

BEDSIDE REFERENCE CARD / ECG INTERPRETATION

The Systematic ECG Reading Sequence

Most missed findings on an ECG are not subtle. They are simply outside the order in which the reader was looking. This card fixes the order, then lists the four patterns that must be checked last — when the eye has stopped hunting for the obvious.

Before step one — three seconds that prevent most errors

Check the calibration. Standard is 25 mm/s and 10 mm/mV. One small square = 0.04 s and 1 mm; one large square = 0.20 s and 5 mm. A half-standard trace halves every voltage criterion you are about to apply.

Check the name, the date and the time. More wrong decisions follow from reading the wrong patient's ECG than from misreading the right one.

Find the prior tracing before you start, not after. New is the word that does the work in every ischaemia criterion below.

The ten steps, in order

#	STEP	WHAT YOU ARE LOOKING AT	NORMAL / THRESHOLD
1	Rate	Regular: 300 divided by the number of large squares between R waves. Irregular: count QRS complexes in 30 large squares (6 s) and multiply by 10.	60-100 bpm. Below 60 bradycardia, above 100 tachycardia.
2	Rhythm	Is there a P before every QRS, a QRS after every P, and is the R-R regular? Irregularly irregular with absent P waves is AF until proven otherwise.	Sinus: upright P in I and II, inverted in aVR.
3	Axis	Net QRS deflection in leads I and aVF. Both positive is normal. I positive with aVF negative: check lead II before calling left axis.	-30 to +90 degrees.
4	Intervals	PR, QRS and QT. Measure QT in the lead where it is longest, usually II or V5, and correct it for rate.	PR 120-200 ms. QRS under 120 ms. QTc prolonged above 450 ms in men and at or above 460 ms in women (AHA/ACCF/HRS 2009); over 500 ms carries a high torsades risk. Bazett over-corrects in tachycardia and under-corrects in bradycardia — use Fridericia outside 60-100 bpm.
5	P wave morphology	Left atrial abnormality: notched P over 120 ms in II, or a deep terminal negative component in V1. Right atrial abnormality: tall peaked P in II.	P amplitude under 2.5 mm, duration under 120 ms.
6	QRS morphology	Pathological Q waves, R wave progression across the precordium, bundle branch block, pre-excitation, and voltage criteria for hypertrophy.	Pathological Q: 40 ms or wider, and/or deeper than 25 per cent of the following R, in two contiguous leads (Fifth Universal Definition, which reverts to this classical definition). LVH by Sokolow-Lyon: S in V1 plus R in V5 or V6 of 35 mm or more. By Cornell: R in aVL plus S in V3 over 28 mm in men, over 20 mm in women.
7	ST segment	Elevation and depression, both measured at the J point. Elevation must be present in two contiguous leads.	See the criteria overleaf. New <i>horizontal or downsloping</i> ST depression of 0.5 mm or more in two contiguous leads is significant — upsloping depression is a different finding (see de Winter).
8	T waves	Inversion, flattening, hyperacute broad-based peaking, and biphasic patterns in the anterior leads.	T inversion is normal in aVR, and in V1 (and III) in isolation.

#	STEP	WHAT YOU ARE LOOKING AT	NORMAL / THRESHOLD
9	U waves	Best seen in V2 and V3. Prominent U waves suggest hypokalaemia; inverted U waves are a recognised ischaemic sign and are easily missed.	Under 25 per cent of T wave amplitude.
10	Compare, then re-read	Put the prior tracing alongside. Then read the four patterns overleaf specifically, as a separate deliberate pass.	Serial ECGs at 15-30 min if symptoms persist and the first is non-diagnostic.

ST elevation thresholds for acute coronary occlusion

New ST elevation measured at the J point in two contiguous leads, **in the absence of left ventricular hypertrophy and left bundle branch block** — that exclusion is part of the criterion, not a footnote to it. Contiguity means anatomically adjacent, not adjacent on the printout.

LEADS	THRESHOLD	NOTE
All leads except V2-V3	1 mm or more (0.1 mV)	Applies to I, II, III, aVL, aVF, V1, V4, V5, V6.
V2-V3, men aged 40 and over	2 mm or more (0.2 mV)	The commonest source of false positives in young men is normal male-pattern early repolarisation.
V2-V3, men under 40	2.5 mm or more (0.25 mV)	
V2-V3, women, any age	1.5 mm or more (0.15 mV)	The lower female threshold is one reason posterior and anterior infarction is under-called in women.
Posterior (V7-V9)	0.5 mm or more (1 mm in men under 40)	Suspect when there is ST depression in V1-V3 with a tall R wave and an upright T. Record the posterior leads; do not infer. These numeric cut-points are from the Fourth Universal Definition and the STEMI guidelines; the Fifth uses qualitative wording.
Right ventricular (V4R)	0.5 mm or more (1 mm in men under 30)	Record in every inferior STEMI before giving nitrates. Source as for the posterior leads above.

The four you read last

Each of these is an acute coronary occlusion that does not meet the millimetre criteria above. They are the reason a systematic sequence ends with a deliberate second pass rather than with a conclusion. All four are now named in the

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PATTERN	WHAT YOU SEE	WHAT IT MEANS
Sgarbossa, in LBBB or a paced rhythm	Concordant ST elevation of 1 mm or more (5 points). Concordant ST depression of 1 mm or more in V1-V3 (3 points). Discordant ST elevation of 5 mm or more (2 points). Three points or more is specific for infarction.	The modified Smith rule is unweighted — it is not scored. Any one criterion positive makes the rule positive, and it replaces the third criterion with a discordant ST elevation to S wave ratio of -0.25 or more negative. Substantially more sensitive than the original score.
Diffuse depression with aVR elevation	ST depression in six or more leads, maximal in V4-V6 and II, with ST elevation in aVR (and often V1).	Left main or proximal LAD subtotal occlusion, or severe three-vessel disease. A pattern that calls for urgent discussion, not a routine troponin pathway.

Mimics worth naming before you activate the lab

MIMIC	THE DISCRIMINATOR
Acute pericarditis	Widespread concave ST elevation that does not respect a coronary territory, PR depression (and PR elevation in aVR), and no reciprocal depression except in aVR and V1.
Early repolarisation	Concave elevation with a notched or slurred J point, most marked in V4, stable across serial tracings and, crucially, on the old ECG.
Left ventricular hypertrophy with strain	Discordant, downsloping ST depression and asymmetric T inversion in the lateral leads, in proportion to very high voltages.
Hyperkalaemia	Tall narrow-based peaked T waves, then P wave flattening, then QRS widening into a sine wave. Treat the potassium, not the ST segment.
Brugada pattern	Coved ST elevation with T inversion in V1-V2, particularly with the leads placed in a higher intercostal space.
Takotsubo syndrome	Anterior ST elevation with very deep, widespread T inversion and marked QT prolongation, with troponin low relative to the ECG. The diagnosis is angiographic, not electrocardiographic.

What changed in August 2026 — read this before you next teach the topic

The Fifth Universal Definition of Myocardial Infarction, published jointly by the ESC, ACC, AHA and WHF at ESC Congress 2026, replaces the numerical types 1 to 5 with three clinical categories: **primary**, **secondary** and **procedure-related** myocardial infarction.

Primary is no longer restricted to atherothrombosis: spontaneous coronary artery dissection, coronary embolism and coronary vasospasm now sit inside it.

Secondary is supply-demand imbalance caused by another acute condition, with no primary coronary pathology and no procedural cause.

Procedure-related covers percutaneous and surgical complications within 30 days. Troponin multiples are no longer confirmatory on their own. Acute myocardial injury must be accompanied by *one or more* of: evidence of a coronary complication, or a new regional wall motion abnormality or absence of viable myocardium. Both are required only where the complication arose during the index procedure, or where the procedure was performed to treat an acute infarction.

Sex-specific troponin thresholds were already recommended in 2018; what is new is that they now *define* acute myocardial injury within the criteria themselves. MINOCA is renamed myocardial injury with non-obstructive coronary arteries.

The ECG content changed too. The ST elevation thresholds in the table above are unchanged, but the pathological Q wave definition reverts to the classical one, the numeric posterior and right-sided cut-points are no longer carried, a numeric T wave inversion threshold of 1 mm in two contiguous leads is added, and hyperacute T waves, de Winter, Wellens, modified Sgarbossa, Aslanger's pattern and the South African flag sign are now named in the document's own electrocardiographic table.

Note that the Universal Definition is a *consensus statement*, not a guideline, and says itself that it should be applied alongside national and regional practice guidelines.

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Last reviewed

6 September 2026
Next review due March 2027

Scope. Written for qualified clinicians and clinicians in training. This card is a memory aid for a reading sequence; it is educational material and is not a substitute for individual clinical judgement, for the full text of the source documents, or for your local protocol. It does not cover paediatric electrocardiography.

Principal sources. Fifth Universal Definition of Myocardial Infarction (2026), ESC/ACC/AHA/WHF, presented at ESC Congress 2026 and published in European Heart Journal and Circulation. Fourth Universal Definition of Myocardial Infarction (2018) for the electrocardiographic criteria. Sgarbossa et al, New England Journal of Medicine 1996, and Smith et al, Annals of Emergency Medicine 2012, for the left bundle branch block criteria. de Winter et al, New England Journal of Medicine 2008. de Zwaan, Bar and Wellens, American Heart Journal 1982.

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