Country cardiograms case 64: Answer

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The electrocardiogram (ECG) in Fig. 1 (on page 113) exhibits normal sinus rhythm, at a rate of 66 beats/min. First-degree atrioventricular block is present, with a PR interval of 0.24 seconds. The QRS duration is normal (0.085 s). The QT interval is 0.335 seconds, with a corrected QT interval (QT_c) of 0.351 seconds. The axis is 5°, and P waves, QRS complexes, ST segments and T waves are all normal. Apart from first-degree atrioventricular block, the only abnormality on this ECG lies in the QT interval, which is short (a normal QT interval is 0.36–0.44 s).

The QT interval varies significantly with rate, and, in order to standardize measurement, the QT_c is calculated. This indicates what the QT interval would be if the ventricular rate were 60 beats/min. The Bazett formula ($QT_c = QT/\sqrt{RR}$, where RR represents the R–R interval) is most commonly used and is accurate for rates of 60–100 beats/min but not for rates outside of this range. A straightforward QT_c calculator can be found at www.mdcalc.com/corrected-qt-interval-qtc.

The QT interval is measured from the beginning of the QRS complex to the end of the T wave, using lead II when possible. Sometimes the end of the T wave can be hard to identify with confidence if it merges gradually with the baseline. In such a case, a tangent can be drawn from the maximum slope of the descending portion of the T wave; the end of the T wave is then measured from where this tangent intersects the baseline. The QT interval is slightly longer in females than in males and tends to increase with age.[1] A short QT_c in an 80-year-old woman is therefore of added significance — perhaps 0.38 could be considered the lower limit of normal in such a case.

Because of the association with severe sequelae, much attention is focused on long QT intervals, whereas less attention is paid to short QT intervals. The result is that a short QT interval may not always be identified.

The main cause for a short QT interval is hypercalcemia; other causes include congenital short QT syndrome and digoxin effect. In the current case, the serum calcium level was significantly elevated, at 3.38 mmol/L (reference range 2.15–2.55 mmol/L), and the serum albumin level was low (32 g/L [reference range 35–52 g/L]). This yielded a worrisome corrected calcium value of 3.50 mmol/L.

Two main diagnostic considerations in such a case include malignant disease and primary hyperparathyroidism. Investigations revealed a parathyroid adenoma and no evidence of malignant disease. Treatment of hypercalcemia may include hydration with saline solution, calcitonin injections and pamidronate infusions. The traditional presentation of "painful bones, renal stones, abdominal groans and psychic moans" is often not present, and the patient's presentation may be of malaise and generalized vague symptoms.

The most common ECG findings of hypercalcemia are a short QT interval (secondary to a shortened ST segment) and a wide or flat T wave.[2] Osborn waves are usually associated with hypothermia[3] but may also be found in association with severe hypercalcemia, and ECG changes that mimic acute myocardial infarction may occur with extreme hypercalcemia.[4]

The relation between the QT interval and elevated calcium levels is not straightforward. Only a minority of patients with hypercalcemia have a short QT_c, and inconsistent changes in QT_c were noted following treatment of chronic hypercalcemia.[5]

It is not clear whether the presence of a short QT interval in cases of hypercalcemia has an effect on prognosis.

The risk of cardiac arrhythmias in patients with a short QT interval appears to be limited to cases of extreme hypercalcemia.[4] Observation and telemetry in patients with mild or moderate hypercalcemia therefore do not appear to be warranted, even if a short QT_c is present. The finding of a short QT_c points to possible hypercalcemia as a diagnostic consideration but does not help substantially in triaging patients. It would not be justifiable to initiate treatment of hypercalcemia based on ECG findings without laboratory confirmation of an elevated corrected serum calcium level. Electrocardiography remains a simple test that can suggest a diagnosis of hypercalcemia, especially in remote communities without immediate access to measurement of serum calcium and albumin levels.

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For the question, see page 113.

Competing interests: None declared.