

The five steps to interpreting an EKG

Rate:

Heart rate (are atrial and ventricular rates the same?)

Count big boxes: 300, 150, 100, 75, 60, 50

Small boxes = 0.04 sec, Big box = .2 sec. 5 big boxes = 1 second.

If irregular, count the beats in 30 boxes (6 seconds) and multiply the answer x10

Junctional usually 40-60 (narrow), Accelerated = 60-100, Tachy = >100

Ventricular usually <40 (wide)

Rhythm – is it sinus?:

Should have normal upright Ps in I, II, III, and aVF. Inverted Ps in any of these = ectopic atrial rhythm. Negative P wave AND QRS in lead I = likely limb lead reversal or dextrocardia (would also have loss of R wave progression.)

Sinus also has normal T wave inversions in aVR and V1

Axis:

Normal = QRS is positive lead I and lead aVF

LAD (QRS positive in lead I and negative in lead aVF) DDx: LAFB, LBBB, inferior MI, LVF, pacing, WPW, sometimes physiologic with age, high diaphragm (ascites, pregnant), congenital heart dsx like primum ASD or cushion defect

RAD (QRS negative in lead I and positive in lead aVF) DDx: LPFB, ~RBBB, lateral MI, RVH, lung disease (PE or emphysema), hyperkalemia, OD on sodium channel blocking drugs (like TCAs), or normal slender adults or young people with a horizontally positioned heart, dextrocardia

Extreme = consider limb lead error, dextrocardia, or congenital disease

Normal intervals:

PR = 3-5 small boxes (120-200ms).

QRS = <100ms. 100-120 often incomplete BBB. >120 prolonged.

QT corrected for rate = 340-470.

Consider prolonged or shortened intervals, and conduction blocks.

Waveforms:

Scan for shape and diagnoses!

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

Helpful reminders

Ischemia

Anterior	Leads V2-V4	LAD
Anteroseptal	lead V1-V4	LAD
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	RCA
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

Tachycardias

DDX narrow-complex regular: 1) ST 2) atrial flutter 3) SVT (atrial tach, AVRT, AVNRT).

-A. flutter atrial activity can often be seen in the inferior leads, and should always be considered when the V rate is 150 +/- intervals of 20 BPM. "Sawtooth" pattern.

- Normal PR interval rules out SVT, and there are often SVT often has retrograde P-waves in the inferior leads

DDX narrow-complex irregular: 1) atrial flutter with variable block 2) MAT 3) A fib

- Atrial Fibrillation: Irregularly Irregular. No P waves; Ventricular Rate: 160-200bpm

- Multifocal Atrial Tach: At least 3 diff types P waves at 100-250bpm – v rate irregular

DDX wide-complex regular: 1) sinus tach with aberrancy 2) SVT with aberrancy 3) VT
-SVT with aberrancy vs. VT is difficult – if you see Ps thrown in throughout, it's VT. When in doubt, it's VT.

DDx wide-complex irregular: 1) a fib with aberrancy 2) a fib with WPW 3) polymorphic ventricular tachycardia (PVT)

-Atrial fibrillation with aberrant conduction usually will not exceed a ventricular rate of 200/minute, but the other two are often 200–250/minute

-In A fib with aberrancy, the morphology of QRS is unchanged, but A fib with WPW and PVT will have significant variation in the width and amplitudes of the QRS complexes

-a fib w/ WPW vs. PVT is difficult, but PVT usually chaotic and unstable quickly

Conduction Analysis

1 degree AVB: PR Interval > 0.20s, All associated P with QRS

2 AVB: Type I Mobitz (Wenchebach): Increasing PR until QRS drops = 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: QRS > 0.12; Deep S wave in Leads I, aVL, V4-V6; rSR' in leads V1-V3 but sometimes just single wide R or qR. Often V1-V3 with slight ST depression and inverted T waves – never elevation.

LBBB: QRS >0.12s, LAD, No septal Q in V4-V6, I, aVL (aka it's just a broad monophasic R-wave/teepee, and it's often notched in V6); "appropriate discordance" = all ST-segments opposite direction of T waves. Often V1 is wide and negatively deflected with mostly S wave and no R wave.

LAFB: LAD, rS (large S) complexes in lead III; qR (large R) in I and aVL. QRS duration usually < 0.12 unless coexisting RBBB

LPFB: RAD, qR complex (large R) in lead III and other inferiors

Bifascicular Blocks: RBBB + LAFB (common) or LPFB (uncommon). Often have T wave inversions in inferior leads

Nonspecific Intraventricular conduction delay: QRS >110ms without typical LBBB nor RBBB, but maybe some aspects of both

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

OTHER: R wave in aVL >11mm, or R wave in V5 or V6 + S in V1 >35

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