

## Strategy to manage T-Wave Oversensing in a Biventricular ICD

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### Abstract

T-wave oversensing is a relatively prevalent cause of intracardiac signals oversensing in patients with Implantable Cardioverter Defibrillator (ICD). Some of these oversensings are typically corrected with device reprogramming. If reprogramming fails to resolve the issue, invasive options such as repositioning the implanted lead may be necessary. We present a patient with dilated cardiomyopathy and intermittent T wave oversensing by a cardiac resynchronization therapy (CRT) that was managed by altering V-V timing.

## INTRODUCTION

Appropriate sensing is essential for appropriate functioning of every cardiac rhythm management device. Oversensing may originate from non-physiologic signals or physiologic signals, which can be intracardiac (P, R, or T waves) or extracardiac (myopotentials) [1]. Oversensing in pacemaker-dependent patients may cause pacings slower than the lower rate limit or asystole. In implantable cardioverter defibrillator (ICD), inappropriate shocks can occur in patients in the absence of tachycardia. In cardiac resynchronization therapy (CRT), this may also be present as loss of biventricular pacing [1, 2]. We present a patient with dilated cardiomyopathy and intermittent T wave oversensing by a CRT which was managed by reprogramming of his device.

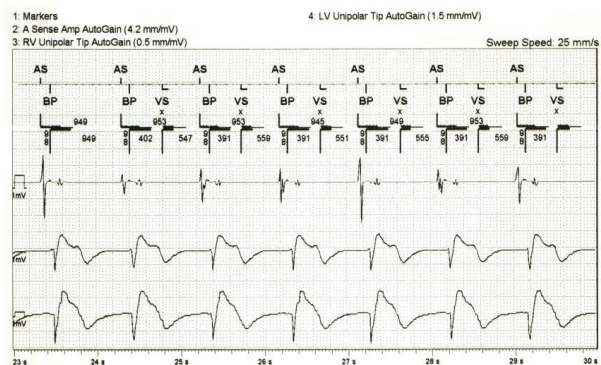
## CASE PRESENTATION

A 58-year-old man was implanted with a CRT (St Jude Medical Promote TM Model 3211-36 generator) due to dilated cardiomyopathy and left bundle branch block. In the initial follow-up, interrogation of the device revealed a loss of biventricular pacing of 20% due to inappropriate ventricular sensed events. The electrocardiogram showed sinus rhythm and biventricular pacing with the sensed T-waves at a coupling interval of 391 ms interpreted as ventricular events (Fig 1). The R-wave amplitude was more than 12 mV, and both the right ventricle (RV) and left ventricular (LV) pacing thresholds were less than 0.5 V at 0.4 ms. During the RV capture test, but not the LV capture test, after each ventricular pacing beats, the sensed T-waves were interpreted as ventricular

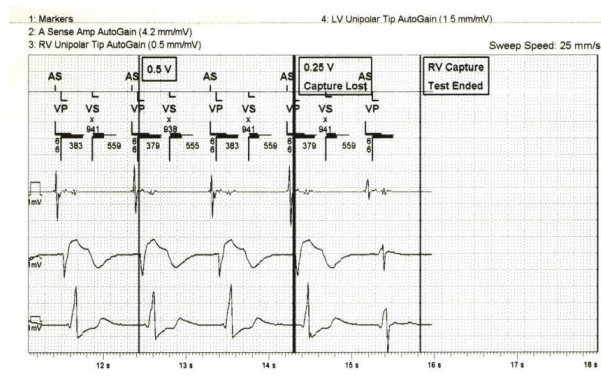
events (Fig 2).

Simultaneous RV and LV pacing and LV preceding RV pacing by intervals ranging less than 30 ms resulted in T-wave oversensing. However, LV first pacing with RV delays of more than 30 ms eliminated T-wave oversensing completely, even at the minimum sensitivity of 0.3 mv (Fig 3).

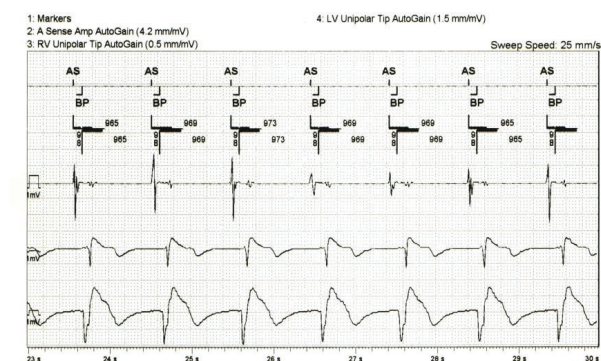
Therefore, the device was programmed in the DDD mode with an RV pace delay of 40 ms and without increase in sensitivity of 0.3 mV.



**Figure 1:** The tracing with simultaneous right and left ventricular pacing settings, it is shown markers, the atrial bipolar EGM, right ventricular unipolar tip EGM, and left ventricular unipolar tip EGM. The rhythm is sinus and biventricular pacing with the sensed T-waves interpreted as ventricular events.



**Figure 2:** The tracing during right ventricular capture test, it is shown markers, the atrial bipolar EGM, right ventricular unipolar tip EGM, and left ventricular unipolar tip EGM. The sensed T-waves interpreted as ventricular events.



**Figure 3:** The tracing with 50-ms pace right ventricular delay after left ventricular pacing settings, it is shown markers, the atrial bipolar EGM, right ventricular unipolar tip EGM, and left ventricular unipolar tip EGM. The rhythm is sinus and biventricular pacing without T-waves oversensing.

## DISCUSSION

T-wave oversensing is a relatively prevalent cause of intracardiac signals oversensing and occurs in up to 20% of patients with ICD [3]. Hyperkalemia, hyperglycemia, Brugada syndrome and changes in QT duration are some of the conditions which may prone the device to oversense the T waves. If it becomes possible, treatment of the reversible causes may solve the problem [4]. Some of these oversensings are

typically corrected with device reprogramming. Decreasing ventricular sensitivity of the device in the setting of a large R/T ratio, increasing the programmed post-ventricular blanking or refractory periods, adjusting the dynamic sensitivity parameters (by increasing the threshold start or prolonging the decay delay) in the St-Jude Medical and Biotronik ICDs, or changing the RV sensing from true bipolar to integrated bipolar, are some of the ways that may avoid T wave oversensing [1, 5].

If reprogramming fails to solve the issue, invasive options such as repositioning the implanted lead or inserting an additional lead for sensing may be necessary [1, 5]. An alternative programming strategy that we considered in our case was altering the V-V sequence and timing sequential. LV pacing before RV pacing, by changing the ventricular depolarization and the repolarization pattern, may change the repolarization electrogram morphology to a degree that the ventricular lead no longer distinguishes it as an extra-ventricular event [6]. This noninvasive strategy could solve the problem without decreasing the sensitivity of the device to detect ventricular arrhythmia and avoid invasive procedures.

## CONFLICT OF INTEREST

The authors report no financial relationships or conflicts of interest.

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