ECG Quiz 74

CASSA
CARDIAC ARRHYTHMIA SOCIETY OF SOUTHERN AFRICA
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ANSWER

OVERVIEW OF THE ECG

This is an irregular, narrow QRS tachycardia at a mean rate of 108/minute. There are 2 short runs of tachycardia, slightly irregular at about 150/minute, with pauses in between.

More detailed analysis of the ECG

The initial 2 complexes are preceded by P waves with an axis of about +60 ° and a PR interval of 150 ms. The QRS duration is 95 ms, and the QRS axis is about +65 °. The QRS morphology is normal, except for a small terminal r in V1, suggesting an incomplete right bundle branch block. The QT interval of the first and last complex is 390 ms. After the second complex, likely of sinus origin, there are 4 beats of tachycardia. Note the downslope distortion of the T wave, mirrored in Lead III above. This is a premature atrial complex (PAC) (Figure 1), followed by 3 beats of tachycardia, with a cycle length of 400 ms (150/minute). The following pause is 830 ms, ending with a complex likely of sinus origin. This complex is also followed by a PAC, distorting the T wave and initiating a longer run of tachycardia. The cycle length starts at 400 ms and lengthens to 450 ms for the last few beats. The 880 ms pause is followed by a sinus beat. Note the peaking of the T waves in the second run of tachycardia (Figure 1, arrows). A sharp deflection in V1 coincides with the peak of the T waves in Lead II (Figure 2).

COMMENT

The most common cause of an irregular, narrow QRS tachycardia is atrial fibrillation (AF) (Table I).[1,2] From the analysis above, this is not AF; the tachycardia is not randomly irregular. The cycle length increases slightly before the longer run terminates. Each QRS during the tachycardia is preceded by a P wave, which is concealed by the T wave in the Lead II rhythm strip, but is clearly visible simultaneously as a sharp deflection in V1.

While it is possible to have short runs of AF triggered by ≥ 1 PACs, this is unlikely in a young woman with no evidence of structural heart disease and an otherwise normal ECG. Nevertheless, this was the diagnosis made in the EU. The doctor

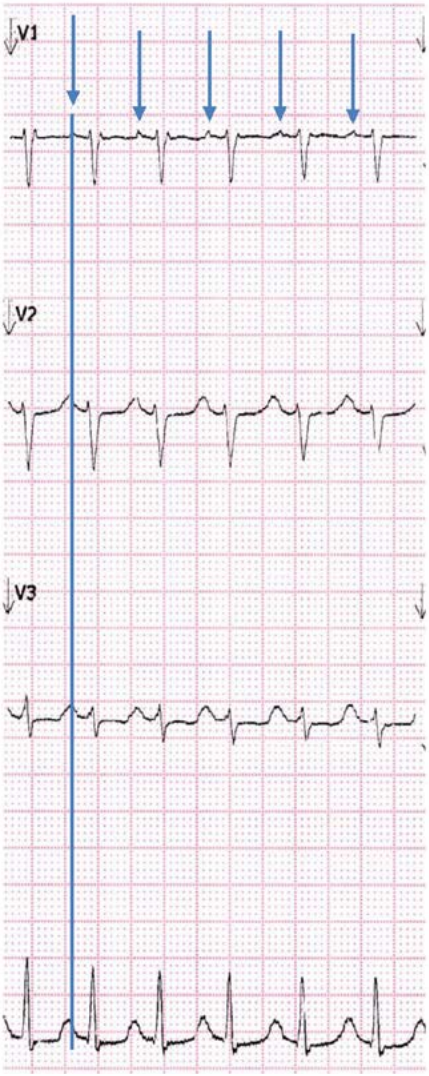

FIGURE 2: Leads V1–3 with Lead II at the bottom, showing the P waves in V1 (arrows) synchronous with the apex of the T waves in Lead II.

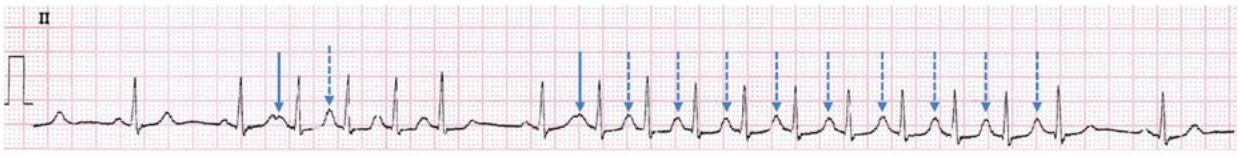

FIGURE 1: Lead II rhythm strip; after 2 sinus beats, a premature atrial complex distorts the T wave and is followed by a run of tachycardia. This is repeated after the pause. The dotted arrows show the P waves distorting the apex of the T waves. The last tachycardia complex is not followed by a P wave.

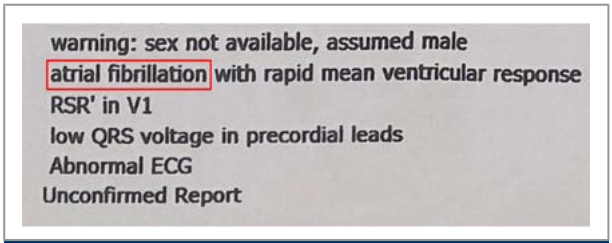

FIGURE 3: Incorrect and misleading computer report falsely diagnosing atrial fibrillation.

in the EU may have been influenced by the computer's false diagnosis of AF, printed on the ECG (Figure 3). The incorrect diagnosis led to her being started on a beta-blocker, which was reasonable, and apixaban, which was not indicated.

The rhythm is not atrial flutter with variable AV block, a common cause of an irregular, narrow QRS tachycardia. There is a single P wave per QRS complex, and all the P waves are conducted. AVNRT must be considered. AVNRT is commonly triggered by a PAC which blocks in the refractory fast pathway. It is then conducted slowly via the slow AV nodal pathway and echoes back to the atrium via the fast pathway, which has now recovered from refractoriness. This results in a very short RP tachycardia, with the retrograde P occurring within or shortly after the QRS. Atypical AVNRT uses the fast pathway as the antegrade limb and the slow pathway retrogradely, resulting in a long RP tachycardia.[3] The case under discussion is a long RP tachycardia. The differential diagnosis of a long RP tachycardia includes sinus tachycardia, atrial tachycardia, atypical AVNRT, and atypical atrioventricular re-entry tachycardia (AVRT).

The P wave axis of the tachycardia can help determine the direction of atrial activation. The P waves are upright in Leads II, III, and aVF, indicating an origin high in the atria and excluding AVNRT and AVRT. The slight slowing before the pauses and irregularity can occur with an atrial tachycardia. Atrial tachycardias are focal in origin with discrete P waves (unlike atrial flutter, a macro-re-entrant arrhythmia with a sawtooth pattern). Atrial tachycardias can cause long RP (common) or short RP (uncommon) tachycardias. Common sites for atrial tachycardias include the high right atrium near the crista terminalis or the pulmonary veins. Incessant atrial tachycardias can cause tachycardia-induced cardiomyopathy. Treatment of atrial tachycardias includes beta-blockers or catheter ablation for resistant cases.

TABLE I: Differential diagnosis of an irregular, narrow QRS tachycardia.

- Atrial fibrillation.
- Atrial flutter with variable atrioventricular block.
- Atrial tachycardia with variable atrioventricular block or intermittent exit block.
- Multifocal atrial tachycardia.

Note: Short runs of otherwise regular supraventricular tachycardias, interrupted by sinus beats, will also give the appearance of an irregular rhythm.

ANSWER

The correct answer is (d.): Atrial tachycardia. While exit block is a possibility, the pauses should be an exact multiple of the tachycardia cycle length, which is not the case here.[4]

Computer analysis of ECG rhythms

Many modern computerised ECG storage systems offer a diagnosis. Although computerised measurements of the various intervals are reasonably accurate, and conditions such as ST-elevation myocardial infarction are usually correctly recognised, rhythm diagnoses are generally appalling and often dangerously incorrect (personal experience). After over-reading many ECGs generated by the system at Groote Schuur Hospital, we had the computer diagnosis removed from the printout. Unfortunately, this is not the case in many hospitals.

LESSONS AND CONCLUSIONS

- Accurate diagnosis of an arrhythmia is vital to ensure appropriate treatment.
- Never accept the computer-generated diagnosis of an arrhythmia without critically examining the ECG and reaching your own conclusion.
- AF is rare under the age of 60 in the absence of structural heart disease ("lone AF").
- Use all available leads to identify P waves.

REFERENCES

1. Chin A, Vezi B, Namane M, Weich H, Scott-Millar R. An approach to the patient with a suspected tachycardia in the emergency department. S Afr Med J. 2016;106(3):246-50. https://doi.org/10.7196/SAMJ.2016.v106i3.10322.
2. Hoevelmann J, Viljoen C, Chin A. Irregular, narrow-complex tachycardia. Cardiovasc J Afr. 2018;29(3):195-8.
3. Millar RS, Chin A. ECG quiz 37 - Answer. SA Heart J. 2015;12(1);28.
4. Millar RS, Chin A. ECG quiz 70 answers. SA Heart J. 2025;22(4):240-3.