

Chest Radiograph Clarifies an Electrocardiographic Abnormality

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A 69-year-old man with severe aortic stenosis underwent transcatheter aortic valve replacement with a 29-mm Edwards SAPIEN 3 Transcatheter Heart Valve (Edwards Lifesciences LLC). During the procedure, he had transient 3rd-degree atrioventricular block, followed by sinus rhythm with PR prolongation, right bundle branch block, and left anterior fascicular block. Our electrophysiology team was consulted.

We decided to implant a dual chamber pacemaker (Medtronic) in DDDR mode. The day after implantation, the following surface electrocardiogram (ECG) was obtained (programmed atrioventricular [AV] delay, 160 ms).

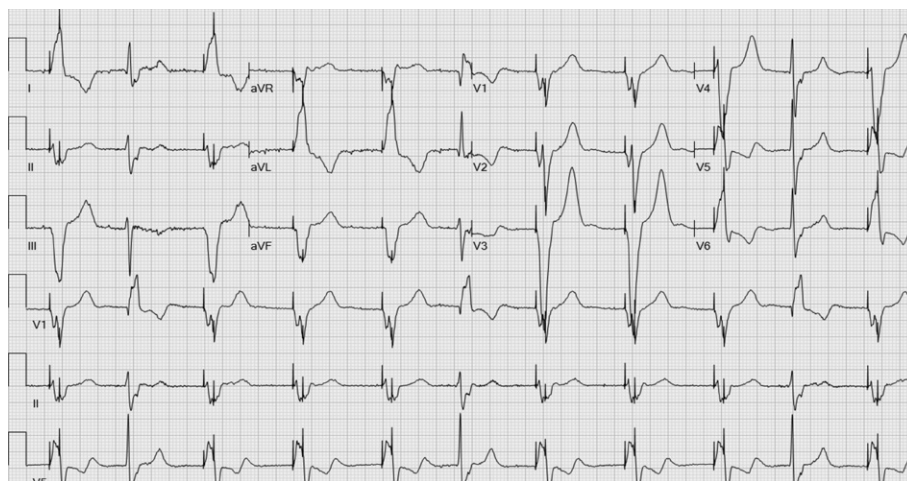


Fig. 1

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What does the rhythm indicate?

- A) Normal DDDR pacemaker function
- B) Ventricular lead dislodgment with atrial safety pacing
- C) Atrial lead dislodgment with ventricular safety pacing
- D) Atrial lead oversensing
- E) Ventricular lead oversensing

See next page for the answer, as well as a link to the Focus on ECGs blog, where you can participate in a moderated discussion.

FOCUS ON ECGs: ANSWER #15

Answer

C) Atrial lead dislodgment with ventricular safety pacing

The other answers are inconsistent with the ECG (note that “atrial safety pacing” does not exist). The ECG shows ventricular pacing by the atrial lead, followed by ventricular pacing by the ventricular lead during the QRS complex—probably after the atrial lead migrated into the right ventricle and stimulated the ventricular myocardium at each pacing event.

To confirm our suspicions, we ordered a chest radiograph (Fig. 2). It indeed shows atrial lead dislodgment (arrowheads).

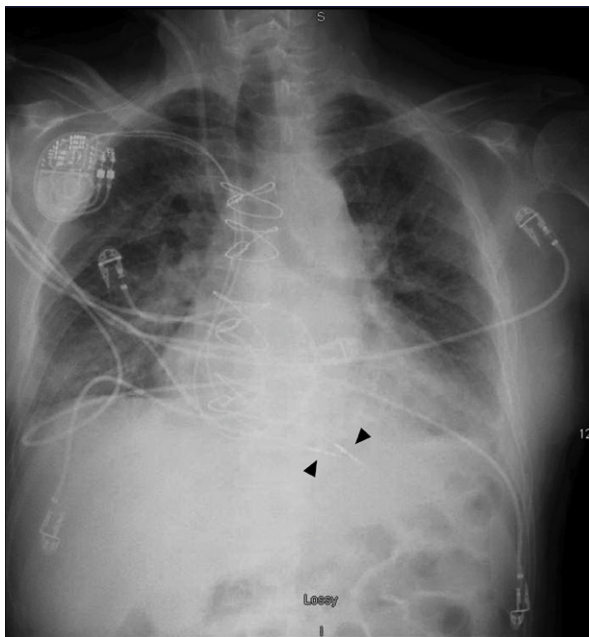


Fig. 2

Of note, the ventricular pacing impulses occur 110 ms after the atrial pacing event. The programmed AV delay

was 160 ms. This interval difference can be attributed to the activation of a safety feature called ventricular safety pacing (VSP),¹ which ensures ventricular pacing when the ventricular lead detects far-field atrial pacing signals that might otherwise inhibit ventricular output (crosstalk). When VSP is on, a paced atrial event initiates a 110-ms interval during which any activity detected by the ventricular channel triggers ventricular pacing to prevent inappropriate inhibition. (In a patient with complete heart block, inhibiting the ventricular output would cause the heart’s pumping function to stop.) The shortened AV interval during VSP is also programmed to prevent safety pacing on the T wave, which may result in ventricular arrhythmia.

In this case, VSP caused ventricular pacing during the QRS complex due to lead dislodgment. These impulses do not capture the ventricle, because they occur during the absolute refractory period.

The unpaced QRS complexes (every 4 beats) probably indicate native impulses of supraventricular origin, which may be premature atrial contractions or echo beats after ventriculoatrial conduction.

It is rather unusual for chest radiographs to clarify a reason for abnormal ECG results. Repositioning the patient’s atrial lead resulted in normal pacemaker function.

References

1. Medtronic Academy [Internet]. Ventricular safety pacing (VSP) feature. Available from: <https://www.medtronicacademy.com/features/ventricular-safety-pacing-vsp-feature> [cited 2018 Mar 27].

To participate in a moderated discussion of this case, go to THIJournal.blogspot.com. Two weeks from the original posting date, the discussion will close, but the comments will remain online for reference.