Electrocardiography for Healthcare Professionals

Chapter 14
Basic 12-Lead ECG Interpretation

Learning Outcomes

14.1 Discuss the anatomic views seen on a 12-lead ECG and the coronary artery that commonly supplies that region of tissue.

14.2 Identify common morphologic changes associated with ischemia, injury, and infarction.

Learning Outcomes (Cont’d)

14.3 Define axis deviation, and list the steps utilized to determine the presence of axis deviation.

14.4 Define bundle branch block (BBB), identify what makes BBB unique, differentiate left from right BBB, and list the steps to determine the presence of BBB.

Learning Outcomes (Cont’d)

14.5 Describe left ventricular hypertrophy (LVH), and list the steps to determine the presence of LVH.

14.1 The Views of a Standard 12-Lead ECG and Major Vessels

- Leads II, III, and aVF:
  - Inferior wall of left ventricle
  - Right coronary- Marginal branch

- Leads V1 & V2:
  - Septal wall
  - Left coronary-Septal branch

14.1 The Views of a Standard 12-Lead ECG and Major Vessels (Cont’d)

- Leads V3 & V4:
  - Anterior wall of left ventricle
  - Left coronary- Left Anterior Descending

- Leads I, aVL, V5 & V6:
  - Lateral wall of left ventricle
  - Left coronary- Left circumflex

14.1 Apply Your Knowledge

The standard 12-lead ECG focuses directly on what part of the heart?
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Answer: Left ventricle

9  14.2 Determining Ischemia, Injury, or Infarction
Step 1:
  Determine the ECG rhythm or regularity
Step 2:
  Determine the atrial and ventricular rate
Step 3:
  Identify the P wave configuration

10  14.2 Determining Ischemia, Injury, or Infarction (Cont’d)
  Step 4:
    Measure the PR interval
    Step 5:
    Measure the QRS duration and analyze the configuration

11  14.2 Determining Ischemia, Injury, or Infarction (Cont’d)
  Anatomically contiguous lead: 2 or more leads “looking” at the same part of the heart
  Includes:
  II, III, aVF
  I, aVL
  V1, V2, V3, V4, V5, V6

12  14.2 Determining Ischemia, Injury, or Infarction (Cont’d)
  T wave inversion:
  □ A positively deflected waveform
  □ In ischemia, will be negatively deflected
  □ May be by itself or seen with ST segment elevation

13  14.2 Determining Ischemia, Injury, or Infarction (Cont’d)
  ST Segment Elevation:
  □ Referred to as myocardial injury, acute injury pattern, or acute MI
  □ Physiologic Q wave:
    □ Normal Q wave
    □ Measures less than 0.04 second
    □ Depth measures less than 1/3 height of R wave

14  14.2 Determining Ischemia, Injury, or Infarction (Cont’d)
  Pathologic Q wave:
    □ Shape changes due to tissue death
    □ Measures 0.04 second and/or greater than or equal to 1/3 height of the R wave
    □ Indicates tissue death in heart if seen in 2 or more anatomically contiguous leads

15  14.2 Apply Your Knowledge
  What is ST segment elevation seen on a 12-lead ECG often referred as?

16  14.2 Apply Your Knowledge
What is ST segment elevation seen on a 12-lead ECG often referred as?

Answer: Myocardial injury, acute injury pattern, or acute MI

14.3 Causes of Axis Deviation

Left Axis Deviation:
- Left ventricular hypertrophy
- Pregnancy
- Obesity
- Emphysema
- Hyperkalemia

14.3 Causes of Axis Deviation (Cont’d)

Right Axis Deviation:
- Right ventricular hypertrophy
- Anterolateral wall MI
- Considered normal in children and tall, thin adults

14.3 Causes of Axis Deviation (Cont’d)

Extreme Right Axis Deviation:
- Situs transversus or dextrocardia (heart is on the right side of chest)
- Pacemaker rhythms
- COPD patients
- Hyperkalemia

14.3 Determining the Presence of Axis Deviation

Step 1: If lead I is up, aVF is up, axis is normal
Step 2: If lead I is up, aVF is down, patient has left axis deviation
Step 3: If lead I is down, aVF is up, patient has right axis deviation
Step 4: If lead I is down, aVF is down, patient has extreme right axis deviation

14.3 Apply Your Knowledge

What are the two leads to refer to when determining the presence of axis deviation?

Answer: Leads I and aVF

14.4 Bundle Branch Block

QRS duration:
- Wider than normal (0.12 second or greater)
- Right Bundle Branch Block (RBBB):
QRS is positively deflected
- Classic RSR pattern in V1
- Referred to as “bunny ears” or “bunny branch block”

14.4 Bundle Branch Block (Cont’d)
- Left Bundle Branch Block (LBBB):
  - QRS is negative or a QS complex is present
- To determine the presence of BBB look for:
  - Evidence of atrial activity (P wave)
  - QRS complex 0.12 second or greater

14.4 Apply Your Knowledge
Which lead is referenced to distinguish between right and left bundle branch blocks?
Answer: Lead V1

14.5 Left Ventricular Hypertrophy (LVH)
- Abnormal thickening of ventricular wall
  - The wall thickens due to increased vascular resistance over time
- QRS complex shows greater amplitude
  - Taller and deeper ventricular depolarization waves will be seen

14.5 Determining the Presence of LVH
Step 1:
- Refer to V1 & V2
- Measure and select the deeper of the 2 views
- Measure from the isoelectric line down to the tip of the deepest QS complex, count mm
- Write this number down

14.5 Determining the Presence of LVH (Cont’d)
Step 2:
- Refer to V5 & V6
- Measure and select the taller of the 2 views
- Measure from the isoelectric line to tip of tallest R wave, count mm
- Write number down
LVH (Cont’d)

Step 3:
- Add the 2 numbers together
- If it adds up to 35 or more mm, clinically you would suspect left ventricular hypertrophy

14.5 Apply Your Knowledge

When totaled, how many millimeters is the minimum necessary to clinically suspect left ventricular hypertrophy?

Answer: 35mm

Chapter Summary

- Leads II, III, aVF view the inferior wall of left ventricle.
- Leads V1 & V2 view the lateral wall of left ventricle.
- ST segment depression of 1mm or more indicates myocardial ischemia.

Chapter Summary (Cont’d)

- ST segment elevation of 1mm or more indicates myocardial injury.
- Pathologic Q wave indicates tissue death or MI
- Electrical deviation causes changes in the ECG due to the position of the heart in the patient’s chest.

Chapter Summary (Cont’d)

- Bundle branch blocks occur when one or both of the ventricular pathways are damaged or delayed.
- BBB has a wider QRS duration (0.12 second or greater)
- Refer to V1 to differentiate RBBB and LBBB.

Chapter Summary (Cont’d)

- LBBB presents with a P wave and a QS complex 0.12 second or more.
- RBBB presents with a P wave and a R wave that has 2 points and a QS complex of 0.12 second or more.

Chapter Summary (Cont’d)

- Left ventricular hypertrophy is a thickening of the ventricular wall due to pumping against increased vascular resistance.
- LVH presents with greater amplitude of the QRS complex and taller and deeper ventricular depolarizations.