STEP-BY-STEP INTERPRETATION OF THE 12-LEAD ECG

STEP ONE Analyze rhythm, PRI, QRS width and shape, QT interval	Lead II usually BEST lead. Each horizontal small block = .04 sec. Each vertical small block = .1 mlvolt. NSR (PRI = .10-.20 sec, QRS = .04-.10 sec, QT = < 1/2 normal R-R interval)	A rhythm with a normally conducted QRS offers the best opportunity to analyze the ECG and compare it with normal standards.
STEP TWO Look for complete right bundle branch block and left bundle branch block in lead V1 & V2	**RBBB:** rSR' configuration or primarily positive QRS in V1 and V2 (may or may not increase the width of QRS > .10 sec. "Rabbit ears" **LBBB:** primarily negative QRS in V1 and V2 of greater than .12 sec. "Carrot-shaped" Repolarization changes in lead I and V6	If LBBB or RBBB is present, the ECG will be of little value in determining presence of an MI. Distorted ST segments, altered J points, widened QRS complexes and variations in T waves usually accompany LBBB or RBBB. Ventricular paced rhythms or ventricular-initiated rhythms, such as complete heart block, also make the ECG of little value in evaluating for MI. RBBB not usually associated with as severe disease as LBBB.
STEP THREE Look for partial left bundle branch block (left anterior hemiblock or left posterior hemiblock)	**LAHB:** • Lead I + QRS • Lead II - QRS "Up, Down, Down" • Lead III - QRS **LPHB:** • Lead I - QRS • Lead II + QRS "Down, Up, Up" • Lead III + QRS	May indicate hypertensive cardiomyopathy, ventricular hypertrophy, MI, CAD, pulmonary emphysema, or myocarditis
STEP FOUR Evaluate for ventricular hypertrophy Examine the QRS in V1 & V5 or AVL or V5 & V6 for Left Ventricular Hypertrophy Examine the QRS in V1 or V1 & V6 for right ventricular hypertrophy	Signs of **LVH:** • Voltage - S in V1 + R in V5 > 35mm or R in AVL > 11mm or R in V5 or V6 > 27mm • Repolarization changes in left heart leads (V3-V6, I and AVL) • LAD >15 may be present • QRS width > .09 sec and intrinsicoid deflection in V5-V6 of .04 sec or more Signs of **RVH:** • Voltage - R wave > S in V1 or R wave in V1 + S in V6 > 11mm • Repolarization changes in right heart leads (V1-V3, III and AVF) • RAD may be present	Enlarged muscle mass resulting from hypertrophy increases voltage Criteria for LVH vary. Body habitus and conditions masking voltage of true electrical event (emphysema and pericardial effusion) may make it difficult to use ECG to determine LVH. Most often associated with hypertension, aortic valve dysfunction, and hypertrophic cardiomyopathy. The voltage associated with right ventricular depolarization accounts for about 5% of the QRS, so only the ECG leads closest to the right ventricle permit determination of abnormalities in that area. Most often associated with mitral stenosis, chronic cor pulmonale, and congenital heart disease.

STEP FIVE Determine frontal axis - the average direction of the mean vectors of the heart for both the P and QRS, using standard and augmented leads (I, II, III, AVR, AVL, AVF)	• The tallest QRS is found in the ECG lead that points directly toward the QRS axis (Tallest can mean either + or -) • The most equiphasic QRS (a positive and negative wave of the same voltage) is seen in the ECG lead that is at right angles to the QRS axis. • Look at <u>Lead I</u> over Lead AVF: If lead I and AVF are both positive, "Everything is on the UP and UP" = Normal axis (↑ ↑) If lead I and AVF "Look away from each other" = Left Axis Deviation (↑ ↓) If lead I and AVF are "Right at each other" = Right Axis Deviation (↓ ↑) If lead I and AVF are both negative, "No Man's Land" = indeterminate axis (↓ ↓)	Since the normal heart is turned to the left, and normal left ventricular and septal depolarization sweep toward the apex, the mid-point of the electrical forces involved in the QRS is usually in the right lower quadrant (0-90) Normal axis: 0-90 (or -10 to +110) LAD: -15 to -90 (right upper quadrant) Associated with mechanical shifts (pregnancy, obesity), LAHB, LVH, WPW, Inferior MI, ventricular ectopy. RAD: +115 to +180 (left lower quadrant) Associated with mechanical shifts (tension pneumothorax, tumors), LPHB, RVH, WPW, Lateral MI, ventricular ectopy. indeterminate axis: +180 to +270 (left upper quadrant) Associated with ventricular ectopy
STEP SIX Inspect for ischemia, injury, or infarction patterns in groups of leads: Anterior leads: V1-V4 Septal leads: V1 & V2 Lateral leads: I, AVL, V5 & V6 Inferior leads: II, III, & AVF Posterior leads: Tall R in V1-V2	Signs of **Ischemia:** • T wave inversion • ST segment depression (1-2mm below baseline) Signs of **Injury:** • ST segment elevation (1-2mm above baseline) Signs of **infarction:** • Q waves - > .04 sec. wide > 1/3 total size of QRS (25% of R wave) ≥ 2mm in depth New or Increased size of Q wave	T wave should be positive in all leads except AVR & V1. Sometimes the T wave may be normally inverted in leads III and V2. When myocardial ischemia is present, T wave size may increase in the acute phase of injury, followed by T wave inversion. ST segment can take on different configurations but J point is always off baseline. T wave will remain inverted but may not be seen if ST segment is greatly elevated. Abnormal Q waves usually begin to appear about 2 hours after the onset of the MI, reaching maximum size in about 24-48 hours. Abnormal Q waves may persist indefinitely or disappear in months to years. Usually accompany symptoms of MI and elevation of enzymes. Non Q MI - may only see T wave inversion