Substernal implantation of a subcutaneous implantable cardioverter-defibrillator in a patient with preexisting Hemodialysis Reliable Outflow graft

Thomas A. Boyle, Joshua Cohen, Roger Carrillo, MD, FHRS

From the Department of Cardiothoracic Surgery, University of Miami Miller School of Medicine, Miami, Florida.

Introduction

Central vein stenosis is a well-documented consequence of cardiovascular implantable electronic devices. In hemodialysis patients, where preserving venous real estate is crucial, use of subcutaneous implantable cardioverter-defibrillators (S-ICDs) remains controversial. We present a novel approach for implanting an S-ICD in a patient with end-stage renal disease, central venous stenosis, and precordial hemodialysis graft obstructing the normal subcutaneous implant site.

Case report

History

A 34-year-old woman with end-stage renal disease secondary to lupus nephritis, nonischemic cardiomyopathy, central venous stenosis, and a Hemodialysis Reliable Outflow (HeRO) graft (Merit Medical Systems, South Jordan, UT) was referred to our center for implantation of an automatic implantable cardioverter-defibrillator (AICD). The patient had a documented episode of sustained ventricular tachycardia 6 months prior to referral, which took place in the setting of methicillin-resistant Staphylococcus aureus bacteremia and required external defibrillation. At that time, transthoracic echocardiography was performed and revealed a left ventricular ejection fraction of 25%, whereas previous studies had been normal. Upon resolution of the infection, and placement of a HeRO graft, the patient received optimal medical therapy for new-onset heart failure with reduced ejection fraction and was advised to wear a LifeVest (ZOLL Medical Corporation, Pittsburgh, PA). Subsequent echocardiography showed no change in ventricular function and the patient was scheduled to undergo implantation of an AICD for primary prevention of sudden cardiac death.

Venograms performed prior to referral reported bilateral subclavian vein occlusion and stenosis of the superior vena cava. Owing to this documented stenosis and the presence of a HeRO graft extending from right brachial artery to left internal jugular vein and then into the right atrium (Figure 1), traditional AICD implantation techniques were of limited value. The decision was made to place a Boston Scientific Emblem S-ICD in the substernal position.

The placement resulted in excellent sensing from all 3 vectors, showing neither T waves nor artificial potentials (Figure 2). Defibrillation thresholds were tested by inducing ventricular fibrillation, and the first 70-joule shock effectively terminated the arrhythmia 2 times. The shock impedance was recorded as 68 ohms. There were no complications from the case and the patient was doing well at 2-month follow-up.

Methods

After obtaining informed consent, a 4-cm subxiphoid incision was made to access the retrosternal space. Blunt dissection was accomplished using a 10-mm cherry dissector. Under fluoroscopic guidance, an S-ICD was placed through an 11 French ultra-sheath. The lead was positioned deep to the left sternal border and then secured in the subxiphoid fascia using the sleeve provided by the manufacturer (Boston Scientific, Marlborough, MA). The lead was then tunneled to the axillary position and connected to the generator, which was then secured to the fascia (Figure 3).1,2

Discussion

Although the literature is sparse, alternative lead positions for S-ICDs have been supported by image-based modeling and a limited number of case reports.3-5 Our experience reinforces the notion that substernal lead placement, in particular, is readily achievable and beneficial in complex scenarios.
Entirely subcutaneous ICDs are especially useful in patients with advanced kidney disease because of their susceptibility to central venous stenosis and relatively high risk of sudden cardiac death. However, implanting an S-ICD in this patient as normally indicated was presumed to carry a high risk of damage to either the lead or the preexisting graft. Standard lead placement is in the subcutaneous tissue along the left sternal border. The metallic portion of the dialysis graft occupied that space in this patient, posing a great risk for damage to either device during implantation or during hemodialysis, when the conduit may pulsate. If the lead and the graft were spared from damage during traditional implant, it was theorized that oversensing or “chatter” might occur owing to the metallic skeleton of the HeRO graft. As demonstrated by a limited number of cases where abandoned electrodes cause interference with new devices, nearby metal need not be carrying current to interfere with new ICD leads. As a result, placement in the substernal location was warranted.

**Conclusion**

In patients with central vein stenosis, an entirely subcutaneous ICD is an appealing and efficacious treatment option. This case demonstrates how the unique capabilities of the technology can be leveraged to avoid damage to existing implanted devices. In addition, it highlights some of the reasons why S-ICDs are of particular value in the hemodialysis patient population. Evidence is accumulating for the safety and efficacy of S-ICDs in patients with renal...
failure who are undergoing hemodialysis, but more is still needed.\textsuperscript{10,11}

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