

## Pacemaker interrogation showing virtually no ventricular pacing in a ventricular pacing dependent patient: what is the explanation?

*Ventrikül uyarısına bağımlı bir hastada pacemaker sorgulaması hemen hemen hiç ventrikül uyarımı göstermiyor: Açıklaması nedir?*

### Introduction

With the advent of pacemakers, the number of related complications and clinical problems is also increasing. Most permanent pacemakers are programmable and some advanced pacemakers convert automatically to the asynchronous or safe mode. However, due to rapid improvements in the pacemaker technology, some of the features of the advanced pacemakers may seem unfamiliar to the clinicians and even electrophysiologists. Therefore, identification and reporting unusual cases of such problems can help to prevent confusion and thereby unnecessary interventions such as pacemaker replacement. In this case report, we introduce a patient who presented with an unusual pacemaker problem.

### Case Report

A 32-year-old man was referred to our clinic due to dizziness and syncope in 2005. He mentioned a history of dilated cardiomyopathy and treatment with implantable cardioverter defibrillator in his brother. Investigations revealed complete heart block, normal echocardiography, and normal laboratory data without evidence of ischemic heart disease. Subsequently, he underwent dual chamber pacemaker implantation (Identity ADx XL DR 5380, St Jude Medical, Sylmar, CA, USA). The initial evaluation showed acceptable function of both leads. The first follow-up visit, 6 weeks after implantation, showed good sensing and pacing values.

Without continuing the follow-up visits afterwards, the patient returned to our clinic in July 2010, as he was informed in another center

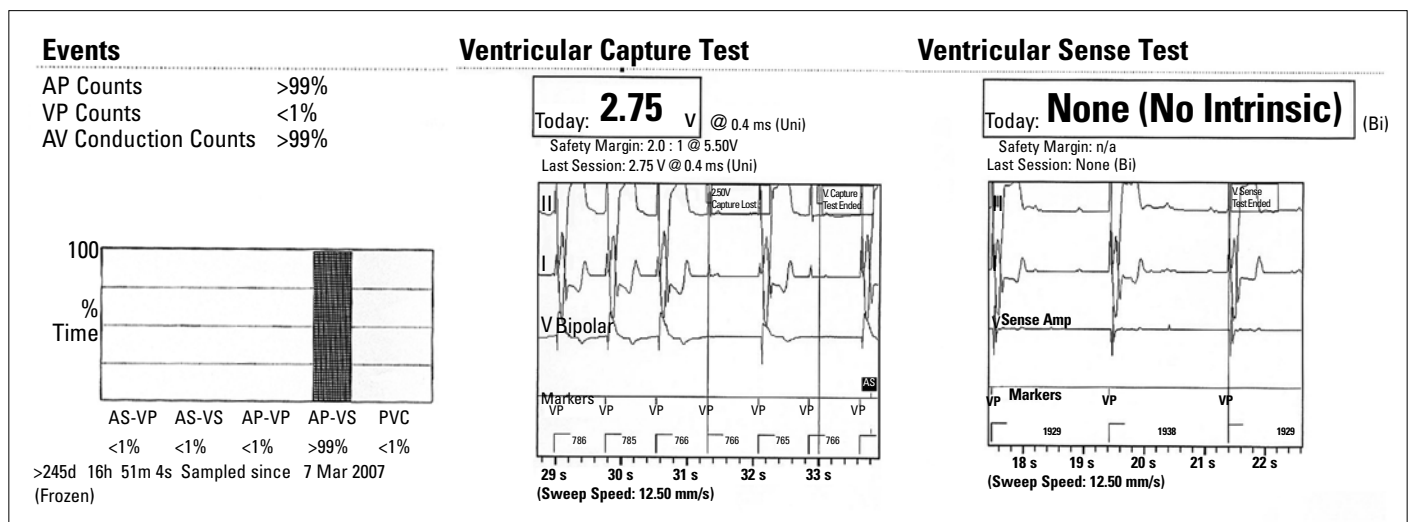
that it is the due time for the replacement of the generator. The interrogation performed in our clinic showed that the device had already reached the elective replacement indicator. The ventricular pacing threshold was high. There was no intrinsic R-wave so we were unable to find the V-sensing. During right atrial (RA) capture testing, even maximum RA output did not capture RA or right ventricle (RV). The most interesting finding was that the programmer showed 99% atrial pacing and less than 1% ventricular pacing (Fig. 1), while ventricular pacing was 100% in the electrocardiogram and Holter monitoring. Moreover, while the pacemaker mode was being switched to AAI, no ventricular pacing occurred. For further evaluation, chest X-ray was performed and revealed atrial lead displacement into the RV, below the tricuspid valve. The patient was scheduled for lead revision and replacement of the generator.

In the cath-lab, the old generator was explanted and the leads were checked with an analyzer again. The connections of the RV and RA leads to the generator were controlled and they were correct. The RV lead could only capture with high output (2.75 V at 0.4 ms pulse width) and the RA lead, which was actually found to be in the RV, could not capture the ventricle even with the highest voltage. Figure 2 shows the electrogram from the atrial and ventricular leads while performing pacing in the cath-lab.

This is our question: How did the interrogation demonstrate more than 99% atrial pacing and less than 1% ventricular (V) pacing in a patient dependent on V pacing and with the displacement of the RA lead into the RV without capturing the RV?

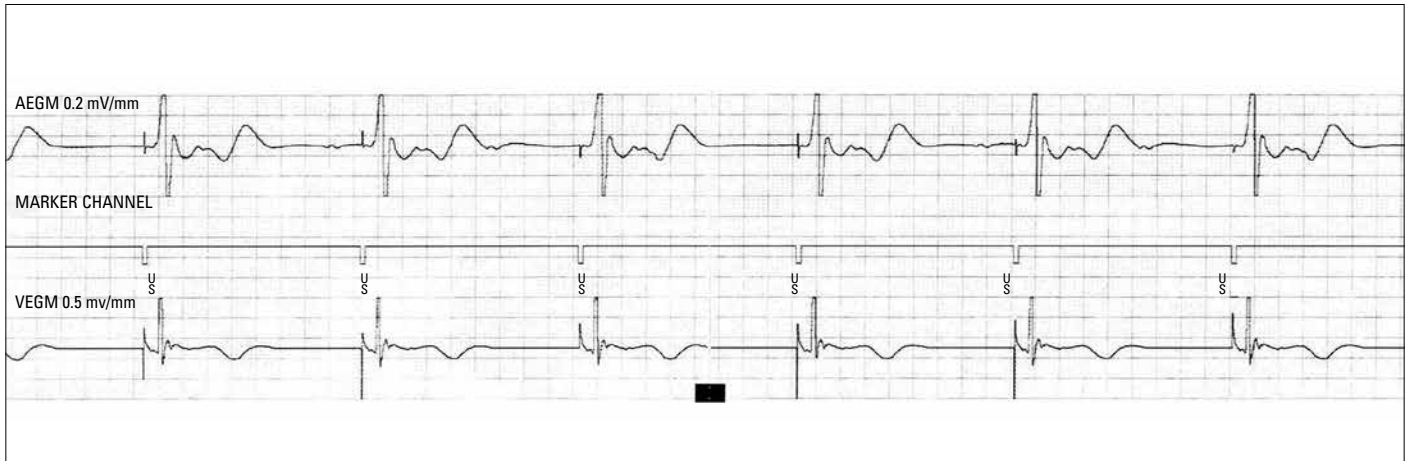
### Discussion

In this case, a dislodged RA lead could neither sense atrial electrical activity nor initiate it. However, the paced impulses were sensed by the ventricular channel in the ventricular safety pacing interval, and these sensed events initiated ventricular safety pacing. The ventricular safety option has been introduced for crosstalk prevention immediately following the ventricular blanking period, where the detection of an atrial impulse in the ventricular channel triggers a ventricular pulse 120 ms after the event. This algorithm ensures that an atrial impulse detected by the ventricular channel immediately after the atrial impulse does not inhibit ventricular pacing (1). In our patient, the pacemaker counted all these instances of ventricular safety pacing as AP-VS.



**Figure 1. Interrogation shows more than 99% atrial pacing and less than 1% ventricular pacing. Programmer strip demonstrates EGM recorded by RA and RV leads in the cath-lab during pacing**

AP - atrial pacing, AV - atrioventricular, EGM - electrogram, RA - right atrial, RV - right ventricular, VP - ventricular pacing



**Figure 2. EGM from the atrial and ventricular leads checked during implantation**

EGM - electrogram

While confronting a patient in whom the DDD pacemaker interrogation shows nearly 100% ventricular sensing, but electrocardiographic monitoring shows ventricular pacing, the most important probabilities are: a) Dislodgement of the atrial lead into the ventricle and ventricular capture by it; b) Inappropriate connection of the leads to the generator (atrial lead being connected to the ventricular channel of the generator and vice versa). But after ruling out these probabilities, simply by a chest X-ray and pacemaker analysis, the only remaining explanation is that the ventricle is already paced by the ventricular safety pacing mechanism and the generator considers it as V-sensing rather than V-pacing.

## Conclusion

In patients with total ventricular sensing in the pacemaker interrogation, ensuring the proper connection of the leads and ruling out the lead dislodgement is necessary. In case both conditions were ruled out, ventricular safety pacing can be the rational diagnosis.

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## Catheter ablation of electrical storm triggered by monomorphic ventricular ectopic beats after myocardial infarction

*Miyokart enfarktüsü sonrası gelişen monomorfik ventriküler erken atımların tetiklediği elektriksel fırtınanın kateter ablasyonu*

### Introduction

Electrical storm is a life threatening situation that involves recurrent episodes of ventricular arrhythmias. It is defined as 3 or more sustained episodes of ventricular tachycardia (VT), ventricular fibrillation (VF) or appropriate implantable cardioverter-defibrillator shocks during 24 hours (1). We report a patient who had drug-refractory, repetitive polymorphic VTs after myocardial infarction (MI) which could only be managed by radiofrequency ablation (RF) ablation of triggering ventricular premature beats (VPCs).

### Case Report

A 62-year-old female patient admitted to hospital with inferior MI after 12 hours of symptom onset. Patient immediately underwent successful primary percutaneous intervention. Echocardiogram revealed left ventricular ejection fraction of 40% with segmental wall motion abnormality.

Four days after the revascularization, she suddenly developed recurrent and sustained polymorphic VTs triggered by monomorphic VPCs (Fig. 1). There was no electrolyte imbalance and no recurrent ischemic event. Coronary angiography was also repeated but no significant lesion was observed. She was not taking any QT prolonging medication and QT interval was normal. Combination therapy of amiodarone and metoprolol was ineffective to suppress arrhythmias. Patient was deeply sedated and mechanically ventilated. Overdrive pacing and intra-aortic balloon pump counter pulsation were also tried to stop electrical storm. Despite all these interventions several electrical cardioversions were required (21 times in last 24 hours). Therefore, patient was transferred to electrophysiology laboratory to attempt catheter ablation of the VPCs triggering the polymorphic VTs.

Left ventricle (LV) was accessed retrogradely across the aortic valve (7.5 F Navistar D curve irrigated tip catheter, Biosense Webster).