www.emsnotes.com - By Forrest Munden

12-Lead ECG Interpretation Guide

STEMI Recognition - Lead Placement - Axis - Intervals
2025-2026 Edition - ACLS / NREMT Paramedic Aligned

Section 1: The 12 Leads - What They See

Limb Leads (Frontal Plane)

Lead I
RA (-) to LA (+)
Lateral wall

Lead II
RA (-) to LL (+)
Inferior wall

Lead III
LA (-) to LL (+)
Inferior wall

aVR
Right arm
No specific wall

aVL
Left arm
Lateral wall

aVF
Left leg
Inferior wall

Precordial Leads (Horizontal Plane)

V1
4th ICS, R sternal
Septal

V2
4th ICS, L sternal
Septal

V3
Between V2 & V4
Anterior

V4
5th ICS, MCL
Anterior

V5
5th ICS, AAL
Lateral

V6
5th ICS, MAL
Lateral

❤ Section 2: STEMI Recognition - The Money Patterns

STEMI Territory	ST Elevation In	Reciprocal Depression	Artery	Critical Notes
Anterior	V1, V2, V3, V4	II, III, aVF	LAD	Widow maker - high mortality
Anteroseptal	V1, V2	None or inferior	LAD (septal branch)	May progress to complete anterior
Anterolateral	V3, V4, V5, V6, I, aVL	II, III, aVF	LAD or LCx	Large territory at risk
Inferior	II, III, aVF	I, aVL	RCA (80%) or LCx	Always check V4R!
Lateral	I, aVL, V5, V6	II, III, aVF	LCx or diagonal	Often subtle - look carefully
Posterior	V7, V8, V9	V1-V3 (tall R, ST depression)	RCA or LCx	Do posterior leads!
Right Ventricular	V4R	-	Proximal RCA	NO NITRATES!

⚠ Right-Sided & Posterior Leads - When to Do Them

- **V4R:** ANY inferior STEMI - check for RV involvement
- **V7-V9:** Inferior STEMI + V1-V3 ST depression = posterior MI
- **RV infarct = Preload dependent:** AVOID nitrates, give fluids cautiously

Section 3: STEMI Mimics - Don't Get Fooled

Condition	ECG Pattern	How to Differentiate
Hyperkalemia	Peaked T waves, wide QRS, sine wave	Check K+ level, look for P wave flattening
LV Aneurysm	Persistent ST elevation (old MI)	History of prior MI, no reciprocal changes
Pericarditis	Diffuse concave ST elevation + PR depression	Diffuse (not territorial), PR depression in II
Early Repolarization	J-point elevation, concave ST, notched	Young, healthy, no symptoms, notched J point
Brugada Syndrome	V1-V2 coved ST elevation	Type 1: coved, Type 2: saddle-back
LBBB	Wide QRS, discordant ST changes	Use Sgarbossa criteria for STEMI in LBBB

Sgarbossa Criteria (STEMI in LBBB)

- **Concordant ST elevation ≥1 mm** in any lead = 5 points
- **Concordant ST depression ≥1 mm** in V1-V3 = 3 points
- **Discordant ST elevation ≥5 mm** = 2 points
- **≥3 points = High probability STEMI**

Section 4: Axis Determination - Quick Method

The Lead I & aVF Method

Lead I	aVF	Axis	Interpretation
+ (upright)	+ (upright)	Normal	0° to +90°
+ (upright)	- (inverted)	LAD	0° to -90° (check Lead II)
- (inverted)	+ (upright)	RAD	+90° to +180°
- (inverted)	- (inverted)	Extreme RAD	-90° to -180° (NW axis)

Common Causes of Axis Deviation

Left Axis Deviation:

- Left anterior fascicular block
- Inferior MI
- LVH
- COPD (sometimes)

Right Axis Deviation:

- Right ventricular hypertrophy
- Pulmonary embolism
- Lateral MI
- Left posterior fascicular block

Section 5: Intervals - The Numbers That Matter

Interval	Normal	Abnormal	Clinical Significance
PR Interval	0.12 - 0.20 sec (3-5 small boxes)	<0.12 = short >0.20 = prolonged	Short: WPW, junctional Long: AV block
QRS Duration	<0.12 sec (<3 small boxes)	≥0.12 = wide	Wide: BBB, hyperkalemia, ventricular rhythm
QT Interval	<half the R-R (use QTc)	QTc >450 ms (men) QTc >460 ms (women)	Long QT = Torsades risk Meds, electrolytes, congenital

⚡ Dangerous QT Prolongation

- **Drug causes:** Amiodarone, antipsychotics, antibiotics (fluoroquinolones, macrolides), methadone
- **Electrolyte causes:** Hypokalemia, hypomagnesemia, hypocalcemia
- **Treatment:** Magnesium 1-2g IV, correct electrolytes, stop offending drugs

Section 6: Rate Calculation Methods

Three Quick Methods

Method	How To	Best For
300 Method	300 ÷ # large boxes between R-R	Regular rhythms
1500 Method	1500 ÷ # small boxes between R-R	More precise
6-Second Strip	Count QRS complexes × 10	Irregular rhythms (A-fib)

Memory trick: 300 - 150 - 100 - 75 - 60 - 50 (for 1, 2, 3, 4, 5, 6 large boxes)

Section 7: Systematic 12-Lead Interpretation

The 10-Step Method

1. **Rate:** Brady (<60), normal, tachy (>100)?
2. **Rhythm:** Regular or irregular?
3. **P waves:** Present? Upright in II? One per QRS?
4. **PR interval:** 0.12-0.20 sec?
5. **QRS width:** Narrow (<0.12) or wide?
6. **Axis:** Normal, LAD, RAD?
7. **ST segments:** Elevation? Depression? Which leads?
8. **T waves:** Inversion? Hyperacute? Peaked?
9. **QT interval:** Prolonged?
10. **Compare:** Prior ECG available?

Master the 12-Lead

The 12-lead is your superpower. Learn to read it like your native language.

Remember: In STEMI, time = myocardium. Every minute counts.
Door-to-balloon <90 min. Scene-to-PCI as fast as possible.

Stay sharp. Stay systematic. Save hearts.