Case Report: Dual-Chamber Cardioverter-Defibrillator Implantation Using a Single-Pass VDD Lead

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Summary
In patients with complete heart block, the use of VDD mode with a single lead in cardiac pacing preserves the chronotropic response. This case report used a similar lead; an innovative approach incorporated a ventricular shock coil and atrial sensing electrodes on the same lead. In order to sense the P-wave, an implantable cardioverter-defibrillator (ICD) was specially designed to optimize atrial channel sensitivity. Floating rings were positioned in the atrium in a bipolar configuration. This solution maintained adequate atrioventricular synchrony. In addition, it provided an increased specificity in discriminating algorithms, especially for supraventricular tachycardias. This approach is similar to dual-chamber ICDs using two separate leads.

Key Words
Implantable cardioverter-defibrillator (ICD), single lead VDD pacing, supraventricular tachycardias, discriminatory algorithms

Introduction
The single-chamber ICD is primarily used to treat ventricular fibrillation. It can also effectively detect the episodes of ventricular tachycardias. Additional criteria, such as frequency, stability, and sudden onset, help to discriminate between ventricular and supraventricular tachycardias, but they cannot totally prevent inappropriate therapy [1-4]. The introduction of the dual-chamber ICD with its specific algorithms provides improved accuracy in discriminating between atrial and ventricular arrhythmias [5-7]. However, dual-chamber ICDs require an additional (atrial) electrode, which could eventually lead to complications such as electrode dislodgment [8]. Alternatively, a single lead can be applied by using the floating rings in the upper part of the right atrium in a bipolar configuration. This configuration is capable of recognizing atrial (P-wave) activity [9-12], and, subsequently maintains synchrony in the atrioventricular system. This procedure has proven to be a safe and rapid solution. The purpose of this article is to present the early results from a dual-chamber/single lead ICD implant.

Case Report
Clinical History
A 72-year-old male was admitted to the coronary care unit of our hospital on August 30, 2001. The patient presented with cranial trauma (Figure 1) due to a fall, as well as a history of syncope. The 24-hour Holter revealed sinus rhythm with episodes of complete heart block, isolated polymorphic ventricular extrasystoles, and multiple episodes of sustained ventricular tachycardia (Figure 2). The Doppler echocardiogram revealed an ejection fraction of 35%, a subtle increase in the diameter of the left ventricle, reduced contractile function, and discrete mitral insufficiency.
After the device determined the correct rhythm, the appropriate therapy was delivered, resulting in a normal sinus rhythm. Synchronized ventricular pacing was identified by the presence of a P-wave on the intracardiac ECG (Figure 4). One week after implantation, the final programming was carried out (Figure 5).

**Discussion and Conclusion**

The preliminary results of this case demonstrate the viability of using a single lead to perform synchronized ventricular pacing for monitoring atrial activity and providing ventricular defibrillation therapy in selected patients. The advantages of a dual-chamber ICD, providing appropriate discrimination algorithms, in combination with a single lead was noteworthy. It is possible to use long-term clinical evaluations as a mechanism to determine the effectiveness of this solution.
References


