Received: 23 June 2020 | Revised: 16 August 2020 | Accepted: 23 August 2020

DOI: 10.1111/pace.14048

PACE WILEY

DEVICE ROUNDS

# Defibrillator therapy in patients with tricuspid valve clips: Which device to choose?

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**KEYWORDS**
implantable cardioverter-defibrillator, subcutaneous array electrode, subcutaneous ICD, SVC coil, tricuspid valve clip

## 1 | INITIAL PATIENT PRESENTATION

A 76-year-old patient with an extensive cardiac medical history was referred to our department for primary prevention implantable cardioverter-defibrillator (ICD) implantation. The patient had undergone coronary artery bypass grafting 7 years previously. One year ago the patient's mitral and tricuspid valve regurgitation had been addressed with one clip to the mitral and two clips to the tricuspid valve (MitraClip, Abbott Laboratories, IL). Now presenting with ischemic cardiomyopathy, a severely reduced left ventricular ejection fraction, and a narrow QRS, receiving guideline directed medical therapy ICD implantation for primary prevention was indicated.[1,2] What is the ideal device for the treatment of this patient? What further diagnostics are required before ICD implantation?

## 2 | CHOOSING THE RIGHT DEVICE

In patients with tricuspid valve clips implantation of leads through the tricuspid valve can limit the success of the interventional tricuspid repair and can even dislodge clips if performed before fibrous encapsulation has fused the clip with the leaflet tissue. Some data suggest that early fibrous encapsulation may begin prior to 30 days. Histological evaluation of clips removed after over 300 days has shown organized fibrous capsules bridging the leaflets and clip arms[3] such that at this point mechanical stability is possible. Nevertheless placement of a trans-tricuspid shock coil may increase tricuspid regurgitation and may furthermore represent a technical challenge in such a case.

We subsequently elected to prepare the patient for subcutaneous ICD (S-ICD) implantation (EMBLEM S-ICD-System, Boston Scientific, MA). To evaluate the patient for S-ICD implantation, a detailed patient history and electrocardiography-guided S-ICD-screening are critical. According to European and American Heart Association guidelines, an S-ICD is indicated as an alternative to a transvenous lead ICD in patients where bradycardia support, cardiac resynchronization, and antitachycardia pacing are not required.[1,2] Our patient had no history of bradycardia, ventricular tachyarrhythmias, or bundle branch block. There was no evidence for venous thrombosis, and the patient had slightly reduced kidney function but was not receiving dialysis therapy. Patient screening can be performed using the Model 4744 patient screening tool (Boston Scientific) or with the automated screening tool available with the Model 3120 Programmer (Boston Scientific). The purpose of screening is to detect patients where S-ICD detection and discrimination algorithms are not reliable. After successful screening, an S-ICD was implanted. Intraoperative defibrillation testing, which is currently still mandatory in S-ICD implantation, successfully terminated ventricular fibrillation (VF).

## 3 | SAME PATIENT—NEW SITUATION

Five months after S-ICD implantation, the patient presented to our clinic with a generator pocket infection (*Staphylococcus aureus*) with cutaneous perforation (Figure 1). In the initial safety and efficacy trial, 4 of 314 (1.27%) developed a device infection requiring device

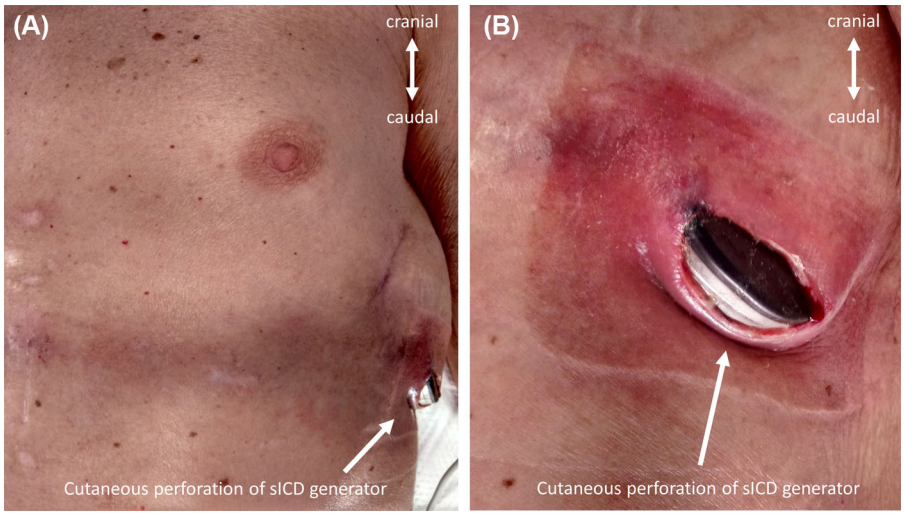


**FIGURE 1** Photographs of the cutaneous perforation of the subcutaneous implantable cardioverter-defibrillator (S-ICD) initially implanted in the patient [Color figure can be viewed at wileyonlinelibrary.com]

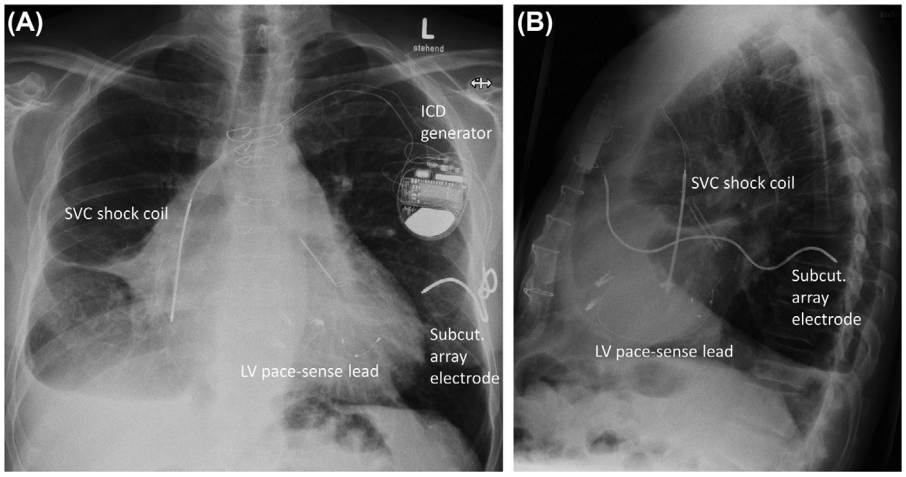


**FIGURE 2** Chest radiograph (A, posterior-anterior radiograph, B, lateral radiograph) of the off-label lead/device setup, which was implanted after explantation of the subcutaneous ICD. A pace-sense lead was placed in a posterolateral vein, a superior vena cava (SVC) coil was placed partially in the superior vena cava and partially in the right atrium, and a subcutaneous array electrode was implanted in the subcutaneous tissue of the left lateral chest wall. Abbreviations: ICD, implantable cardioverter-defibrillator; LV, left ventricular; Subcut., subcutaneous

explantation within the 180-day timeframe investigated.[4] Boersma et al reported a similarly low rate of infections (1.6% at a mean follow-up of 651 days).[5] After explantation of the S-ICD, in light of the patient's age, we first confirmed that the patient wanted reimplantation. We were then once again confronted with the question: what is the appropriate device for this patient?

The available choices are as follows:

1. Reimplantation of an S-ICD system after adequate time for resolution of infection.
2. Implantation of an ICD with a trans-tricuspid shock coil under echocardiographic guidance to achieve a low level of regurgitation after lead placement (accepting a risk of clip dislodgment).
3. Implantation of a conventional ICD with an off-label lead combination: a left ventricular pace-sense electrode (transvenous or epicardial), a superior vena cava (SVC) coil, and a subcutaneous array electrode.
4. Implantation of a totally epicardial ICD with an epicardial pace-sense and a retro-cardiac shock electrode.

Which mode of therapy would you choose? In Figure 2, you will see the device implanted after interdisciplinary discussion of the case. Can you identify the choice we made?

As the reader can surmise from the radiographs presented in the figure we chose option 3. We implanted a conventional ICD (Medtronic Primo VR, Medtronic, MN) with an IS-1/DF-1 setup. A bipolar Attain

Stability lead (Medtronic) was placed in a posterolateral vein to allow for ventricular sensing and pacing functionality. This lead would subsequently also allow for antitachycardia pacing. An alternative approach would have been to implant an epicardial pace-sense lead through a lateral mini-thoracotomy but the route of the lead would have brought it very close to the S-ICD pocket infection site and was considered a higher risk option. An SVC coil (Medtronic) was placed in the right atrium, and a 7.5 French unipolar subcutaneous array electrode (Medtronic) was placed in the extrathoracic subcutaneous tissue of the the left lateral chest wall (HVB). The patient had been informed prior to the procedure that this lead/device setup would be an off-label construct. Defibrillation threshold testing was performed, however the device failed to adequately terminate VF even after repositioning of the subcutaneous array electrode. Nonetheless, the device and electrodes were left in place, and repeat defibrillation testing was planned. In defibrillation threshold testing, 2 days postoperatively VF could successfully be terminated with both 35 and 26 J.

## 4 | DISCUSSION

While there are no data suggesting increased infection rates after reimplanting an S-ICD following explantation of an infected S-ICD, we did not feel comfortable with option 1. As mentioned above, the tricuspid clips should have been safely encapsulated at this point (now over 1½ years after tricuspid clipping). Furthermore, lead placement across the tricuspid valve can be assisted with transesophageal echocardiography to find a lead position resulting in the lowest possible grade of regurgitation. It is however our institutional policy that in patients with tricuspid clips whenever possible a solution should be found where no lead crosses the tricuspid valve (thus we did not choose option 2). We decided against choice 4 due to the fact that the patient had previously received bypass surgery and epicardial lead, and retro-cardiac shock electrode placement in the re-operative setting is associated with a great risk for the patient. Subsequently option 3 was in our view the most appropriate choice.

Many factors must be taken into account in choosing a device for antitachycardia therapy. Whether the device is for primary or secondary prevention, the presence of monomorphic ventricular tachycardia, the presence of bradycardia, vascular access options, and kidney function all play a role in choosing the right device. As the era of interventional tricuspid valve therapy has accelerated, the presence of tricuspid valve clips has become another variable which we must consider in the choice of the appropriate ICD. New tricuspid regurgitation therapeutics are being developed at a fast pace such that it is key that the pacemaker surgeon adapt to this new field and the new patient population which is developing. The ICDs implanted in our patient demonstrate two of the myriad options for ICD therapy in the tricuspid clip patient.

### ACKNOWLEDGMENTS

Open access funding enabled and organized by Projekt DEAL.

### CONFLICT OF INTEREST

Stephanie Fichtner has received lecture fees from Medtronic and Abbott Laboratories and has received a research grant from Abbott Laboratories.

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**How to cite this article:** Herrmann FEM, Juchem G, Hagl C, Fichtner S, Sadoni S. Defibrillator therapy in patients with tricuspid valve clips: Which device to choose?. *Pacing Clin Electrophysiol*. 2020;43:1572–1574. https://doi.org/10.1111/pace.14048