DEVICE THERAPY

EMERGING TECHNIQUES

Coronary Sinus Venoplasty for Optimal Left Ventricular Lead Placement in Cardiac Resynchronization Therapy

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ABSTRACT. *As the use of cardiac resynchronization therapy for mild to severe heart failure has increased over the last few years, the implanting electrophysiologist has been driven to learn innovative techniques addressing the technically challenging aspects of device implantation. Specifically, positioning the left ventricular (LV) lead via the coronary sinus (CS) can be challenging because of unsuitable CS anatomy, vein stenosis, and unacceptable electrical parameters. This report describes successful LV lead implantation by using balloon venoplasty to overcome a small diameter posterior-lateral branch.*

KEYWORDS. *cardiac resynchronization therapy, coronary sinus, lead delivery, venoplasty.*

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Introduction

Cardiac resynchronization therapy (CRT) has been shown to reduce morbidity and mortality in moderate to severe heart failure, and the indications for its use in heart failure have been growing. As the use of CRT for mild to severe heart failure has increased over the last few years, the implanting electrophysiologist has needed to learn innovative techniques addressing the technically challenging aspects of device implantation. Specifically, positioning the left ventricular (LV) lead can be technically challenging because of unsuitable coronary sinus (CS) anatomy, vein stenosis, and unacceptable electrical parameters. This report describes successful LV lead implantation by using balloon venoplasty to overcome a small diameter posterior-lateral branch of the CS.

Case report

A 61-year-old gentleman with refractory New York Heart Association class III heart failure due to ischemic

cardiomyopathy, ejection fraction of 20%, and left bundle branch block on electrocardiogram refused cardiac resynchronization and intracardiac defibrillator therapy (CRT-D) as an outpatient. He was admitted with out-of-hospital cardiac arrest. After undergoing hypothermia with good recovery, he was offered CRT-D therapy. An occlusive CS venogram showed small-diameter target vessels for the LV lead placement. A St. Jude 1058 lead (St. Jude Medical, St. Paul, MN) over a Choice PT 0.14-mm wire (Boston Scientific, Natick, MA) could not be advanced in to the branch vein distally. A Voyager 3 mm × 8 mm balloon (Abbott Laboratories, Abbott Park, IL) was passed over the wire in to the target vessel. Branch vein venoplasty was performed with a total of six balloon inflations at 16 atm along the entire length of the vessel. The LV lead was then easily advanced over the wire distally in the branch vein with acceptable electrical parameters and stability (**Figure 1**). No complications were seen, the total procedure time was 2 h and 26 min and fluoroscopic time 22 min and 8 s.

Discussion

CRT has been established as an effective therapy in patients with moderate to severe heart failure.^{1–3} However, difficulties associated with LV lead implantation and ideal positioning in a posterior-lateral or lateral

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branch vein via the CS are frequently encountered in clinical practice. Failure to implant a transvenous LV lead adds morbidity to the procedure as it may require surgical placement of a LV epicardial lead via a mini-thoracotomy.

Maneuvering the LV lead into an optimal position is technically challenging because of anatomical obstructions such as valves in the CS, stenosis of the proximal portion of the target branch, phrenic nerve stimulation, and unsuitable branch vein diameter. Asymptomatic coronary vein stenosis may be encountered in up to 10%

of CRT cases.⁴ In a large study of over 2000 patients, failure to implant LV leads was attributed to an inability to access the CS os (39%), unstable lead position (35%), and failure to achieve a distal lead positioning (32%).⁵

As a consequence, the implanting electrophysiologist has had to learn techniques not necessarily part of the traditional skill set. An example of this is CS balloon venoplasty, which has been described in the literature to overcome discrete stenosis and spasm.^{4,6-8} Small caliber branch veins may deter operators from implanting the

Figure 1: Small caliber branch veins seen on top left. Balloon angioplasty top right and bottom left allowed distal positioning of the left ventricular lead with acceptable electrical parameters.

lead in that branch vein despite its optimum location and force the LV lead to be implanted in a less than optimal position. Although balloon venoplasty to overcome discrete venous obstructions has been described before, there is a relative paucity of reports on manipulation of small caliber branch veins in order to make them suitable for lead implantation. We describe successful placement of an LV lead after balloon angioplasty of a small-diameter branch vein. After several dilatations along the entire length of the vessel, the LV lead was passed without any resistance in an optimal position with satisfactory pacing parameters.

Balloon venoplasty to manipulate the size of a target vessel may be a technique that implanting electrophysiologists need to incorporate into their skill set in order to achieve optimum placement of the LV lead.

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