ECG Quiz 37

CASSA
CARDIAC ARRHYTHMIA SOCIETY OF SOUTHERN AFRICA
A SPECIAL INTEREST GROUP OF SA HEART ASSOCIATION

ANSWER

The ECG shows a regular, narrow complex (80ms) tachycardia with a ventricular rate of 180bpm. The rhythm is supraventricular in origin.

The first step in the analysis of a supraventricular tachycardia (SVT) is to identify P-waves. The morphology, axis and rate of the P-waves are useful discriminatory features. It is important to look for P-waves in both the limb and chest leads. In lead V3, P-waves are visible at the end of the T-waves (see Figure 1). The T-waves are of very low amplitude in all the limb leads and P-waves can be mistaken for T-waves. The P-wave axis is -90 degrees which excludes sinus tachycardia, as does the rate of 180bpm in an adult at rest. There is a single P-wave before each QRS complex (i.e. there is 1:1 AV or VA conduction). A ventricular rate of 180bpm is unusual for typical right atrial flutter (the ventricular rate is too slow for 1:1 AV conduction and too fast to be 2:1 AV conduction as the atrial rate of typical right atrial flutter is usually between 240bpm and 360bpm). The morphology of the P-waves in the inferior leads is not compatible with the "saw-tooth" pattern of typical right atrial flutter which is therefore excluded.

It is useful to classify a SVT into 1 of 2 groups: (1) short RP tachycardia or (2) long RP tachycardia. In a short RP tachycardia, the P-wave occurs in the first half of the R-R interval during the tachycardia. When a P-wave occurs in the latter half of the R-R interval it is classified as a long RP tachycardia - as in this case (RP 220ms, PR 100ms). Typical AV nodal re-entrant tachycardia (AVNRT) is a short RP tachycardia where the retrograde P-waves are either not seen or are seen immediately after the QRS complex (RP interval usually <70ms) as the fast

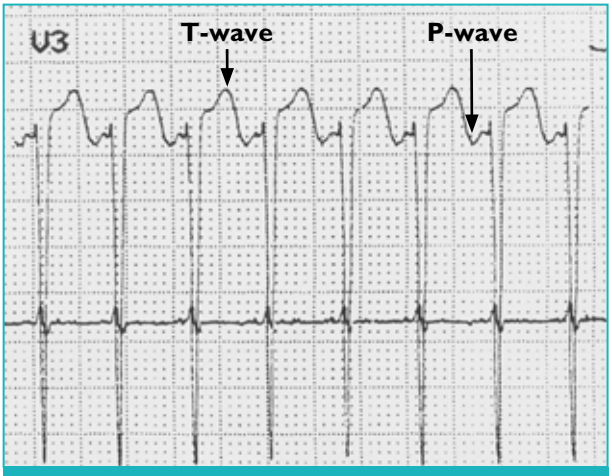

FIGURE 1: In lead V3, P-waves are visible at the end of the T-waves.

pathway of the AV node forms the retrograde limb of the tachycardia.

The correct answer for Question 1 is therefore a) Supraventricular tachycardia (long RP tachycardia). Negative P-waves in the inferior leads (P-wave axis is – 90 degrees) suggest the atria are being activated from "low to high" which can be due to retrograde atrial activation (as in the case of atypical AVNRT or permanent junctional reciprocating tachycardia (PJRT)) or have its focal origin in the low atrium (as in the case of atrial tachycardia (AT)). Atypical AVNRT is a re-entrant tachycardia that uses the fast AV nodal pathway as the antegrade limb and the slow pathway as the retrograde limb of the tachycardia. Slow retrograde conduction over the slow pathway is responsible for the long RP interval during the tachycardia. PJRT is a another term for orthodromic atrioventricular re-entrant tachycardia (AVRT) where the AV node and His-Purkinje system form the antegrade limb and a slowly conducting accessory pathway the retrograde limb of the circuit which is responsible for the long RP interval during the tachycardia. AT, which has its focal origin in the low atrium, could also account for the P-wave morphology. AT can cause both long RP and short RP tachycardias depending on AV nodal conduction. In summary, the differential diagnosis of a long RP tachycardia is atypical AVNRT, PJRT or AT.

Vagal stimulation such as carotid sinus massage is the next step to help distinguish between atypical AVNRT, PJRT and AT. Atypical AVNRT and PJRT are AV junction-dependent tachycardias and may terminate with carotid sinus massage or a vagal manoeuvre. In contrast, AT is a non-AV junction-dependent tachycardia and will not terminate with a vagal manoeuvre. However, "unmasking" of underlying P-waves with AV block would confirm a diagnosis of AT and exclude atypical AVNRT and PJRT.

Unfortunately, carotid sinus massage had no effect on the tachycardia. Eighteen mg intravenous adenosine was then given which terminated the long RP tachycardia. Termination of the SVT per se does not help exclude any of the above diagnoses as AV junction-dependent tachycardias (AVNRT and PJRT) can terminate with adenosine and, unlike carotid sinus massage, a significant proportion of focal atrial tachycardias can terminate with adenosine.[1]

There are additional clues to help us. How the tachycardia terminates is important. In this ECG, the tachycardia terminates with a P-wave (Figure 2). This makes atrial tachycardia very unlikely as it is most unusual to have the AT and the AV node "block" with the same beat, although this can happen by

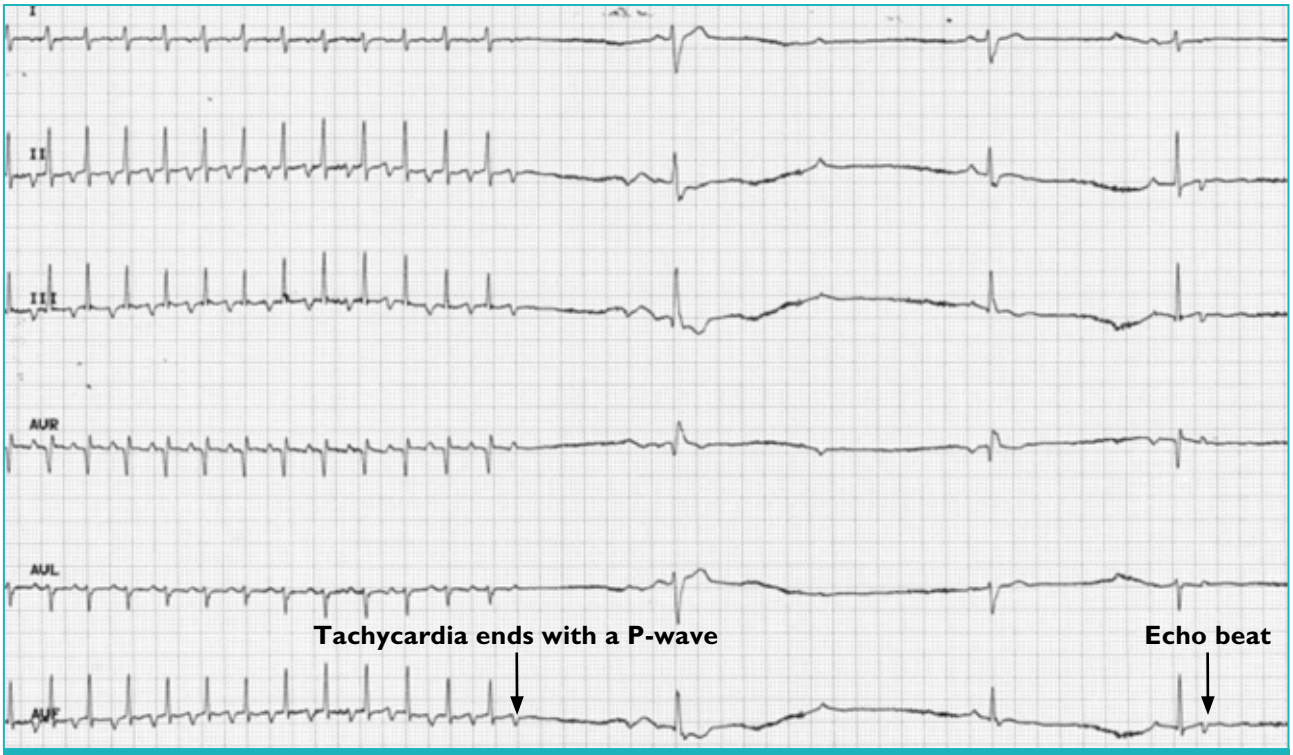

FIGURE 2: The tachycardia terminates with a P-wave.

chance. Usually, when an AT terminates with adenosine, there may be slowing of the AT rate which is not seen here (tachycardia ends abruptly in this case). The last QRS complex in Figure 2 (lead aVF) also demonstrates a conducted QRS complex followed by a P-wave. For the same reasons as above, it is most unusual to have a single beat of AT to occur, stop spontaneously and block in the AV node. This P-wave is most likely an "echo beat" from retrograde atrial activation suggestive of atypical AVNRT or PJRT. Atypical AVNRT or PJRT cannot be distinguished on the ECG alone, but AT can now be excluded.

The correct answer for Question 2 is therefore c) Focal atrial tachycardia.

This patient underwent an electrophysiology study and had atypical AVNRT confirmed. He had a successful ablation of the slow pathway which rendered the atypical AVNRT non-inducible post procedure and at follow-up.

TAKE HOME POINTS

- The differential diagnosis of a long RP tachycardia includes atypical AV nodal re-entrant tachycardia, permanent junctional reciprocating tachycardia and atrial tachycardia.
- The mode of termination of an SVT can be a useful distinguishing feature between atrial tachycardia and atypical AV nodal re-entrant tachycardia/permanent junctional reciprocating tachycardia.

REFERENCE

1. Issa, Miller and Zipes. Clinical Arrhythmology and Electrophysiology. Second Edition. Elevier 2012: Page 214.

Conflict of interest: none declared.

ECG and **QUESTIONS** on page 24