Rate or Ratio?

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The ECG shown in Figure 1 was recorded in an asymptomatic 85-year-old woman recently found to have a slow pulse rate. The rhythm strip shown in Figure 2 was recorded a few hours later, when it was noted that the patient's heart rate had fallen further.

Figure 1. Initial ECG.

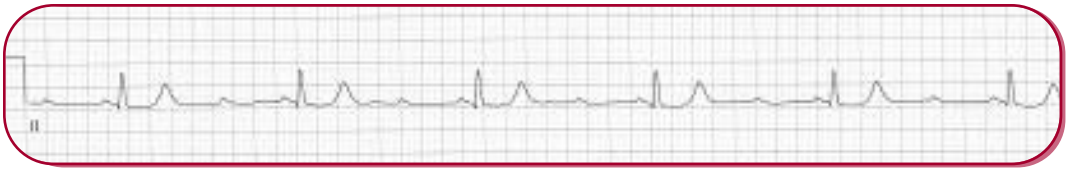

Figure 2. Subsequent rhythm strip.

1. Why is the patient bradycardic?

2. What can we deduce from the subsequent change in heart rate?

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This Month's ECG Diagnosis

1. The ECG in Figure 1 shows sinus rhythm with an atrial rate of 88 bpm and a ventricular rate of 44 bpm. The patient is in second-degree atrioventricular (AV) block with a 2:1 conduction ratio. The QRS duration and morphology are normal, suggesting that the block is most likely at the level of the AV node.

Figure 3. Episode of Mobitz II AV block.

2. The subsequent rhythm strip (Figure 2) shows that the patient is still in second-degree AV block but the conduction ratio is now 3:1 (there is a P wave buried in each T wave). One might reasonably be concerned that this represents progression of the underlying conduction disease but it is important to note that the atrial rate has increased to 105 bpm. The most likely explanation for the deterioration in conduction ratio is that an atrial rate around 90 bpm represents this patient's threshold for 2:1 conduction. Further increases in atrial rate exceed the conduction threshold so fewer P waves are conducted.

This type of behaviour is suspicious for block occurring within the His-Purkinje system (HPS); because the QRS duration is normal, the block would need to be within the His bundle proximal to its bifurcation. Carotid sinus massage can sometimes be of diagnostic value in this setting. The conduction ratio in AV nodal block may transiently worsen, due to the vagally mediated slowing in AV node conduction. With HPS block, the conduction ratio may paradoxically improve if the atrial rate slows sufficiently. Review of this patient's previous ECGs revealed an episode of Mobitz II AV block (Figure 3) supporting the hypothesis about the location of the block within the HPS.

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