ECG Quiz 59

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

ANSWER

OVERVIEW OF THE ECG

There is a bradycardia of 42bpm with a P wave before each narrow QRS and a prolonged PR interval. This first impression suggests a diagnosis of sinus bradycardia with first degree AV block.

1. MORE DETAILED ANALYSIS OF THE ECG

First impressions (thinking fast) may be correct but are often misleading and need to be followed up by more careful and considered analysis (thinking slow).[1] Sinus rates between 50 and 60 are technically bradycardias, but they are common among normal people. While a heart rate below 50 may simply be sinus bradycardia, it should be considered to be second- or third-degree heart block until proven otherwise (Figure 1).

The rhythm is a regular bradycardia. P waves are seen before each QRS. The P wave axis is +60° with normal morphology, suggesting sinus node origin. The PR interval is markedly pro-

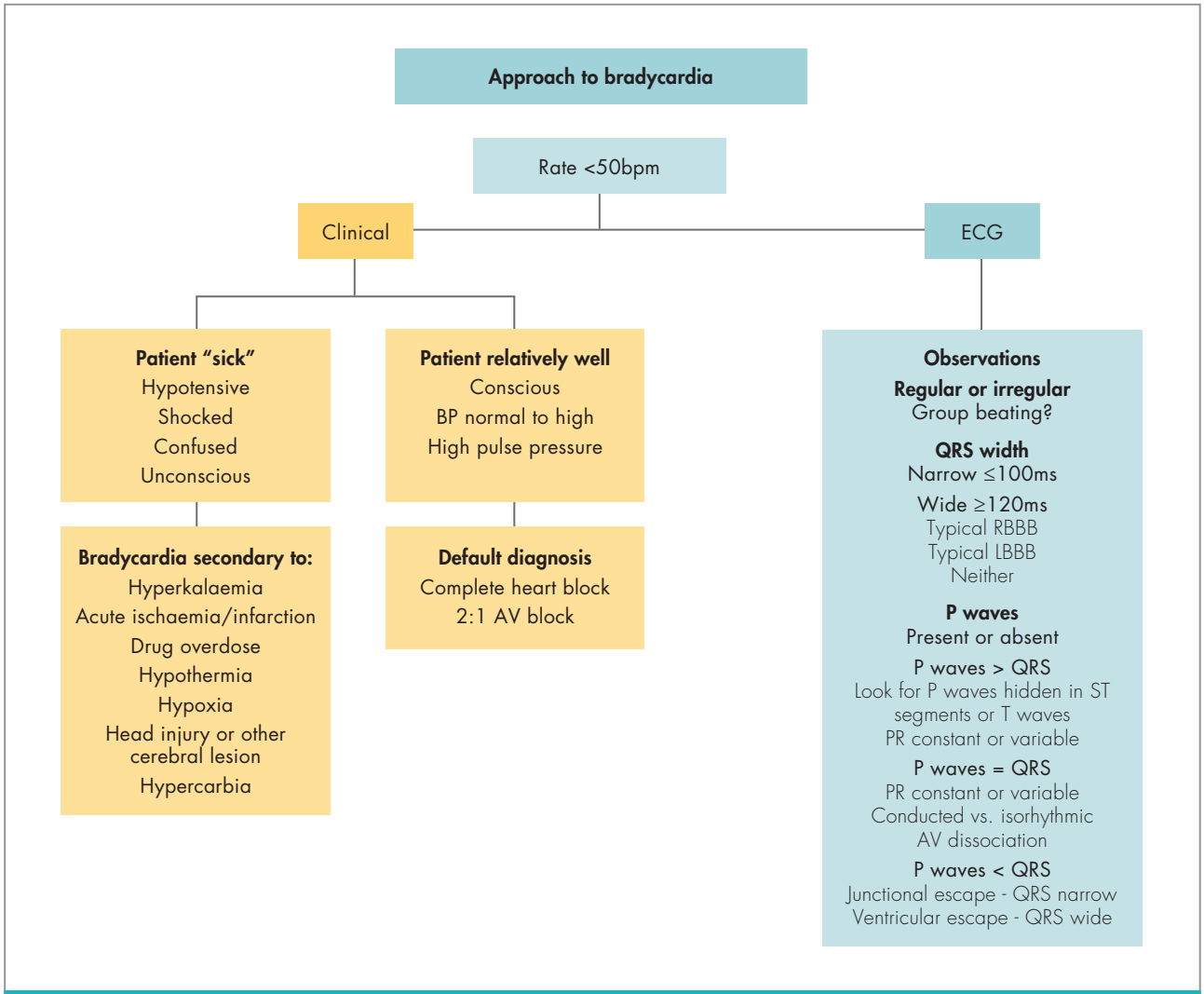

FIGURE 1: Marked bradycardia (<50bpm) may be due to a disorder of impulse formation (sinus node dysfunction) or AV conduction (heart block). It may be secondary to an acute event (e.g., myocardial infarct), in which case the patient is usually "sick" or be primarily an electrical disorder.

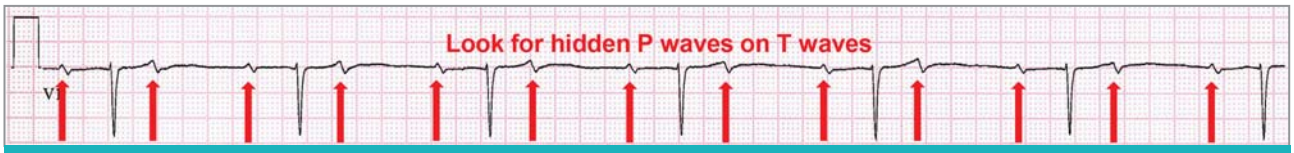

FIGURE 2: The arrows indicate the P waves. Note the higher frequency waves distorting the ends of the T waves.

FIGURE 3: Rhythm strip from another patient showing 2:1 AV block. The PR interval of the conducted complexes is normal and the QRS is wide due to right bundle branch block.

longed at 420ms and is constant from beginning to end of the tracing, making AV dissociation unlikely. The QRS complexes are narrow at 90ms. The QRS axis is +30° and there are no QRS abnormalities. The ST segments and T waves appear to be normal, except for the terminal part of the T wave in V1. This T wave ends with a biphasic, relatively sharp deflection. This deflection falls almost halfway between the visible P waves and has a similar morphology. It is therefore a hidden blocked P wave (Figure 2). The initial impression of sinus bradycardia with first degree AV block is therefore incorrect.

The blocked P wave is slightly premature, but its morphology does not change, nor is it early enough to cause physiological block in the AV node. This phenomenon is called ventriculophasic sinus dysrhythmia, in which the P-P interval encompassing a QRS complex is shorter than the interval that does not. It is common in 2:1 and complete heart block, particularly in younger individuals. The mechanism is thought to be vagal feedback induced by the mechanical systole. Atrial bigeminy would likely result in greater prematurity and difference in P wave morphology.

The constant PR interval excludes complete heart block. Neither Mobitz I (Wenckebach) nor Mobitz II second degree AV block can be inferred without 2 consecutively conducted P waves.

The correct answer to (question 1) is therefore (c): 2:1 AV block.

COMMENT

This diagnosis is easily missed. The key is a high level of clinical suspicion and careful perusal of the ECG to find the blocked P waves. One clue is the relatively sharp (high frequency) termination of the T waves in V1 which is not apparent in other leads instead of the smooth low frequency that one expects. It emphasises the need to examine all the leads and would have been more difficult if V1 was not chosen for the rhythm strip. The other clue is the prolonged PR interval which points to a problem with AV conduction. While one cannot be sure, in the absence of the Wenckebach phenomenon, it suggests AV nodal block rather than block within the His-Purkinje system. This is supported by the narrow QRS complexes.

There is no evidence of a cause of the block, such as inferior STEMI or other structural cardiac abnormality in this asymptomatic man. It is probably idiopathic conduction disease which more frequently affects the more distal conducting system, in which case the QRS is usually wide, and the PR interval of the conducted complexes tends to be normal (Figure 3). A wide QRS in the presence of marked bradycardia is an important to clue to 2:1 and complete heart block.

Patients with heart block unrelated to a severe acute cardiac insult such as myocardial infarction or other severe illness tend to be relatively well even if they have had recent syncope, dizziness or reduced effort tolerance. The blood pressure is characteristically high (e.g., 170/70mmHg) with a high pulse pressure. This is related to the non-compliant arterial tree in older

patients receiving a higher-than-normal stroke volume and a longer time for diastolic runoff. If the patient is hypotensive or unresponsive, consider the conditions listed in Figure 1.

The patient whose ECG is shown in Figure 4 is a case in point. He was cool and clammy with a BP of 80/60. Considering his presentation, the bradycardia of 56/minute was inappropriate. After the initial obvious impression of an inferior STEMI, close observation reveals a sinus tachycardia with 2:1 AV block and P waves hidden at the end of the T waves.

2. MANAGEMENT

It is traditionally believed that block within the AV node is benign[2] and does not require pacing in the absence of symptoms, in contrast to infra-nodal block within the His-Purkinje system. This view is supported by the 2018 ACC/AHA/HRS guideline on the evaluation and management of patients with bradycardia and cardiac conduction delay with respect to Wenckebach and 2:1 second degree AV block known to be AV nodal.[3] The 2013 ESC pacing guideline states that pacing remains controversial for AV nodal block. According to these guidelines, it would therefore be reasonable to exclude infra-nodal block in this patient. If the block is indeed AV nodal, exercise may result in temporary 1:1 conduction. If the block fails to improve or worsen, it would suggest block is infra-nodal. This is the least that should be done before deciding against pacing. Alternatively, an invasive electrophysiological study (EPS) could be done to prove AV nodal block and exclude infra-nodal block. The latter may manifest as a prolonged HV interval or split His potential. A 24-hour Holter monitor should also be done to look for episodes of higher-grade AV block.

The answer to (question 2) is (d): Perform an exercise stress test and 24-hour Holter monitor.

In summary, based on current guidelines, a pacemaker will be indicated if higher grade block is seen on either of these tests or if the block does not resolve with exercise. It may be reasonable to defer implanting a pacemaker if exercise results in 1:1 conduction and to wait for development of symptoms.

There are, however, few long-term natural history studies and no controlled trials to support the view that AV nodal block is benign. Those on which the prevailing view is based were small and contained mainly young patients. Two observational studies, neither of which is quoted in the American guidelines, with mainly elderly patients suggest the opposite. The Devon Heart Study, first reported in 1985,[4] looked at patients from GP practices in South West England and identified patients with Mobitz I, Mobitz II, 2:1 and 3:1 AV block. They showed no survival difference between types of second-degree AV block.

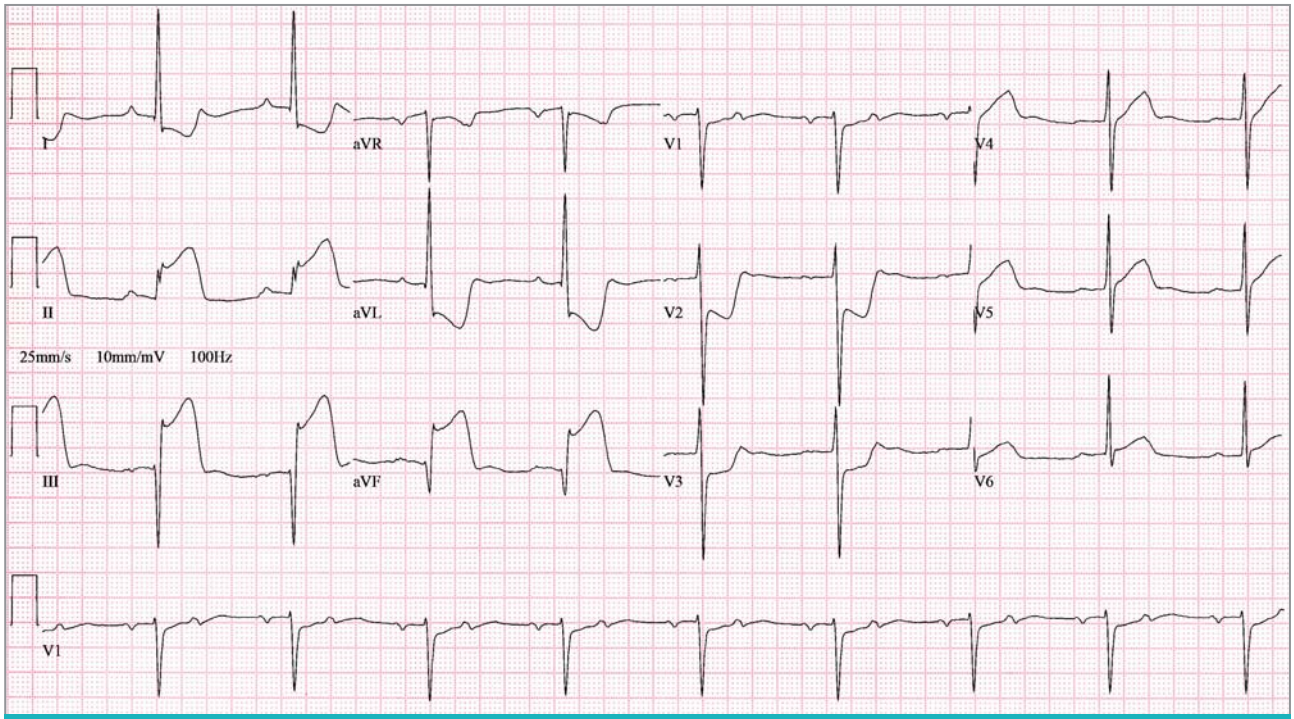

FIGURE 4: ECG of a patient with inferior STEMI, sinus tachycardia and 2:1 AV block (see text).

Those who received permanent pacemakers for whatever reason lived significantly longer. A subsequent prospective observational study from the same group[5] included patients from age 20 with Mobitz I AV block with similar findings in those aged 45 or older. There were no deaths in the small number under 45 years. A retrospective cohort study from Minnesota, USA came to similar conclusions.[6] The benefit of pacing was seen in both symptomatic and asymptomatic patients. Based on this evidence, it would be reasonable to adopt a more cautious approach and to recommend implantation of a permanent pacemaker to the patient even in the absence of symptoms. This is particularly relevant in South Africa where access to exercise stress testing, Holter monitoring, and EP procedures is limited and when the expert interpretation of these tests can be challenging for non-electrophysiologists. One would have to point out that it is a Class III recommendation (i.e., not indicated, potentially harmful) in the HRS guideline,[3] a viewpoint with which we disagree. In a strong editorial in the same issue of Heart as the Minnesota study[7] Richard Sutton, a doyen of pacing in the UK, also disagrees with the American guidelines on this issue. It is unlikely that a randomised controlled trial will ever be performed to provide a definitive answer.

In a controversial issue such as this, one will have to be open with the patient and allow him/her to participate in the decision and give properly informed consent.

LESSONS AND CONCLUSIONS

- If the heart rate is less than 50, the patient has complete heart block or 2:1 AV block until proven otherwise.
- Before diagnosing sinus bradycardia carefully examine the T waves for hidden P waves.
- Consider permanent pacing in all patients with second degree AV block not related to a reversible cause, even if asymptomatic. Exception: Wenckebach AV block under age 45.[5]

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Conflict of interest: none declared.

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