Atrial Escape Capture Bigeminy

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Abstract: Atrial escape capture bigeminy is a rare electrocardiographic entity. A case of atrial escape sinus capture presenting as true atrial bigeminy is reported. Key words: Electrocardiology, atrial escape capture bigeminy, ectopic P waves atrial bigeminy.

Escape capture bigeminy is a common arrhythmia and is a well-recognized nosologic electrocardiographic (ECG) entity. Atrial escape capture bigeminy, however, is extremely rare, and only a few examples have been recognized (1).

Case Report

A 69-year-old man with irritable bowel syndrome but with no antecedent heart disease was accidentally observed to have pulsus bigeminy. A routine ECG was recorded, which showed an unusual arrhythmia. Lead II (Fig. 1) is only a section of the long tracing and shows two types of atrial activity. The positive atrial wave (designated P) is of similar shape and polarity to a subsequent ECG tracing (Fig. 2) and is apparently of sinus origin. The negative atrial wave is of ectopic origin and is being designated P'.

The following salient observations were made (Fig. 1).

1. Sinus bradycardia: The sinus P waves (2nd, 4th, 6th, and 8th complexes) occur at regular intervals of 1.16 seconds, equivalent to 52 beats/min. Each P wave is followed by a QRS complex, with a PR interval of 0.14 second.

2. Atrial escape rhythm: Each sinus cycle is interrupted by an atrial escape beat P' (1st, 3rd, 5th, and 7th) with an almost constant escape interval of 0.68 second, which is conducted to the ventricle with a PR interval of 0.12 second. Since this PR interval is only 0.02 second less than the sinus PR interval, it is likely to be of low atrial origin; a retrograde nodal or junctional origin can be ruled out, as this would require the atrial escape PR interval to be at least 0.04 second shorter than the sinus PR interval (2).

3. Capture rhythm: Following the atrial escape beat (P' QRS), a regular sinus capture beat (P QRS) occurs at an interval of 0.48 second.

4. Absence of resetting of atrial cycle: The escape P' wave does not interfere with or reset the sinus P atrial cycle rhythm, as would normally have been expected.

5. Entrance block of sinus P: Since the escape P' wave has not interfered with the sinus P wave, it can be inferred that the sinus P has an entrance block and is protected.

6. Second QRS complex of the bigeminal couples (2, 4, 6, and 8): This shows a higher voltage, with depression of the PR and the ST-segment. The higher voltage is evident of a mild phase aberration, commonly known as the Ashmann phenomenon. Depression of the PR and the ST-segment of sinus conducted beats is due to
PTa waves caused by a tachycardia effect and is a well-known phenomenon in exercise electrocardiology. Moreover, this feature is absent in ectopic conducted beats [ie, normalization of the PR and the ST-segment (3)].

The arrhythmia was monitored and persisted overnight, but the ending could not be recorded. An ECG recorded after cessation of the arrhythmia (Fig. 2) shows normal sinus rhythm with intersinus cycle length of 0.64 second, corresponding to a heart rate of 94 beats/min. The ventricular complexes are similar to ectopic conducted complexes, and the PR and the ST-segment have become much less pronounced. From the next day on, the patient remained in sinus rhythm. A later recording failed to show any rhythm abnormality or ectopics even with various vagotonic and vagolytic maneuvers. Sinus node functions could not be obtained because suitable facilities were not available.

Discussion

The ECG tracing presented here is a true atrial escape capture bigeminy. This arrhythmia has been considered to be extremely rare, and Schamroth found no case reported as such (1), and only one of three cases that he cited as probable unrecognized examples shows unequivocal atrial escape capture bigeminy.

The rarity of this arrhythmia is possibly due to the fact that it can only become manifest under highly uncommon circumstances. The first requirement is that the manifest intersinus interval must be longer than the atrial escape interval, as only then the atrial escape cycle can become manifest. This, in turn, can only be possible in situations in which there is either underlying sinoatrial block, with sinus rate becoming relatively low or extreme sinus bradycardia. Either condition could have been possible in the present case.

An interesting feature of the present ECG is that atrial escape beats failed to reset or influence the sinus beats, as would have happened under normal circumstances. The only inference is that there is entrance block surrounding the sinus node and the latter is being protected.

As neither the beginning nor the end of the arrhythmia P' could be recorded, certain hypothetical alternatives may be considered. It may well be argued that during the period of recording, the dominant rhythm is ectopic atrial (P' waves) and positive atrial P waves represent premature atrial ectopic activity. Thus, the rhythm would be a true ectopic atrial bigeminy. However, the similarity of shape,
size, and PR interval of these so-called ectopics to later recorded sinus atrial activity (Fig. 2) would negate this assumption. On the other hand, ectopic atrial (P') activity may be considered as interpolated atrial ectopics with long coupling intervals. However, interpolated atrial ectopics are centrally located (not eccentric) and are rare and infrequent. Their presence as an uninterrupted rhythm is highly unusual if not impossible.

References