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CASE REPORT

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Usefulness of lead repositioning from left to right sternal border for a patient with subcutaneous implantable cardioverter defibrillator showing high defibrillation threshold

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Abstract

A 62-year-old man with Brugada syndrome underwent subcutaneous implantable cardioverter defibrillator implantation. The lead was positioned along the left sternal border and defibrillation threshold (DFT) testing was performed. However, ventricular fibrillation (VF) was not terminated with 65 J and 80 J shocks. Shock impedance was 82 ohms. We repositioned the lead to the right sternal border and performed DFT testing again, followed by the VF termination with a 65 J shock. Shock impedance was 59 ohms. The positional relationship among the lead, generator, and heart was changed by lead repositioning, which may have contributed to improved shock impedance and DFT.

KEYWORDS

Brugada syndrome, high defibrillation threshold, shock impedance, subcutaneous implantable cardioverter defibrillator, ventricular fibrillation

1 | INTRODUCTION

The subcutaneous implantable cardioverter defibrillator (S-ICD) is an alternative to transvenous implantable cardioverter defibrillator (TV-ICD) for the prevention of sudden cardiac death. However, the factors associated with high defibrillation threshold (DFT) have not been fully examined.

2 | CASE REPORT

A 62-year-old man with Brugada syndrome who had undergone TV-ICD implantation, underwent S-ICD implantation because of the previously inserted transvenous shock lead failure. His height was 168 cm, weight was 77.0 kg, and body mass index was 27.3. The implantation was performed under general anesthesia. The S-ICD generator was inserted between the serratus anterior muscle and latissimus dorsi muscle. The S-ICD lead was positioned along the left sternal border using the 3-incision technique. Subsequently, DFT testing was performed. Ventricular fibrillation (VF) was induced by a 50 Hz electrical burst, and was detected appropriately. However, the VF was not terminated with 65 J and 80 J standard polarity shocks delivered from the S-ICD (Figure 1A), and was terminated with a 360 J monophasic shock using external defibrillator. The S-ICD shock impedance was 82 ohms. We changed the placement of the generator to a more posterior position and performed DFT testing again. However, the VF was not terminated with 65 J and 80 J standard polarity shocks, and the shock impedance was not decreased. Subsequently, we repositioned the S-ICD lead from the left to the right sternal border and performed DFT testing again. VF was induced and was detected appropriately, followed by its termination with a 65 J standard polarity shock delivered from

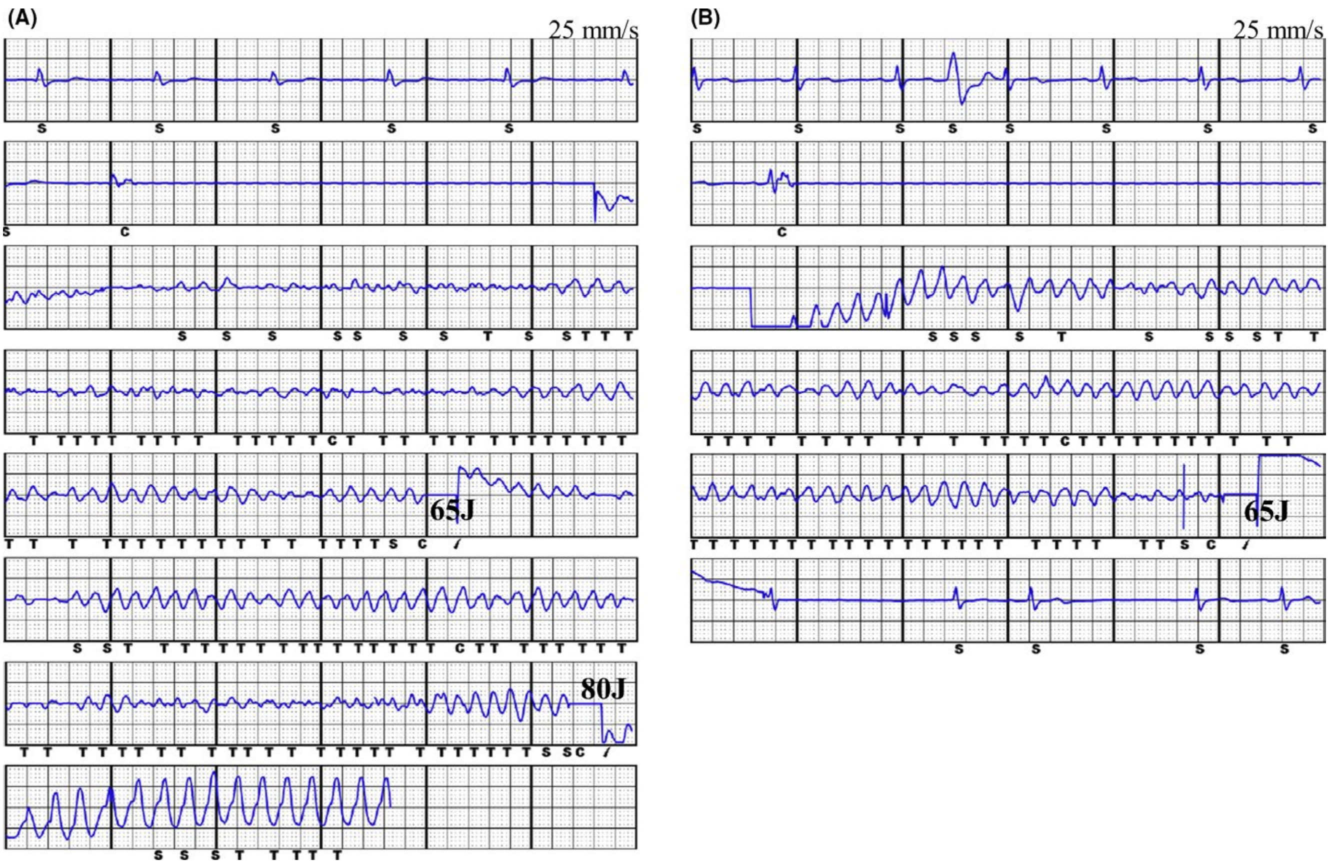

FIGURE 1 Electrocardiograms during the defibrillation threshold (DFT) testing. A, Electrocardiogram during the first DFT testing. Ventricular fibrillation (VF) was induced by a 50 Hz electrical burst, and was detected. However, the VF was not terminated with 65 J and 80 J standard polarity shocks. B, Electrocardiogram during the successful DFT testing. VF was induced by a 50 Hz electrical burst and was detected, followed by its termination with a 65 J standard polarity shock

the S-ICD (Figure 1B). Shock impedance was decreased to 59 ohms. Procedure-related complication was not observed, and the patient was discharged 1 week after the operation.

3 | DISCUSSION

The S-ICD is widely used for the treatment of life-threatening ventricular arrhythmias as an alternative to the traditional TV-ICD. The transvenous lead complications including infection or fracture are significant issues in patients with TV-ICD, whereas the S-ICD could avoid these long-term issues. Additionally, the S-ICD is highly effective in treating ventricular arrhythmias.[1] However, high DFT was observed in some patients and implant factors associated with high DFT in patients with S-ICD have not been fully evaluated. Hirao et al reported a case of S-ICD showing high shock impedance and DFT caused by the fat between the lead and sternum.[2] However, in the present case, computed tomography demonstrated less fat above the sternum (Figure 2A). Another previous report of a computer simulation indicated that subcoil fat, subgenerator fat, and anterior positioning of a generator contributed to high shock impedance and DFT.[3] However, in the present case, we initially changed the generator placement to a more posterior position. Therefore, the generator was not positioned anteriorly, and no subgenerator fat was observed (Figure 2A,B). Additionally, another previous report suggested the association between S-ICD lead position and DFT. Sugumar et al reported a case of S-ICD showing high DFT, in which the S-ICD lead was positioned on the left side and was distant from the sternum. The lead was repositioned to the left sternal border, followed by the improved DFT, and they considered that the lead repositioning changed the positional relationship among the lead, generator, and the heart, which improved shock vector for the heart.[4] In the present case, the S-ICD lead was repositioned from left to the right sternal border (Figure 2C) and DFT was improved. However, all patients with S-ICD should not indicate improved DFT with lead repositioning, as a previous computer modeling study reported that a right parasternal S-ICD lead increased DFT.[3] Meanwhile, another previous study reported a patient with S-ICD showing improved DFT with lead repositioning to the right parasternal position, as shown in this case.[5] The positional relationship among the lead, generator, and heart was changed by lead repositioning from the left to the right sternal border, which may have contributed to improved shock vector for the heart. Furthermore, this phenomenon may have led to the decreased shock impedance and DFT, which may have been attributed to the tissue between the generator and the lead showing a more decreased electrical resistance.

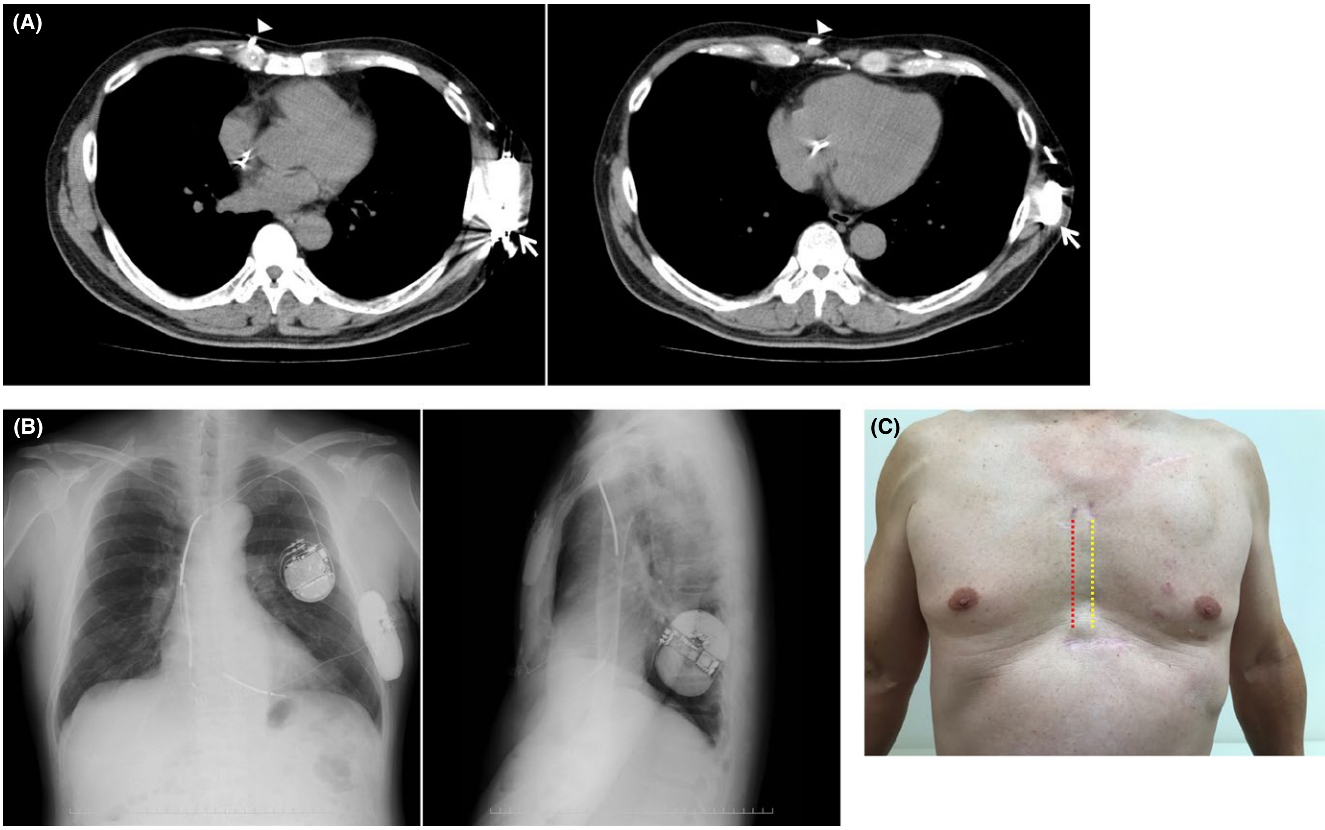

FIGURE 2 Images and operative scars after the subcutaneous implantable cardioverter defibrillator implantation. A, Computed tomography. Arrows indicate the generator inserted between the serratus anterior muscle and latissimus dorsi muscle. Arrowheads indicate the lead positioned along the right sternal border. B, Posterior to anterior and lateral chest X-ray image. C, Operative scars on the chest. The yellow line indicates the first lead position and red indicates the final position

In conclusion, we should consider lead repositioning from the left to the right sternal border if patients with S-ICD indicate high DFT despite generator displacement to a more posterior position.

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CONFLICT OF INTEREST

Authors declare no conflict of interests for this article.

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