DEVICE THERAPY

COMPLEX CASE STUDY

Biventricular Pacemaker Implantation in a Patient with Superior Vena Cava Occlusion

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ABSTRACT. Cardiac resynchronization therapy has been shown to improve quality of life and mortality in patients with heart failure. Patients referred for device upgrade may present with an occluded superior vena cava. We describe a technique using a stylet through a left ventricular lead to cannulate the coronary sinus and overcome the occlusion. This technique had no complications and resulted in successful placement of the left ventricular lead with good capture and pacing thresholds.

KEYWORDS. biventricular pacemaker, superior vena cava occlusion.

Introduction

Patients with advanced heart failure (New York Heart Association (NYHA) class III or IV), left ventricular systolic ejection fraction (LVEF) less than 35% and a QRS duration of at least 120 ms have shown improvement in the quality of life and mortality with cardiac resynchronization therapy (CRT).1,2

Approximately 7% of asymptomatic patients with previous devices planned for upgrade have a subtotal or complete occlusion of the subclavian vein.3 Various venoplasty techniques have been used to overcome the occlusion. We describe a technique using a stylet through a left ventricular (LV) lead to cannulate the coronary sinus (CS) and overcome a total superior vena cava (SVC) occlusion.

Case

A 73-year-old male with a history of ischemic dilated cardiomyopathy, status post coronary artery bypass graft surgery, atrial fibrillation, and a previous pacemaker implantation was referred for an upgrade to a biventricular pacemaker. The patient had advanced heart failure (NYHA class III) despite optimal medical therapy. A baseline 12-lead electrocardiogram (ECG) showed a right ventricular (RV) paced QRS complex with duration of 166 ms (Figure 1). An echocardiogram showed a LVEF of 25%.

The left axillary vein was cannulated using a micro-puncture technique. It was noted that there was difficulty advancing the guidewires at the junction of the left subclavian vein and the SVC (Figure 2). Neither the CS sheath nor catheter would advance beyond the stenosis at the junction of the subclavian vein and SVC. Injection of radioconstrast dye confirmed subtotal occlusion at this site.

At this point, a 0.014-mm Whisper wire was advanced to the inferior vena cava. It was then possible to advance a Ventura catheter over the Whisper wire. Despite the Ventura catheter, the Whisper wire would not cannulate the CS. Hence, the Ventura catheter was removed and the LV pacing lead (St. Jude Medical model number 1158T) was advanced over the Whisper wire into the right atrium. Subsequently, the Whisper wire was removed and a stylet was placed into the LV lead. The stylet was shaped with a wide curve (Figure 3) and placed in the LV lead to cannulate the CS. After cannulating the CS, the LV lead was advanced into the CS and placed in a posterior lateral branch vein using the stylet and the natural curve of the lead (Figure 4). Adequate pacing and sensing thresholds were obtained and lack of diaphragmatic stimulation at high input was noted. Despite the difficulty with lead placement, narrowing of the baseline QRS was obtained as seen on...
the 12-lead ECG taken post procedure (Figure 5). The patient showed improvement in clinical symptoms over a follow-up period of 15 months.

Discussion

Subtotal occlusion of the SVC is occasionally noted in patients referred for device upgrade. Venoplasty techniques to overcome SVC occlusions include balloon venoplasty, microdissection, excimer laser photoablation, or the use of a hollow tube with screw-like tip to rotate through the occlusion. Complications of these mechanical techniques include barotrauma, perforation, and bleeding with misdirection, especially if venoplasty is performed after such misdirection.

The transfemoral approach is another technique used to overcome such occlusions. Complications with this technique include infections, phlebitis, lead displacement, deep venous thrombosis, and, rarely, pulmonary embolism. Surgical techniques include epicardial lead placement, transatrial approach via median sternotomy, or a limited right parasternal mediastinotomy. These techniques require invasive surgery and often result in early lead degradation. The risk is even higher in patients with previous sternotomy, which was the case in our patient.

Given the complications of the aforementioned techniques, traditional placement of the LV lead if at all possible is the most desirable choice. In our technique, the stylet was curved to match the CS cannulating sheath. This, along with the natural curve of the LV lead, helped subselect the branch vein leading to successful placement of the LV lead with no complications and good capture and pacing thresholds. This technique may have limitations in that not all LV lead types can cannulate the CS lead. This can be expensive due to the cost of the LV lead if this technique is not successful.

Conclusion

In the event of SVC occlusion, we propose the use of a curved stylet within the LV lead as an alternative and safe technique to cannulate the CS and pace the LV.
Figure 2: Occlusion at the junction of the left subclavian vein and superior vena cava.
Figure 3: Stylet shaped into a wide curve that was used to cannulate the coronary sinus.
Figure 4: Successful placement of biventricular pacemaker with left ventricular lead in posterior lateral branch vein of coronary sinus.
References


Figure 5: Electrocardiogram post biventricular pacemaker insertion showing narrower QRS complex duration of 120 ms.