Subcutaneous Implantable Cardioverter-Defibrillators and Sternal Wires
A Cautionary Tale

Joachim Winter, MD, PhD; Antonia Kohlmeier, MD; Dong-In Shin, MD; Stephen O’Connor, PhD

We commenced implanting the subcutaneous implantable cardioverter-defibrillators (S-ICD) in July 2010, and a surgeon (J.W.) has implanted 86 systems to date without surgical complications until this case study.

Case Report
This patient was a man, aged 71 years, 1.68 m, 79 kg with left ventricular ejection fraction of 30% with previous myocardial infarctions, atrial fibrillation, mechanical aortic valve, and single coronary artery bypass graft via median sternotomy in 1999, renal insufficiency since 2003 with hemodialysis via a catheter in the right internal jugular vein, and bare metal stents in 2013. The patient fulfilled Multi center Automatic Defibrillator Implantation Trial (MADIT) II criteria for primary ICD implantation. Surgery under general anesthesia was uneventful. The S-ICD has 3 sensing vectors, described in Figure 1. The chosen sensing vector at implant was secondary with 1.8-mV amplitude after automatic assessment of QRS:T wave ratio. Ventricular fibrillation conversion testing was performed successfully by 65 J standard polarity shock with a type I break. The patient received an inappropriate shock on the second and third postoperative days, an example of which is shown in Figure 2. The subcutaneous electrogram with the baseline shifted, not observed at implant, is suggestive of electric interference. On investigation, the chosen vector, secondary, and the alternate vector demonstrated noise when the distal tip of the electrode was manipulated while the primary vector was noise free, giving rise to suspicions about the distal tip. The patient had posterior–anterior and left lateral chest radiograph and computed tomographic scan (Figures 1 and 3), all showing proximity of the distal tip and sternal wire. The patient was reoperated. The electrode was released at the superior and xiphoid incisions and moved to rest between 2 sternal wires. The secondary vector was again selected with R wave amplitude 1.8 mV. Ventricular fibrillation conversion testing was repeated successfully with a normal 55 Ω impedance. Figure 3, taken intraoperatively shows the distal tip sitting on the sternal wire. After repositioning of the electrode, manipulation of the distal tip no longer produced noise on any vector. The patient was discharged from hospital on the following day and has been complication free for 9 months.

Discussion
The choice of 3 sensing vectors in the S-ICD system generally allows a resolution to sensing issues without further surgery simply by reprogramming. The primary vector does not involve the distal tip for sensing. Manually selecting the primary vector was the solution adopted in the only other reported case of distal tip and sternal wire causing electric noise.1 However, this is not a complete solution where post-shock pacing is required because the sensing automatically changes to the alternate vector until postshock pacing is no longer required or times out after 30 s. This could cause further inappropriate therapy. Therefore, we chose a reintervention to reposition the electrode. We recommend intraoperative fluoroscopy in S-ICD implantation in patients with previous median sternotomy with the classical 3-incision technique but not with the 2-incision technique without a superior incision.2 In our series, 22 (25.6%) patients had a previous median sternotomy. S-ICD distal tip on sternotomy wires may not remain a rarely reported complication.

Conclusions
Implantation of all ICD must be performed with care and attention to detail, and the S-ICD is no exception. Our report of the S-ICD distal tip in intermittent contact with a sternotomy wire details a rare complication reported to date in 2 of ≈2000 implanted patients worldwide. Intraoperative
fluoroscopy in patients with median sternotomy patients would avoid this complication.

**Disclosures**

Dr Winter is on the Speakers’ bureau for Boston Scientific and is a Consultant on the Advisory Board of Boston Scientific and formerly of Cameron Health. Stephen O’Connor is a former employee of Boston Scientific and Cameron Health. The others authors report no conflicts.

**References**


**Key Words:** complications, defibrillation, electric, shock

---

**Figure 1.** Posterior–anterior (PA) and left lateral chest radiograph before reintervention showing proximity of distal tip and sternal wire. Sensing vectors are shown: alternate, distal tip to proximal ring; primary, proximal ring to pulse generator; and secondary, distal tip to pulse generator.

**Figure 2.** Episode of inappropriate therapy delivered showing baseline shift. • indicates discard; C, charge start; N, noise; P, pace; S, sense; and T, tachycardia detection.

**Figure 3.** Left, Computed tomographic scan before reintervention showing proximity of distal tip and sternal wire. Right, Intraoperative photograph showing distal tip on sternal wire.
Subcutaneous Implantable Cardioverter-Defibrillators and Sternal Wires: A Cautionary Tale
Joachim Winter, Antonia Kohlmeier, Dong-In Shin and Stephen O'Connor

Circ Arrhythm Electrophysiol. 2014;7:986-987
doi: 10.1161/CIRCEP.113.001139
Circulation: Arrhythmia and Electrophysiology is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2014 American Heart Association, Inc. All rights reserved.
Print ISSN: 1941-3149. Online ISSN: 1941-3084

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circep.ahajournals.org/content/7/5/986

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in Circulation: Arrhythmia and Electrophysiology can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Circulation: Arrhythmia and Electrophysiology is online at:
http://circep.ahajournals.org/subscriptions/