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CASE REPORT

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High defibrillation threshold with a subcutaneous implantable cardiac defibrillator due to the lead having been positioned in the fat layer

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Abstract

A 46-year-old female with a body mass index of 38.9 kg/m^2 and no organic heart disease underwent a subcutaneous implantable cardioverter-defibrillator implantation for secondary prevention of sudden cardiac death in the setting of idiopathic ventricular fibrillation. Defibrillation threshold (DFT) testing during implantation detected high shock impedance and high DFT. Fluoroscopy revealed subcoil fat between the lead and the sternum, which we suspected was the reason for the high shock impedance and high DFT. We repositioned the lead to a site just above the sternum and the shock impedance and DFT improved to within the respective normal ranges.

KEYWORDS
fat layer, high defibrillation threshold, obesity, subcutaneous implantable cardiac defibrillator, ventricular fibrillation

1 | INTRODUCTION

The subcutaneous implantable cardioverter-defibrillator (S-ICD) (Boston Scientific, Marlborough, USA) made it possible to defibrillate patients who have lethal ventricular arrhythmias without having to implant transvenous leads. Placement of the subcutaneous lead is relatively simpler than that of the transvenous lead. However, there have been reports of high defibrillation thresholds (DFT).

2 | CASE REPORT

A 46-year-old woman, previously healthy but obese (Height 158 cm, Weight 97 kg, body mass index 38.9 kg/m^2), had collapsed, and cardiopulmonary arrest was confirmed. After cardiopulmonary resuscitation, the ventricular fibrillation (VF) had returned to a normal sinus rhythm using a single shock from an automated external defibrillator.

No abnormalities were noted in the electrolyte blood test results, 12-lead electrocardiography (ECG), or cardiac echography, and she recovered adequately normal conscious level after hypothermia therapy. The coronary angiography was normal, no spasms were observed during the acetylcholine loading test, and no abnormalities were observed in the 12-lead ECG under pilsicainide and epinephrine loading. She was diagnosed with idiopathic VF.

As no episodes of ventricular tachycardia or bradycardia were observed, we judged that implantation of an S-ICD was suitable for secondary prevention. In the DFT testing during the procedure, VF was induced with 50 Hz burst pacing and was successfully detected. However, VF was not terminated with a 65 J shock by the S-ICD whose vector was coil to generator, but was successfully terminated with a 200 J shock using an external defibrillator. After the DFT testing, we confirmed high shock impedance (138 Ω). The DFT testing was repeated, but the results were confirmed to be the same.

To investigate the cause of the high shock impedance and high DFT, we used fluoroscopy to check the lead position in the right anterior oblique (RAO) 70-degree view, which revealed a space between the lead and the sternum (Figure 1). We suspected the reason for the high shock impedance and high DFT was due to fat between the lead and sternum, so we repositioned the lead to the depth just above the sternum at parasternal position. The shock impedance and DFT were retested, and the impedance had decreased to a normal value (68 Ω), and the induced VF was terminated with the first 65 J shock by the S-ICD. After the implantation, the positioning of lead and generator was confirmed to be normal (Figure 2).

3 | DISCUSSION

In obese patients, the subcutaneous fat tends to be thick and may cause high shock impedance and high DFT. In this case, although the impedance was normalized after repositioning the lead, the entry site of lead was still above the fat because of thick subcutaneous fat. To position the whole lead just above the sternum, we had cut the skin more. In most cases of high DFT, no attempt to reposition the lead or generator is made; instead, the system is changed to a transvenous ICD or is just implanted in the original location.[1–3] However, in such cases, relocating the lead or generator should be attempted as there are cases in which the testing is successful only after changing the position of the system, as was true in our case.[4] To see the space between the lead and sternum, we confirmed the lead position by RAO 70, but RAO 90 seems to be better.

A computer simulation indicated that subcoil fat, subgenerator fat, and anterior positioning of an S-ICD generator all affected high estimated shock impedance and DFT.[5] This computer simulation result may support our speculation as to the cause of the high DFT, which was reduced after repositioning the lead in our case.

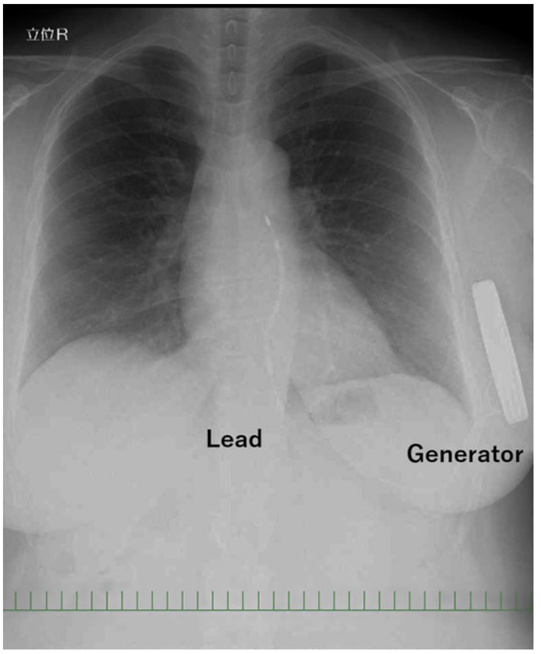

FIGURE 2 Positioning of the lead and generator in X-ray After the implantation, the positioning of lead and generator was confirmed to be normal

4 | CONCLUSIONS

We report a case in which repositioning the S-ICD lead improved both high shock impedance and high DFT. During implantation of an S-ICD, the positional relationship of the lead and sternum needs to be checked by fluoroscopy, especially for obese patients. If there is a wide space between them, repositioning of the lead to a site just above the sternum should be attempted.

CONFLICT OF INTEREST

Authors declare no Conflict of Interests for this article.

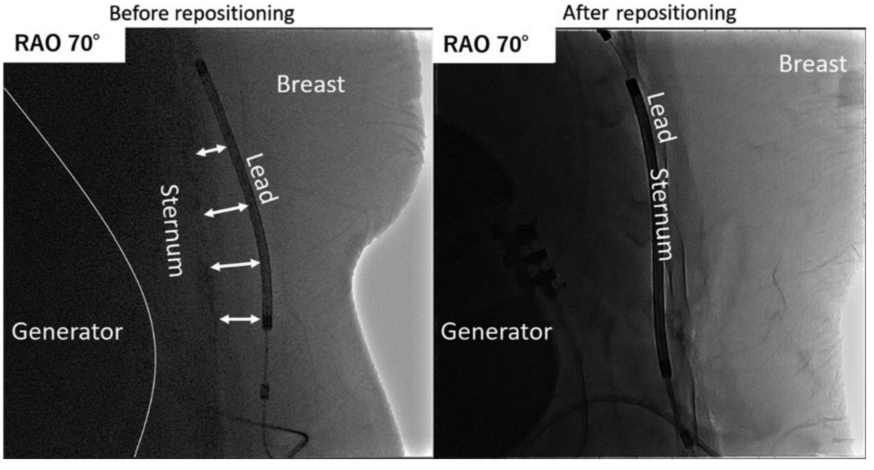

FIGURE 1 Positioning of the lead in fluoroscopy In the right anterior oblique (RAO) 70-degree view, there was a space between the lead and sternum that included fat tissue (left); this was the reason for the high DFT. We repositioned the lead to a site closer to the sternum (right). After repositioning, the DFT testing results improved. RAO, right anterior oblique; DFT, defibrillation threshold

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