

Escape Capture Bigeminy Following Convergent Ablation for Long-Standing Persistent Atrial Fibrillation

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Background

Escape-capture bigeminy is a rare rhythm that can be an early sign of sick sinus node manifesting as a sino-atrial exit block. We described an occurrence of this uncommon rhythm following surgical epicardial ablation of long-standing persistent atrial fibrillation- a finding never documented before.

Case

A 45-year-old gentleman with a diagnosis of symptomatic long-standing persistent atrial fibrillation (AF) for ten years underwent elective surgical epicardial ablation - Convergent Procedure via subxiphoid approach and video-assisted thoracic surgery ligation of left atrial appendage with a 40 mm AtriClip. No intraoperative cardioversion was performed and patient tolerated the procedure well with no peri-operative complication. Twenty-four hours later, the patient developed rhythm as noted on the 12-lead electrocardiogram (ECG) (without any antiarrhythmic drugs).

The 12-lead ECG demonstrated sinus bradycardia (54 bpm) with repetitive group beating in a bigeminy fashion with junctional escape beat followed by a sinus conducted beat (Figure). The PP interval was 2280 ms, and PR interval was 240 ms. The junctional escape beat is seen following the sinus beat with constant interval of 1800ms, which is then followed by the capture beat at interval of 480 ms-pattern that repeated itself. This is an escape-capture bigeminy. The patient was asymptomatic and hemodynamically stable throughout until he self-converted to sinus rhythm 12 hours later (with no evidence of any reversible cause). The patient had remained in sinus rhythm until discharge without any recurrence of AF or escape-capture bigeminy at follow-up.

Discussion

Escape-capture bigeminy is a repetitive group beating consists of a ventricular escape beat followed by a sinus conducted beat in a bigeminy fashion. The escape beat occurs because of the intermittent sino-atrial exit block preventing the propagation of sinus impulse. Our patient escape beat likely originated from the atrioventricular junction given the same QRS morphology, although escape from the ventricle has been reported as well.

This rhythm is rare as its emergence requires two conditions to be met. First, the effective cycle length of the sino-atrial (SA) node or the primary pacemaker (2280 ms) must exceed the escape interval (1800 ms) plus the refractory period following the escape complex. Second, the escape beat could not reset the SA node retrogradely due to either an entrance block at the sinus node level or any retrograde conduction block. Thus, without recent usage of SA node suppressing medications or significant electrolytes imbalance, these findings are signs of early sick sinus node manifesting as SA exit block, with or without an entrance block^{1,2}. Progression to advanced SA node disease is very likely and permanent pacemaker may be indicated.

Transient atrial electrical silence up to 12 hours has been reported following cessation of persistent atrial arrhythmias³. Chronic overdrive suppression of SA node and other pacemaker cells may result in an increased intra-cellular calcium leading to intracellular resistance and inhibition of pacemaker activity and/or pacemaker exit block³. Our patient had long-standing persistent AF which was likely associated with the transient SA exit block presenting as escape-capture bigeminy following the ablation.

Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests

Key Words

Atrial Fibrillation Ablation, Escape Capture Bigeminy

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Figure 1:

Twelve-lead electrocardiogram with a corresponding ladder diagram demonstrating escape capture bigeminy rhythm. The cycle lengths for the PP, PR, and RP intervals are denoted in milliseconds (ms). Capture beat occurs with the constant P-P interval of 2280ms. The junctional escape beat is seen following the sinus beat with constant interval of 1800 ms, which then again followed by the capture beat at interval of 480 ms. The pattern then repeats itself.

References

1. Reddy Manne JR, Garg J. Hyperkalemia-induced escape capture bigeminy. HeartRhythm Case Rep 2021;7:706-708.
2. Manne JRR. A case of atenolol-induced sinus node dysfunction presenting as escape-capture bigeminy. Oxford medical case reports 2018;2018:omy015.
3. Turitto G, Saponieri C, Onuora A, El-Sherif N. Prolonged transient atrial electrical silence following termination of chronic atrial tachyarrhythmias. Pacing Clin Electrophysiol 2007;30:1311-5.