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.

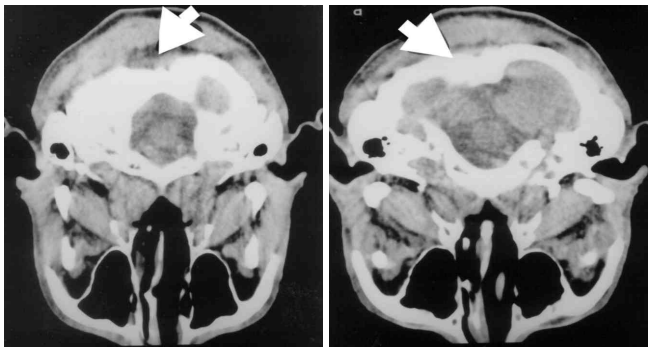

Figure 1. Cranial tomography showing the trauma (arrows).

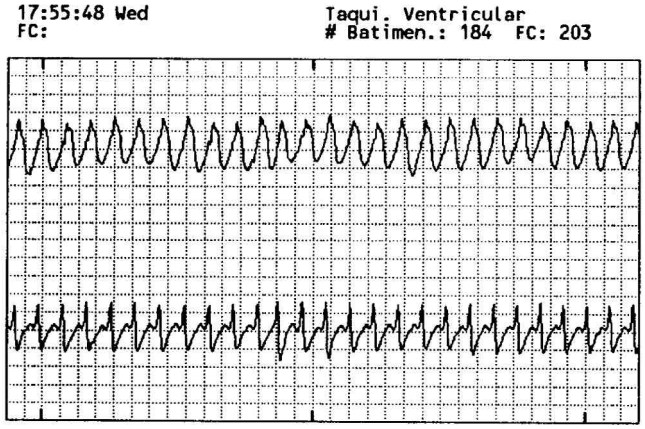

Figure 2. An episode of sustained ventricular tachycardia, registered on a 24-h Holter ECG.

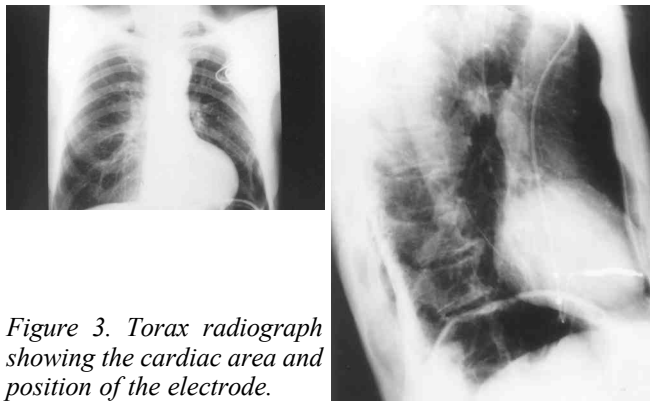

Figure 3. Torax radiograph showing the cardiac area and position of the electrode.

Implant

On September 12, 2001, the patient received a single-chamber ICD (Deikos A+, Biotronik, Germany) and a VDD lead (Kainox, Germany). The procedure was performed without any complications. The P-wave measurement revealed values ranging from 1.1 to 1.6 mV (Figure 3). For testing purposes, ventricular fibrillation was induced, and the defibrillation threshold was 14 J.

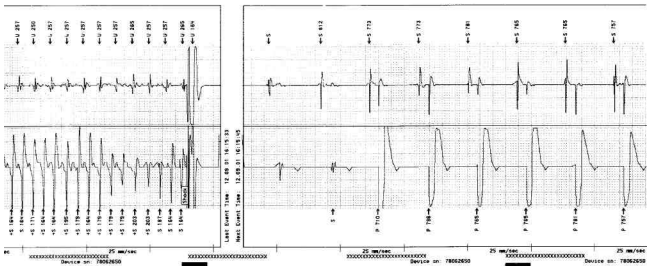

Figure 4. Intracardiac ECG documenting ventricular fibrillation and its termination by a 14 J shock.

BIOTRONIK *Follow-up Assistant FAST*

1-HDR.2.A/2

Date/Time	13.09.2001 12:39
Patient	
ICD	DEIKOS A+
Therapy	Ven

VENTRICULAR THERAPY

	VT-1		VT-2		VF
	ATP-1	ATP-2	ATP-3	ATP-4	
ATP Type	BURST	RAMP	BURST	RAMP	
Num of Bursts	6	6	6	6	
Num of Pulses	10	10	10	10	
R-S1 Interval	81 %	85 %	87 %	91 %	
S1-S1 Interval	81 %	85 %	87 %	91 %	
		-10 ms		-10 ms	
S1-S1 Scan	0 ms	0 ms	0 ms	0 ms	
Add 1	ON	ON	ON	ON	
ATP Time-Out	2:00min				
Number of Shocks	5		6		8
1st Shock Energy	14 J		14 J		18 J
2nd Shock Energy	20 J		20 J		30 J
Reconfirmation	YES		YES		YES

Figure 5. Final programming of ventricular therapies.

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.

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