EKG TECH BASICS · ONE-PAGER

Reading a 12-Lead

Axis, atrial enlargement, LVH and RVH voltage, ST elevation by lead group, reciprocal change, Q waves, posterior MI, STEMI mimics, and what to report at once

28 sources + more detail
ekgtechbasics.com/sheets/ekg-twelve-lead-interpretation.html
checked Nov 2026

1 Axis: quadrant method

LEAD I	LEAD AVF	LEAD II	AXIS
Positive	Positive	Positive	Normal (0° to +90°)
Positive	Negative	Equiphasic or positive	Physiological left axis (0° to −30°): not abnormal
Positive	Negative	Negative	Left axis deviation (beyond −30°)
Negative	Positive	Any	Right axis deviation (beyond +90°)
Negative	Negative	Negative	Extreme axis (−90° to 180°)

Left axis: LVH, LBBB, inferior MI, left anterior fascicular block, ventricular pacing, a short wide build. Right axis: RVH, pulmonary embolism, COPD, lateral MI, left posterior fascicular block, a tall thin build; normal in infants. Extreme axis: ventricular rhythms, hyperkalemia, severe RVH.

2 Chamber enlargement and hypertrophy

FINDING	CRITERIA (10 MM/MV, 25 MM/S)
Right atrial enlargement	P in II over 2.5 mm tall; first part of P in V1 over 1.5 mm
Left atrial enlargement	P in II over 0.12 s, often notched; last, negative part of P in V1 over 0.04 s wide and over 1 mm deep
LVH: Sokolow-Lyon	S in V1 + taller R in V5 or V6 ≥ 35 mm
LVH: Cornell	R in aVL + S in V3 over 28 mm (men), over 20 mm (women)
LVH: supporting	Lateral ST depression and T inversion (strain); left axis; LAE
RVH	Axis +110° or more; R in V1 over 7 mm or R/S over 1; deep S in V5–V6; QRS under 0.12 s

EXAM TIP Voltage criteria are specific but miss many patients: a normal ECG does not rule out LVH on echo, and athletes often meet Sokolow-Lyon with normal hearts. Check the calibration first: at 5 mm/mV, double every height.

3 Ischemia, injury and infarction

CHANGE	THRESHOLD, IN 2 CONTIGUOUS LEADS
ST elevation (injury), at the J point	V2–V3: men under 40 ≥ 2.5 mm, men 40+ ≥ 2 mm, women ≥ 1.5 mm. All other leads ≥ 1 mm
ST depression (ischemia)	Horizontal or downsloping ≥ 0.5 mm
T-wave inversion	New ≥ 1 mm
Pathological Q wave (infarction)	≥ 0.04 s wide or ≥ 25% of the R wave

WALL	LEADS	USUAL ARTERY	RECIPROCAL LEADS
Septal	V1–V2	LAD	—
Anterior	V3–V4	LAD	III, aVF (when I, aVL are up)
Lateral	I, aVL, V5–V6	Circumflex or diagonal	II, III, aVF (III most)
Inferior	II, III, aVF	RCA (most) or circumflex	aVL, often I
Posterior	V7–V9 (≥ 0.5 mm)	Circumflex or RCA	Seen as V1–V3: ST down, tall R, upright T
Right ventricle	V4R; clues: ST up in V1, III higher than II	RCA	—

Contiguous leads look at the same wall (II and aVF; I and aVL) or sit next to each other across the chest (V2 and V3). Regional elevation with reciprocal depression points to a blocked artery; widespread elevation without reciprocal change points to a mimic.

4 STEMI mimics

MIMIC	WHAT IT LOOKS LIKE
Early repolarization	Concave ST elevation V2–V5, notched J point (best in V4), tall T waves; young patients; no reciprocal change; stable over time
Pericarditis	Widespread concave ST elevation with PR depression; ST depression and PR elevation only in aVR (and V1)
LBBB or ventricular pacing	QRS ≥ 0.12 s; ST and T opposite the QRS, so ST elevation in V1–V3
LVH	ST elevation in V1–V3 opposite the deep S waves; lateral strain
Brugada pattern	Coved ST elevation over 2 mm in V1–V3 into a negative T wave
Hyperkalemia	Peaked T first, then flat P and long PR, then a wide QRS

SAFETY A mimic is the reader's call, not yours. ST elevation in a patient with symptoms is reported at once even when you suspect a mimic or the machine statement is normal; compare with the last tracing and say what changed.

5 Report immediately

- ST elevation meeting the thresholds, or new LBBB, in a patient with chest pain, jaw or arm pain, shortness of breath, sweating or nausea: suspected STEMI.
- ST depression in V1–V3 with tall R waves (possible posterior MI); widespread ST depression with ST elevation in aVR.
- Deep symmetric or biphasic T waves in V2–V3 after recent chest pain, even when the pain has gone; report it before any stress test is started.
- Peaked T waves, a coved V1–V3 pattern, or any life-threatening rhythm.

Hand the tracing to the provider or nurse in person, stay with the patient, leave the electrodes on for repeat or extra leads (V4R, V7–V9), and document the time and who you told. If the patient becomes unresponsive, call the code team and start CPR or use the AED if you are trained.

EXAM TIP Door-to-ECG: a patient with possible ACS should have a 12-lead obtained and read within 10 minutes of arrival. Atypical symptoms (women, older patients, dizziness, abdominal pain) are where the minutes are lost.

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