Substernal ICD lead implantation in a patient not suitable for subcutaneous ICD implantation without venous access due to superior vena cava syndrome

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Introduction

Implantable cardioverter-defibrillator (ICD) implantation may be challenging in patients with lack of venous access and who are not suitable for a standard subcutaneous ICD (S-ICD).

Case report

A 51-year-old man with a dilated cardiomyopathy with a left ventricular ejection fraction of 10% was transferred to our hospital. The patient was known to have superior vena cava (SVC) syndrome related to a *JAK2* mutation. He had several hospital admissions in the past with heart failure. His current NYHA class is II–III on optimal heart failure medication. During his hospital stay he experienced several episodes of nonsustained ventricular tachycardia. The patient had, according to current guidelines, a class I indication for an ICD.[1] The patient was recompensated and he was discharged from the hospital with a wearable defibrillator (LifeVest, Cardio Solutions B.V., Landsmeer, The Netherlands) until placement of a definitive ICD.

SVC occlusion precluded implantation of endovascular ICD by a superior approach (Figure 1). Furthermore, implantation of an endovascular ICD by a femoral approach was deemed not appropriate considering his high risk of venous thrombosis secondary to his *JAK2* mutation and we chose not to use epicardial patches to prevent the risk of restrictive pericarditis. He was also not a suitable candidate for an S-ICD because he had an unfavorable R/T-wave ratio on his surface electrocardiogram (Figure 2), episodes of ventricular tachycardia, and conduction abnormalities.[2]

We implanted a conventional ICD (Evera MRI XT Surescan DVMB2D4, Medtronic, Minneapolis, MN) in the left mid-axillary line at the 5th–6th intercostal space, combined with a standard epicardial pace/sense electrode (Myodex 1084T, St Jude Medical, St Paul, MN) via a left-sided mini-thoracotomy, and a substernal SVC coil (Transvene-SVC, Medtronic) with the standard tunneling tool from the S-ICD with an 11 F peel-away sheath. The substernal tunneling was performed under thoracoscopy guidance (see online movie). Both the epicardial pace/sense electrode and the substernal shock electrode were then tunneled to the left lateral pocket.

Conventional ICDs have a maximal energy delivery of 40 J. In S-ICDs the defibrillation safety margin test is performed at 65 J and the ICD shock therapy is set at 80 J. We hypothesize that if we place the shock lead in a parasternal subcutaneous position the patient would probably need more than 40 J to successful defibrillate ventricular fibrillation. That is why we decided to implant the SVC coil lead in a substernal position. The patient underwent a successful

Figure 1 Left- and right-sided venograms showing bilateral occlusion of the subclavian veins.

KEYWORDS Substernal shock lead; Epicardial pace/sense electrode; Implantable cardioverter-defibrillator; Superior vena cava syndrome
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KEY TEACHING POINTS

- Endovascular implantable cardioverter-defibrillator (ICD) placement may be hampered by venous access issues.
- Placement of substernal ICD lead by using a tunneling tool is feasible and the lead remains stable over time.
- A substernal ICD may be a useful alternative in selected patients with superior vena cava syndrome, especially those deemed not suitable for a subcutaneous ICD and those who may benefit from antitachycardia pacing.

defibrillation test at 40 J and had an uneventful recovery. The chest radiograph in the anteroposterior and left lateral projection shows the final position of the ICD and leads 3 months after implantation demonstrating the stable lead position (Figure 3).

This is, as far as we know, the second description of an ICD implantation using a substernal ICD lead.[3] However, it is the first with a conventional ICD combined with an epicardial pace/sense electrode. It presents a good alternative for patients who are not candidates for a transvenous or a subcutaneous ICD. An additional benefit of this system is that the patient also has a possibility for pacing in case of bradycardia, and also antitachycardia pacing in case of sustained ventricular tachycardia s.

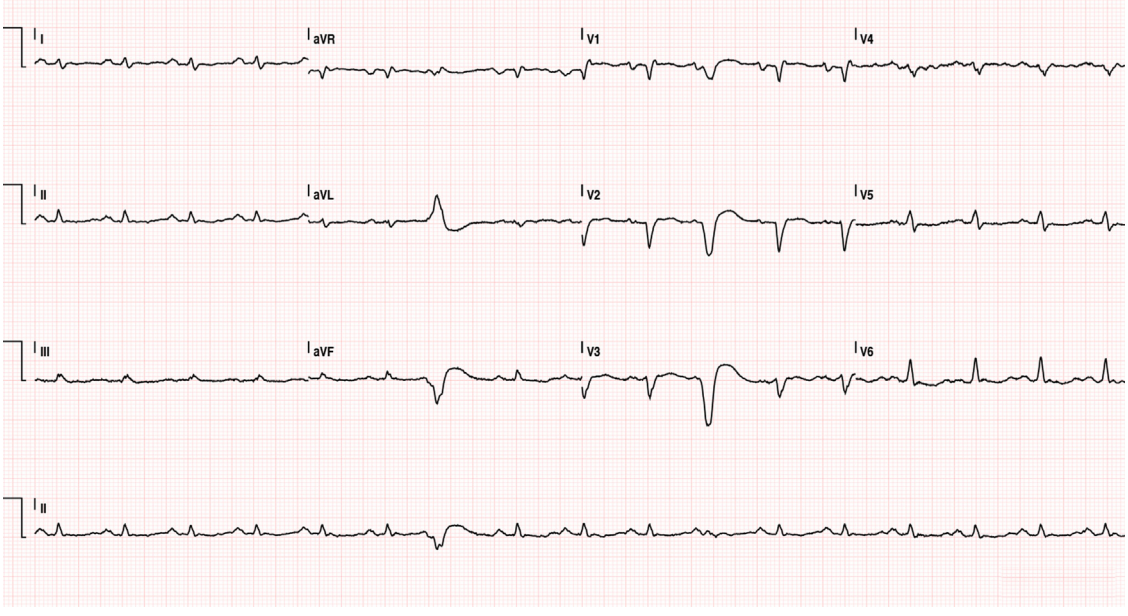

Figure 2 Electrocardiogram.

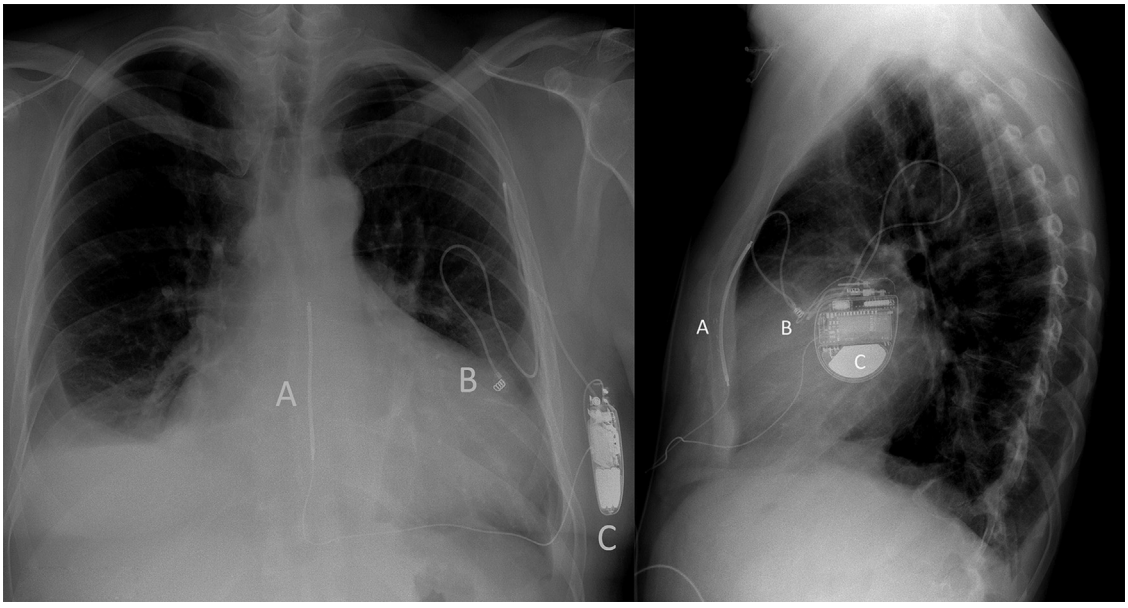

Figure 3 Chest radiograph 3 months after implantation in anteroposterior and left lateral projection. **A:** Substernal implantable cardioverter-defibrillator (ICD) lead. **B:** Epicardial pace/sense electrode. **C:** Left lateral midaxillary-placed conventional ICD can.

Appendix

Supplementary data

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.hrcr.2016.09.013.

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