Subcutaneous ICD lead position affects defibrillation threshold

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Introduction
Subcutaneous implantable cardioverter-defibrillators (S-ICD) provide an alternative to traditional transvenous implantable cardioverter-defibrillators (TV-ICD) and avoid complications associated with intravascular access and leads. They are highly effective in detecting and treating ventricular arrhythmias, with comparable inappropriate shock rates.1 Use of S-ICD is anticipated to increase significantly.2 Defibrillation testing (DT) is no longer routinely recommended for TV-ICDs.3 Although S-ICD systems have high rates of successful defibrillation threshold, DT is routinely recommended as part of the procedure. Implant factors that affect defibrillation threshold have not been fully evaluated. Initial experience has suggested that factors such as amount of adipose tissue below the coil and generator, along with the transverse position of the generator, affect defibrillation threshold.4 There is increasing opinion that DT may not be needed for S-ICD systems owing to their efficacy in the future.

We describe a case with suboptimal DT outcomes owing to lead position.

Case report
A 40-year-old man with a structurally normal heart had an S-ICD for secondary prevention. The initial part of the procedure was uneventful, with a S-ICD generator (Cameron Health/Boston Scientific Inc., Minneapolis–St. Paul, MN-A 209 Emblem) placed over the left lateral chest wall muscle and a Boston Scientific 3401 Emblem S-ICD 45 cm lead tunneled immediately over the fascial layer in the left parasternal position using the 3-incision technique. The sensing and impedance (69 Ω) values were within normal limits. DT failed at 65 J and twice at 80 J despite adequate and appropriate sensing. Fluoroscopy revealed that the lead position was lateral to the midline (Figure 1C; position C). The lead was then re-tunneled and

Figure 1  A: Radiograph in straight posterior-anterior (PA) view showing position of subcutaneous implantable cardioverter-defibrillator lead after repositioning with successful defibrillator testing at 65 J. B: Computed tomography image demonstrating improved shock vector. Initial lead position (red arrow) and final lead position (green arrow). C: Initial lead position, which failed to defibrillate at 80 J, in straight PA view.

KEYWORDS Failure to defibrillate; High threshold; Reposition lead; Subcutaneous ICD; Shock vector; Screening at implant (Heart Rhythm Case Reports 2018;4:29–30)

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Discussion
A limitation of our case report is that defibrillation is a probabilistic phenomenon, which may have caused our first defibrillation attempts to be ineffective and which may have been successful with further shocks. Nonetheless, shock vector is an important consideration in TV-ICD implantation, and it certainly should be no different in S-ICD implantation. As illustrated in this case, a small change in lead position has significant impact on defibrillation threshold in S-ICD implants. There is a reluctance to reposition the S-ICD lead once implanted. However, as shown in our case, repositioning is feasible and safe and will provide long-term benefit. The most recent and largest analysis of the S-ICD implant and follow-up showed that S-ICD repositioning was required in up to 3.5% of cases and that DT failed in 1.3% of patients.5

One perceived advantage of an S-ICD system is that the procedure can be performed without the need for ionizing radiation. Many centers do not use fluoroscopy for S-ICD implant. However, as this case demonstrates, it may be of benefit to visualize the final lead position at the end of implant to exclude bowing of the defibrillation coil away from the midline. This could simply avoid futile defibrillation attempts and allow the operator the option of repositioning the lead.

Preimplant screening with surface electrocardiogram/sensing does not include assessment of ideal shock vector based on anatomy. Preimplant planning may be improved with CT, allowing better definition of cardiac anatomy and optimization of shock vector in addition to the manufacturer’s standard patient screening tool.

Intraprocedural fluoroscopy may assist in confirming lead position prior to DT. Alternatively, if DT fails, consideration for examining the position of the lead with respect to the myocardium should be undertaken. When required, intraoperative S-ICD lead repositioning is safe and can improve defibrillation threshold in selected patients.

Appendix
Supplementary data
Supplementary data associated with this article can be found in the online version at https://doi.org/10.1016/j.hrcr.2017.10.017.

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