

1. MEASUREMENTS (usually made in frontal plane leads):

- Heart rate (state both atrial and ventricular rates, if different)
- PR interval (beginning P to beginning QRS) 0.12-0.20 sec
- QRS duration (width of most representative QRS) 0.06 – 0.10 sec
- QT interval (beginning of QRS to end of T) 0.36 – 0.46 sec (40% R-R)
- QRS axis in frontal plane

2. RHYTHM ANALYSIS:

- Basic rhythm (e.g., "normal sinus rhythm", "atrial fibrillation", etc.)
- ID additional rhythm events if present (e.g., "PVC's", "PAC's", etc)

3. CONDUCTION ANALYSIS: SA, AV, and IV

- 2nd degree SA 'exit' block (type I, type II, or uncertain)
- 1st, 2nd (type I or type II), and 3rd degree AV block
- IV blocks: bundle branch, fascicular, and nonspecific blocks
- Exit blocks are blocks distal to sinus or an ectopic pacemaker site

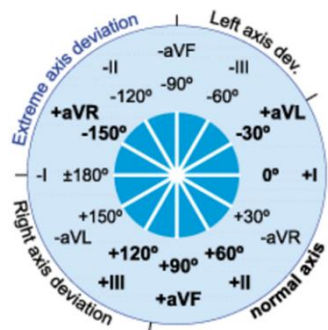
4. WAVEFORM DESCRIPTION: P, QRS, ST, T, and U wave

- P waves: too wide, too tall, look funny (i.e., are they ectopic), etc.?
- QRS complexes: look for pathologic Q waves, abnormal voltage, etc.
- ST segments: look for abnormal ST elevation and/or depression.
- T waves: inverted or unusually tall. U waves: prominent or inverted

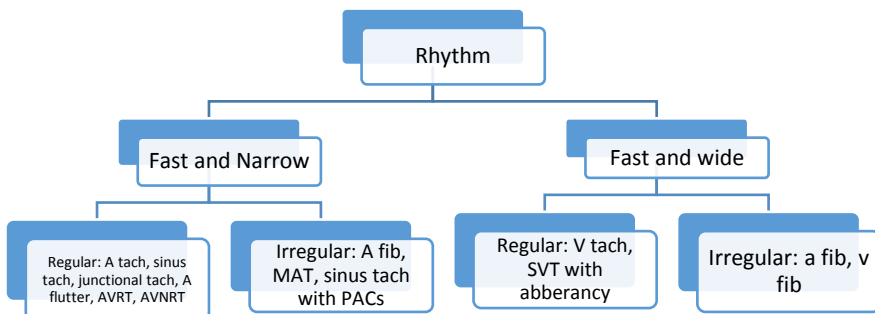
5. ECG INTERPRETATION: ie old MI, LAFB, LVH, rhythm abnl, etc.

6. COMPARE TO PRIORS

HEXAXIAL SYSTEM (Frontal plane)



- Normal:** +90 to -30
- Right Axis Deviation:** +90 to +180
Ddx: LPFB, COPD, PE, Pulm HTN, RVH, Lateral Wall MI, Children/Teens
- Left Axis Deviation:** -30 to -90
Ddx: LAFP, LVH, Inferior MI, Obesity, Paced Rhythm
- Extreme:** -90 to +180
Differential: Consider Limb Lead Error, Dextrocardia, Congenital Heart Disease



- Atrial Flutter: Atrial rate: 240-350 bpm; saw tooth pattern
- Atrial Fibrillation: Irregularly Irregular. No P waves; Ventricular Rate: 160-200bpm
- Atrial Tachycardia: Unifocal P' waves atrial rates < 250bpm
- Multifocal Atrial Tach: At least 3 diff types P waves at 100-250bpm – v rate irregular
- Junctional Tach: AV node is primary pacemaker; rate 40-60. In JT, heart rate > 60; retrograde P waves in ST segments

Conduction Analysis

- 1 degree AVB:** PR Interval > 0.20s, All associated P with QRS
- 2 AVB:** Type I Mobitz (Wenchebach): Increase PR Int → QRS is dropped = AVnode Dysfunction
- Type II Mobitz: PR interval is constant until QRS is dropped = Infra His Dysfunction
- 3 AVB (Complete):** No AV conduction. P has no relation to QRS

RBBB: Widening of QRS > 0.12, Deep and round S wave in Leads I, aVL, V4-V6, RR' or M pattern of QRS in leads V1-V3.

LBBB: Widening of QRS, No septal Q in V4-V6, I, aVL; Normal ST-T waves should be oriented opposite to the direction of the terminal QRS forces

LAFB: LAD, rS complexes in leads II, III, aVF; Small q waves in leads I and/or aVL. QRS duration usually < 0.12 unless coexisting RBBB

LPFB: RAD, rS complex in lead I and aVL; qR complex in leads II, III, aVF

Bifascicular Blocks: RBBB + LAFB (common) or LPFB (uncommon)

Waveform Analysis:

Right Atrial Enlargement: P wave amplitude > 2.5mm in lead II and/or > 1.5 mm in V1

Left Atrial Enlargement: P wave duration > 0.12sec in frontal plane; Biphasic P wave with broad negative component in V1.

Bi-atrial Enlargement: P wave in lead II > 2.5mm tall and > 0.12sec in duration

LVH: Cornell Criteria – Male: S in V3 + R in aVL > 28mm; Female: S in V3 + R in aVL > 20mm

RVH: RAD, Tall R-wave in RV leads (V1-2); Deep S-waves in LV leads (V5-6); R in aVR > 5mm or R in aVR > Q in aVR

Ischemia:

Anterior	Leads V2-V4, Left Ant Descending
Anteroseptal:	Leads V1-V4, Left Ant Descending
Anterolateral:	Leads V1, V6, I, aVL, LAD/Diagonal
Inferior:	Leads II, III, aVF, Right Main/Circumflex
Lateral:	Leads I, aVL, V5-V6, Circumflex/Diagonal
Posterior:	Tall R in V1-V3; Right Coronary Artery
RV:	Right V4; Right Coronary Artery

Electrolyte Abnormalities:

- Hypercalcemia: Abbreviated ST segment with short QT
- Hypocalcemia: Long ST segment with prolong QT
- Hyperkalemia: Peaked Ts, long QRS, flat P, severe sin wave
- Hypokalemia: ST depression, low T waves, and large U
- Digoxin: scooped ST depression, low amp T, short QT

Ischemia = lack of oxygen:
ST depression and increased T wave amplitude
Injury = irreversible: - represented by ST depression
Infarct:
Acute = Pathological Q waves, ST may be elevated, and T may be inverted
Age indeterminate – pathological Q waves with ST segment and T wave returned to normal
Q wave that are wider than 0.04 sec and greater than 0.5 the entire QRS complex.