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ECG Decoded



Patterns. Reasoning. Clinical decisions.

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FIRST EDITION

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ECG Decoded

Twenty-three chapters in six parts, four appendices and an index.

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BEFORE YOU BEGIN

How to use this book

ECG Decoded teaches one method and applies it to every trace. Each chapter is written in three layers, so a student, a resident and a fellow can read the same page and each take what they need.

Three layers, one page

Layer	Written for	What it gives you
L1 Foundations	Medical students, interns	The method, normal values and the common patterns you must never miss.
L2 Practice	Residents, junior registrars	Atypical and mixed patterns, the management decision attached to each finding, and the pitfalls that catch working clinicians.
L3 Mastery	Critical care, emergency and trauma fellows; consultants	Mechanism in depth, the evidence behind the criteria, key trials, controversies and where the field is heading.

Text without a tag is core reading for everyone. Shaded L2 and L3 panels can be skipped on a first pass and returned to later.

The features in every chapter



PEARL

A short, practical insight that makes the next ECG easier to read.



TRAP

A common error, the reason it happens, and how to avoid it.



EVIDENCE

The study or guideline behind a criterion, with numbers.



DECODE REFLEX

A fixed "if you see this, look for that" link that experienced readers apply automatically.



RED FLAG

A finding that needs action within minutes, not a routine report.



BEDSIDE CARD

A one-page summary at the end of each chapter, built to be printed or kept on a phone.

Reading the tracings

All ECGs are printed on standard paper at **25 mm/s and 10 mm/mV**, reduced to fit the page. Because the grid is reduced with the trace, every measurement still works in small and large squares: one small square is always 40 ms and 0.1 mV. Each 12-lead shows the classic 3 × 4 layout (2.5 s per lead) with a 10-second rhythm strip underneath.

01

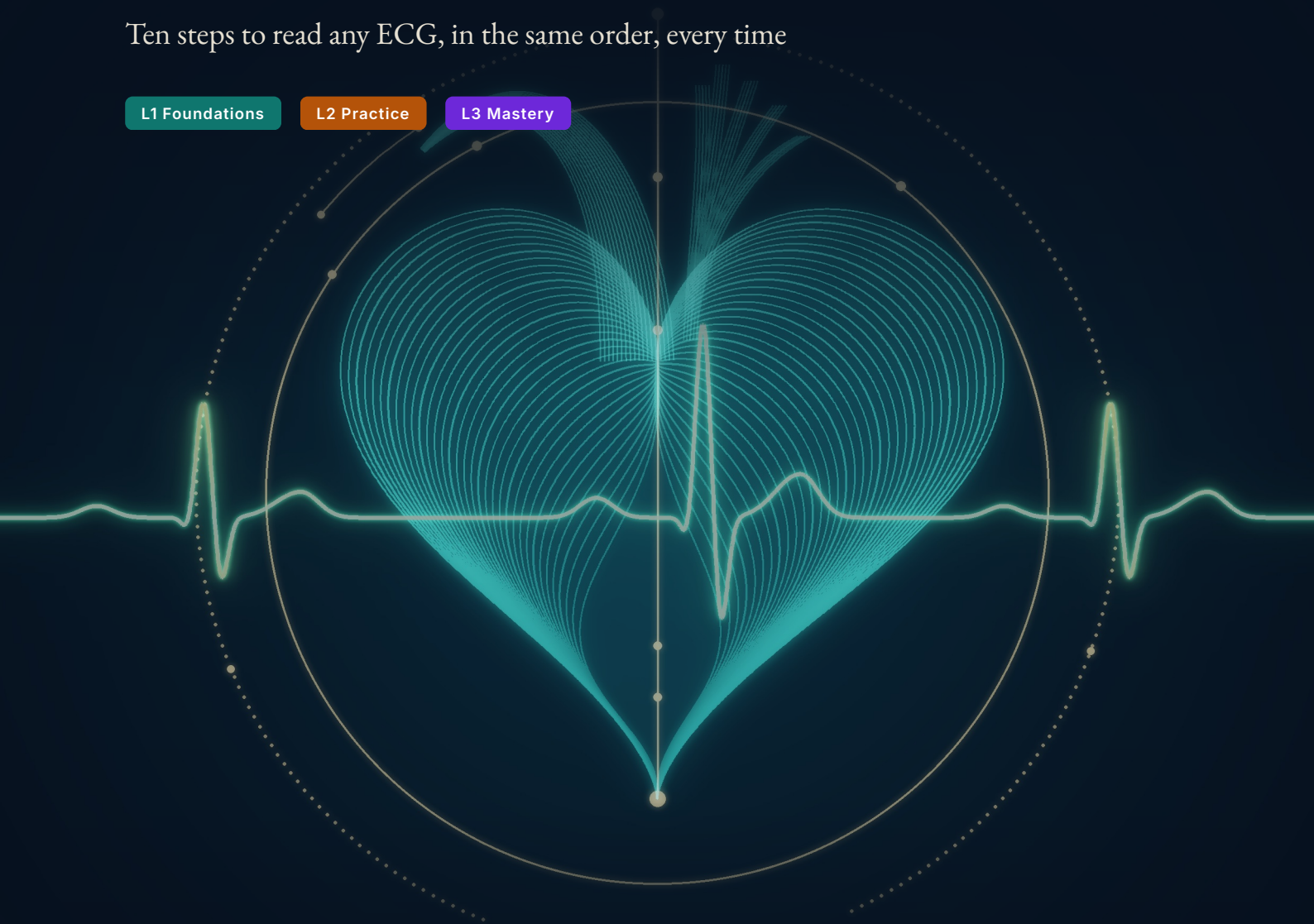
The Decode Sequence

Ten steps to read any ECG, in the same order, every time

L1 Foundations

L2 Practice

L3 Mastery



IN THIS CHAPTER

- 01 Why a fixed sequence beats pattern-spotting
- 02 Step 0: set up the trace before you read it
- 03 Steps 1–3: rate, rhythm and axis
- 04 Steps 4–6: P wave, PR interval and QRS
- 05 Steps 7–8: ST segment, T and U waves
- 06 Step 9: measuring and correcting the QT
- 07 Step 10: synthesis, decision and the written report
- 08 Two worked examples, four graded cases, a bedside card and ten self-test questions

THE CHAPTER IN 60 SECONDS

Most ECG errors are errors of **omission**, not of knowledge: the reader saw the obvious finding and stopped looking. A fixed order prevents this. The Decode Sequence has ten steps: **set up** (patient, calibration, leads, old ECG), then **rate, rhythm, axis, P wave, PR, QRS, ST, T/U and QTc**, then **synthesis**: compare, put in clinical context, and decide.

Steps 1–8 are the author's bedside eight; QTc and synthesis complete them for acute and critical care. Each step asks a short, fixed set of questions with numbers attached. Read the whole trace before naming a diagnosis. Never let a computer statement replace Step 2.

Why a sequence?

Experienced readers look fast, but they do not look randomly. Studies of physician ECG interpretation show wide variation in accuracy across every level of training, with the largest gains coming from structured teaching and deliberate practice rather than from more exposure alone (see the L3 deep dive at the end of this chapter). The commonest failures are predictable: a second finding missed because the first was dramatic, flutter called sinus tachycardia, a long QT never measured, an old ECG never pulled.

The Decode Sequence turns the read into a checklist. Each step has a question, a measurement and a normal range. You finish every step before you allow yourself a diagnosis. With practice the whole sequence takes under a minute, and it never changes: the same order for a pre-operative ECG in a fit 30-year-old and for a peri-arrest strip at 3 a.m.

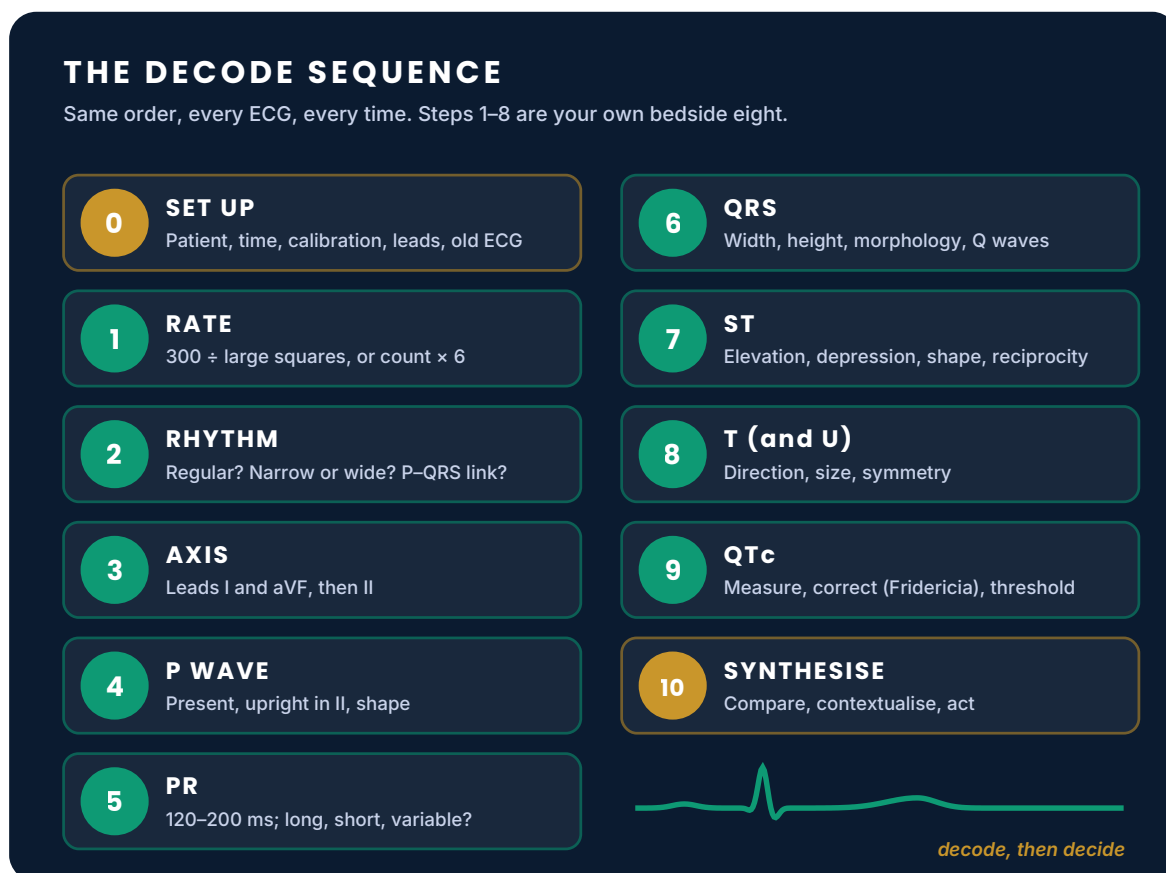


Figure 1.2 The Decode Sequence. Step 0 and Step 10 frame the read; Steps 1–9 are measured in strict order. Every later chapter of this book expands one of these steps.

**PEARL · DECODE, THEN DECIDE**

Say the findings before the diagnosis: *"Regular narrow-complex tachycardia at 150, no clear P waves, sawtooth baseline in the inferior leads"* leads naturally to *"atrial flutter with 2:1 block"*. Saying the diagnosis first tends to make you stop looking.

**STEP 0****Set up the trace**

Thirty seconds spent before reading prevents most interpretive disasters. Answer five questions:

- 1. Right patient, right time?** Name, identifier, and the time of recording. Serial ECGs in chest pain are only useful if you know their order.
- 2. Standard calibration?** Paper speed 25 mm/s and gain 10 mm/mV; the calibration pulse at the start of each row should be 10 mm tall. Half-gain (5 mm/mV) hides voltage criteria; 50 mm/s makes every interval look long.
- 3. Leads placed correctly?** A negative P, QRS and T in lead I with an upright complex in aVR suggests right-left arm reversal (true dextrocardia also shows poor R-wave progression across V1–V6). An unexpected change in only one or two chest leads suggests misplaced electrodes.
- 4. Is the trace readable?** Baseline wander, tremor and electrical interference can mimic flutter, fibrillation or even VT. If in doubt, repeat it.
- 5. Is there an old ECG?** Comparison is the single most powerful tool in ECG interpretation. "New" changes and "old" changes lead to different decisions.

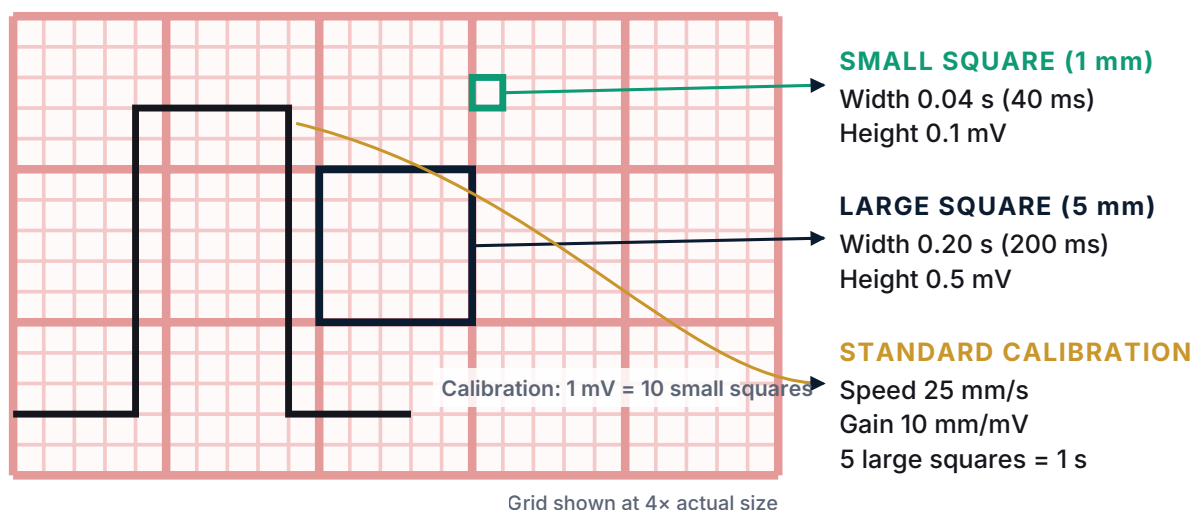


Figure 1.3 ECG paper and calibration. One small square is 40 ms by 0.1 mV; one large square is 200 ms by 0.5 mV; five large squares make one second.

Before the steps, name the parts. The P wave is atrial depolarisation; the PR interval runs from the start of the P wave to the start of the QRS; the QRS complex is ventricular depolarisation; the J point is where the QRS ends and the ST segment begins; the T wave is ventricular repolarisation; the QT interval runs from QRS onset to the end of the T wave. The isoelectric reference for measuring ST deviation is the TP segment (or the PR segment when the TP is short).

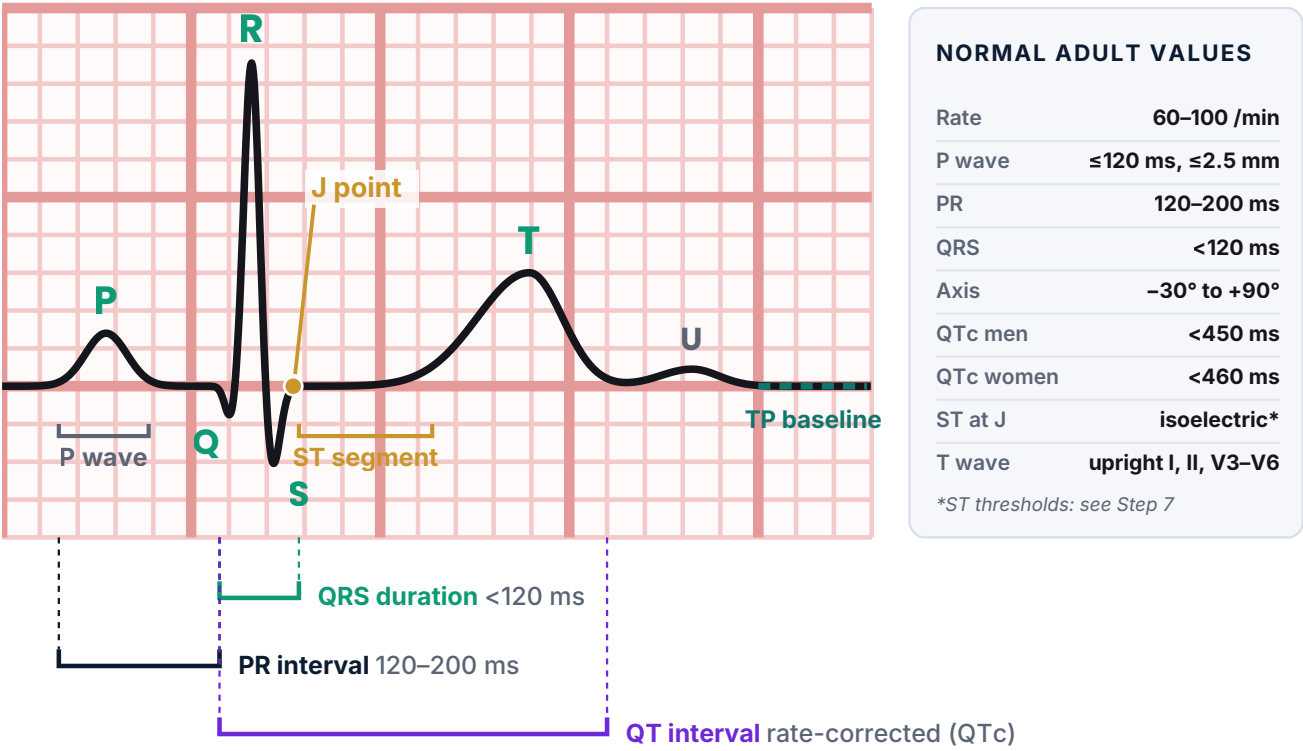


Figure 1.4 Anatomy of one complex in lead II, drawn at five times normal size, with the normal adult values used throughout this book.

TRAP · LIMB-LEAD REVERSAL

Reversing the right and left arm electrodes inverts lead I, swaps II with III and swaps aVR with aVL. The result can mimic right axis deviation, a lateral infarct or dextrocardia. Check lead I first: a negative P wave in lead I with sinus-looking rhythm elsewhere is lead reversal until proven otherwise.

1

STEP 1
Rate

Normal adult resting rate is 60–100/min. Below 60 is bradycardia; above 100 is tachycardia. Measure the **ventricular** rate (QRS) and, separately, the **atrial** rate (P or flutter waves) whenever they might differ.

TABLE 1.1 · THREE WAYS TO MEASURE RATE

Method	How	Use when
300 rule	300 ÷ number of large squares between two R waves (sequence 300, 150, 100, 75, 60, 50)	Regular rhythm, quick estimate
1500 rule	1500 ÷ number of small squares between two R waves	Regular rhythm, precise value
10-second count	Number of QRS complexes on the 10-second rhythm strip × 6	Irregular rhythm (AF, ectopy, block)