



An Arm and a Leg

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Vignette

This 12-lead electrocardiogram (ECG) is obtained from a 72-year-old woman as part of a routine preoperative assessment before planned cholecystectomy (Figure 1).

Questions

- 1. What abnormality is shown?**
- 2. What is the explanation?**

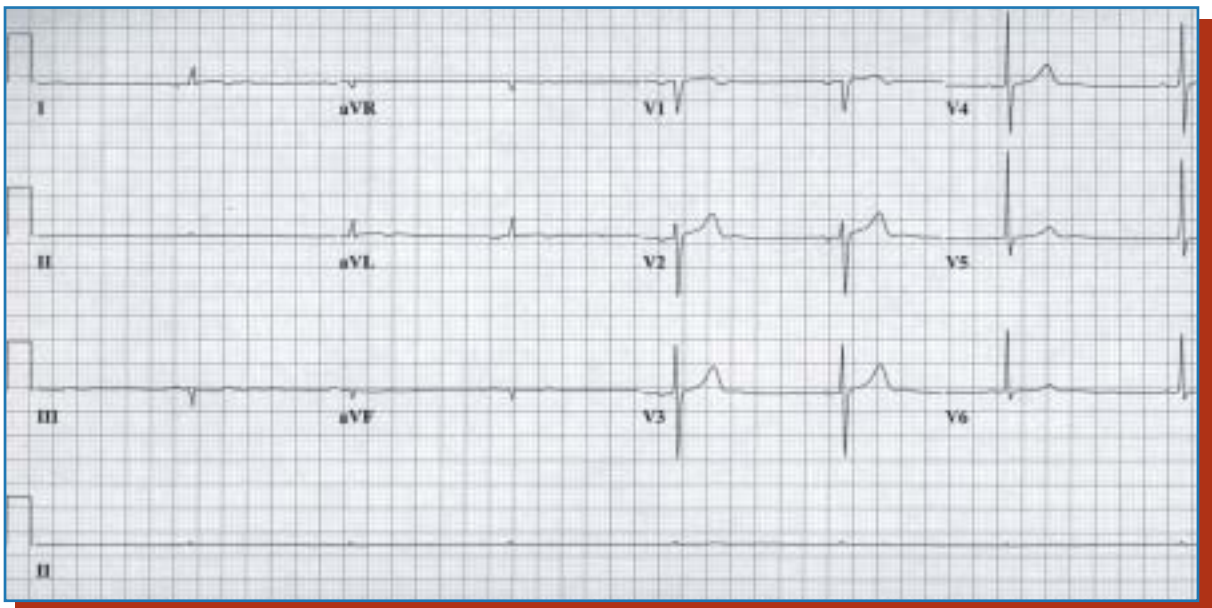


Figure 1. ECG upon presentation.

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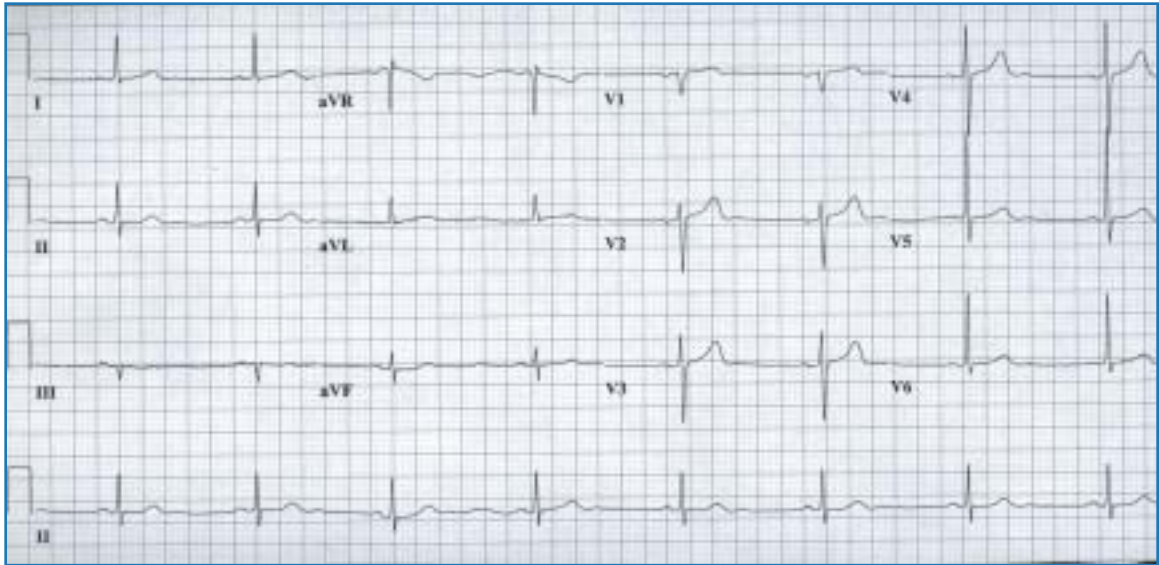


Figure 2. Repeat ECG with careful attention to correct electrode placement.

Answers

1. The rhythm is a bradycardia at 44 beats per minute. Although the P waves in the chest leads are consistent with sinus rhythm, they are not well-seen in the limb leads. All six limb leads show unusually low QRS amplitude (< 5 mm in all leads). Curiously, the amplitude of the QRS complexes in the chest leads appears quite normal. A quick check of the calibration standard at the beginning of the recording confirms the ECG has not been inadvertently recorded at half-normal standardization.

2. Lead II provides the clue to the puzzle. It is very nearly isoelectric, but careful inspection reveals the presence of tiny deflections corresponding to the timing of the QRS complexes in other leads. This ECG finding is virtually pathognomonic of inadvertent reversal of the right arm and right leg electrodes. A repeat ECG with careful attention to correct electrode placement is shown in Figure 2.

The right leg lead is normally the ground electrode and misplacement affects the amplitude and polarity of all the limb leads, as the potential of the central terminal is no longer zero. “Lead II” (normally the potential difference between right arm and left leg) is now recording the potential difference between the two legs, hence the near absence of electrical activity. “Lead I” is actually an inverted Lead III, while “Lead III” is unaffected. Comparison of Figures 1 and 2 confirms these findings.

Fortunately, errors of this nature are rare when ECGs are recorded by a trained, experienced technician. The most commonly encountered example (reversal of the right and left arm electrodes) is easily recognized by most physicians, but less common electrode placement errors can be much harder to recognize. If there is suspicion about such a possibility, inspection of a previous ECG in the same patient or repeating the ECG with confirmed appropriate electrode placement should resolve the matter. **Dx**