
   If depressed, identify leads:
   If elevated, identify leads:

5. T waves: Normal or Abnormal
   If abnormal, identify leads and describe:

6. Reciprocal changes present? Yes No
   If yes, identify leads:

7. Interpretation:

Think about the coronary arteries involved; treatment strategies, including monitoring; and possible complications that would apply to this patient.
Case Study: ECG #5

The patient is a 58 yo Hispanic male who presents to the ED with substernal chest pain that he rates 12/10. He states that the pain started approximately 2 hours ago while at work. Patient is diaphoretic, gray, and clutching his chest. VS: B/P: 118/60, RR: 22, T: 98.9, Pulse Ox: 95% (RA).

Review the 12 Lead ECG and complete the following information:

1. Basic (underlying) Rate and Rhythm:

2. R wave progression: Normal or Abnormal
   
   If abnormal, describe:

3. Pathologic Q waves present? Yes No
   
   If yes, identify leads:

4. ST segments (circle all that apply): Isoelectric Depressed Elevated
   
   If depressed, identify leads:
   If elevated, identify leads:

5. T waves: Normal or Abnormal
   
   If abnormal, identify leads and describe:

6. Reciprocal changes present? Yes No
   
   If yes, identify leads:

7. Interpretation:

Think about the coronary arteries involved; treatment strategies, including monitoring; and possible complications that would apply to this patient.