INTERESTING ELECTROCARDIOGRAM

FELLOWS CASE OF THE MONTH

AV Dissociation Masquerading as an Accelerated Junctional Rhythm with Retrograde Atrial Activation

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ECG description

A 49-year-old woman presented to the Emergency Department with flu-like symptoms for the preceding 3 days. She denied any recent symptoms of cardiac ischemia or failure. There was no history of cardiac disease in her past. A routine 12-lead electrocardiogram (ECG) (Figure 1A) demonstrated a narrow complex regular rhythm at 78 bpm with visible P waves immediately following the QRS complexes superimposed on the ST segments. This represents an accelerated junctional rhythm with isorhythmic atrioventricular (AV) dissociation. A repeat ECG (Figure 1B) performed a few minutes later demonstrated sinus rhythm at 70 bpm with resting ST segment depression in the inferolateral leads. A transthoracic echocardiogram performed at the time revealed normal left ventricular size and systolic function with no regional wall motion abnormalities and no significant valvular disease.

Points to ponder

AV dissociation is most commonly associated with third-degree or complete AV block. However, AV dissociation, in which two separate rhythms exist concurrently within the heart, can occur in other conditions.1,2 AV dissociation can occur with slowing of the physiological pacemaker as occurs in the setting profound sinus bradycardia with a junctional escape rhythm or VVO/VVI pacing in a patient with sinus node dysfunction. This requires absence of retrograde VA conduction, otherwise the ‘downstream’ rhythm would capture the sinus node. It can also occur when there is a pathologically high junctional or ventricular rate such as ventricular tachycardia (VT) with absence of retrograde VA conduction.

The final cause is AV dissociation due to interference; this occurs where there are two rhythms (either atrial and junctional or atrial and ventricular) occurring at similar rates and near simultaneously such that both anterograde and retrograde conduction fall into each other’s refractory period; this is termed isorhythmic AV dissociation.

In our patient, the rhythm was initially misdiagnosed as an accelerated junctional rhythm with retrograde atrial activation. This is not correct as the P waves that follow the QRS complexes are positive in the inferior leads (II, III, avF) indicating an inferior axis; this indicates they must be originating in the high right atrium. Additionally, the RP interval is not fixed; one can see in Figure 1A that the P-wave appears to move “backwards” into the QRS complexes in the later beats. If these P waves were due to retrograde conduction, the RP intervals would be constant.

In our patient, her flu-like illness was associated with enhanced automaticity of the junctional pacemaker focus resulting in an accelerated junctional rhythm. The rare conditions of the sinus node beating at a similar rate, and...
Figure 1: (A) Electrocardiogram (ECG) on presentation demonstrating an accelerated junctional rhythm with isorhythmic atrioventricular dissociation. (B) The patient’s baseline ECG.

Figure 2: Ladder diagram demonstrating near simultaneous sinus and junctional pacemaker sites with similar rates resulting in anterograde and retrograde conduction respectively that fall within each other’s refractory periods.
both pacemaker sites discharging near simultaneously have occurred to allow interference isorhythmic AV dissociation to exist (Figure 2). Eventually, the slight difference in rates between the two pacemaker sites allows one site to discharge early enough to capture the other site, breaking the cycle and resulting in return to sinus rhythm.

References