

Is the Pacemaker Functioning Properly?

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A 93-year-old woman with no symptoms was admitted to the hospital for a pacemaker generator exchange. She had a history of ischemic cardiomyopathy and was taking optimal medical therapy. She had also experienced paroxysmal atrial arrhythmia, which had been treated with atrioventricular node ablation and dual-chamber permanent pacemaker implantation. Upon her arrival, a 12-lead electrocardiogram was obtained (Fig. 1).

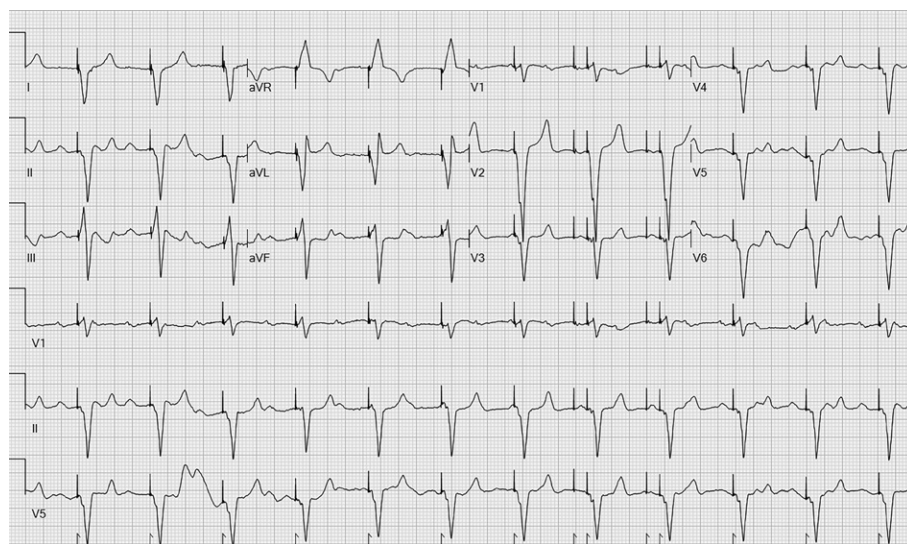


Fig. 1

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This ECG is most consistent with:

- A) Sinus rhythm with a normally functioning pacemaker set in DDD mode
- B) Sinus rhythm with a pacemaker sensing malfunction
- C) Atrial tachycardia with a normally functioning pacemaker set in DDD mode
- D) Atrial tachycardia with a pacemaker sensing malfunction
- E) Atrial tachycardia with a normally functioning pacemaker set in DDI mode

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 #11

Answer

E) Atrial tachycardia with a normally functioning pacemaker set in DDI mode

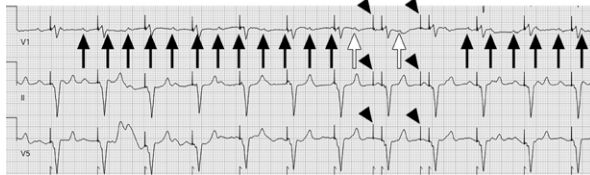


Fig. 2

Figure 2 shows atrial tachycardia and a normally functioning pacemaker set in DDI mode.

Selections A and B are incorrect, because the P-wave morphology is not consistent with sinus rhythm.

Selection C is incorrect, because the paced R-R intervals are constant and the atrioventricular intervals vary between QRS intervals. This signifies that atrial depolarizations are not triggering ventricular pacing, which would occur in DDD mode.

Selection D is incorrect, because the pacemaker is appropriately sensing atrial activity.

During most cardiac cycles, only the ventricle is being paced, regardless of atrial activity. The reason is atrial channel inhibition by native atrial impulses (black arrows).

However, there are 2 atrial-paced beats (arrowheads). These atrial pacing events occur because the native atrial

beats preceding them (white arrows) came during the postventricular atrial refractory period (PVARP), and no other P wave was sensed before the ventriculoatrial or atrial escape interval timed out. The pacemaker does not trigger when atrial activity takes place during the PVARP. The black arrows point to the rest of the native atrial impulses.

Our conclusion was confirmed on the pacemaker's intracardiac electrogram. With the PVARP set at 400 ms and the rate at 70 beats/min, atrial sensing and infrequent atrial pacing were noted. Increasing the rate to 85 beats/min caused the PVARP to cover a larger proportion of the R-R interval. Thus, native atrial impulses fell within the PVARP more frequently, failing to inhibit atrial output, so the frequency of intermittent atrial pacing increased.

The DDI mode can be used to avoid tracking atrial arrhythmias. In this mode, the pacemaker is inhibited by atrial beats that would otherwise trigger a ventricular event in DDD mode. Most modern pacemakers automatically switch from DDD to DDI mode if atrial tachyarrhythmias are detected. This feature is called mode switch.

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.