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CASE REPORT

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A novel way to facilitate left ventricular lead implantation: Jailed catheter technique

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Abstract

An important therapeutic modality for heart failure with left ventricular dyssynchrony, left ventricular lead placement, cannot be achieved due to anatomic challenges in some cases. In the current case, a novel implantation technique to overcome an anatomic difficulty, angled takeoff of the side branch of the coronary sinus, was presented.

KEYWORDS
coronary sinus, implantation, jail, sharp angled, side branch

1 | INTRODUCTION

Unsuccessful left ventricular (LV) lead implantation due to various causes including inexperienced operators, absence of required tools, and anatomic variations can be encountered although the majority of procedures end successfully. Various tools and techniques have been described to achieve a proper LV lead implantation.[1–3] Herein, a case with challenging anatomic variation preventing the coronary sinus (CS) lead implanted through the side branch of the CS and the management of the difficulty was presented.

2 | CASE REPORT

A 65-year-old man with ischemic cardiomyopathy and QRS widening was referred to our center for the implantation of a cardiac resynchronization therapy (CRT) defibrillator. After proper patient preparation, the axillary vein was punctured for the right atrial (RA), right ventricular (RV), and CS lead implantation. First, the RV single-coil shock electrode was conventionally implanted in the RV apex. Then, the CS was cannulated using a peel-away CS catheter (Attain Command™ + SureValve™, Medtronic), and a venography was performed to show anatomy of the CS and its branches. Only 1 side branch, the anterolateral branch, was seen (Figure 1 Panel A). The anterolateral branch was difficultly cannulated using an inner catheter (Attain Select™ II + SureValve™, Medtronic) and a 0.014″ floppy guidewire because of a sharp-angled takeoff of the branch from the CS (Figure 1 Panel A and B). The CS lead buckled and prolapsed back into the distal body of the CS when forward pressure was applied. The buddy wire technique with various guidewires with multiple hardness levels and the inner catheter did not succeed to implant the lead. In addition, further distal advancement of guidewires to cannulate collaterals and to perform vein-vein or vein-CS or vein-RA loops to perform balloon anchoring or snare use was all unsuccessful. The balloon-anchoring technique for inner catheter cannulation of the branch or lead advancement into the branch was also unsuccessful due to no advancement of various sized balloons from the sharp angle. Balloon inflation in the CS just distal to the side branch did not work, which resulted in prolapsing of the lead. After all possible interventions were exhausted, the jailed catheter technique was applied. An additional, separate axillary vein puncture other than previous 3 punctures for the right atrium, right ventricular, and left ventricular leads was performed to introduce the 4th guidewire, and then, cannulation of the CS using a second catheter (Attain Command™ + SureValve™, Medtronic) was performed. A 7 × 40 mm peripheral balloon (EverCross, Covidien) was advanced over a 0.035″ guidewire and parked in the main body of the CS, where the first CS and inner catheters

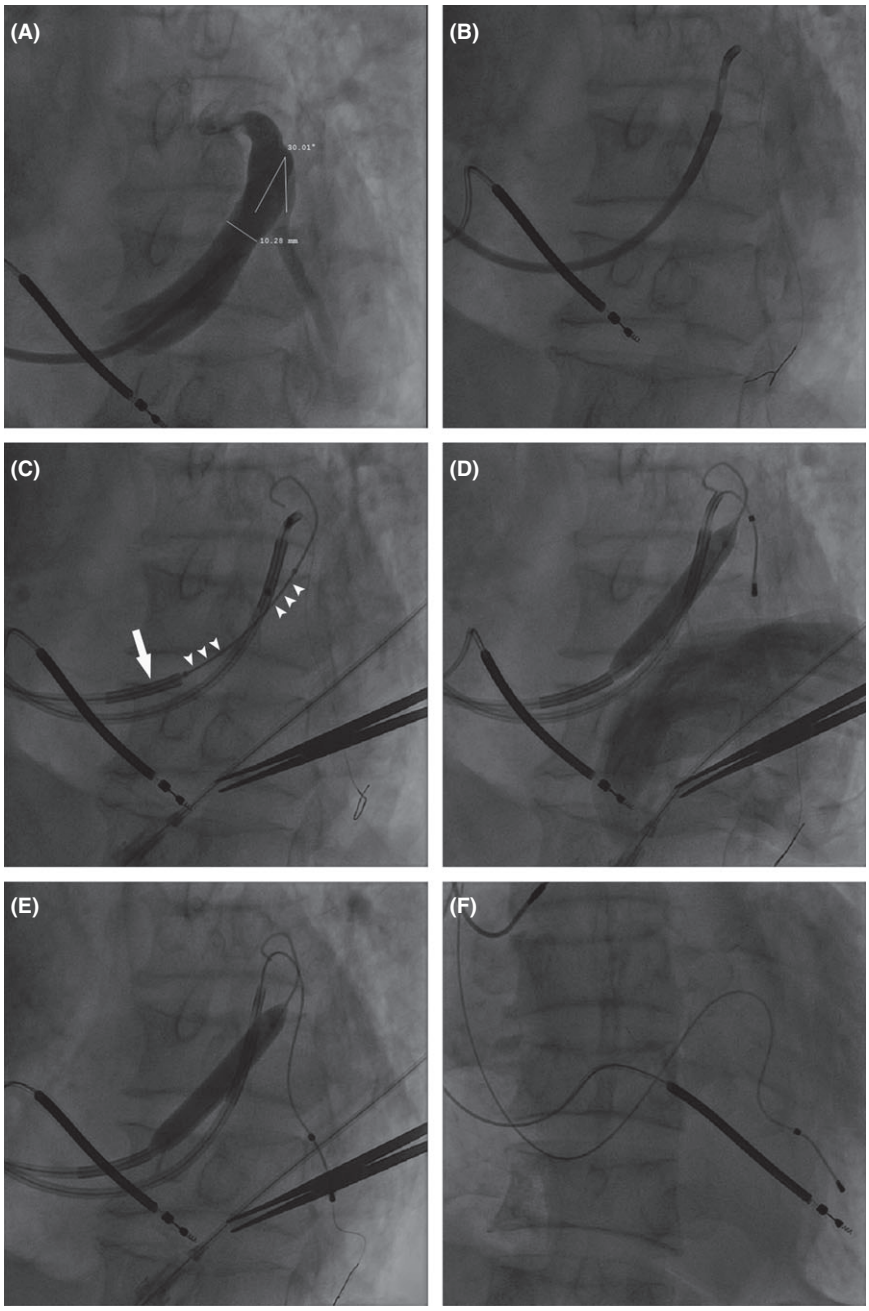

FIGURE 1 Venography of the coronary sinus (CS) showed a single side branch, anterolateral, with a sharp takeoff angle (30°) from the main body. The width of the narrowest segment of the main body was 10 mm (A). This side branch was difficultly cannulated using an inner catheter, and the floppy guidewire was distally advanced (B). Through a second CS catheter (arrow), a peripheral balloon (arrowheads) was placed in the main body to jail catheters (C). With the inflation of the balloon and stabilization of catheters, the CS lead could be advanced into the branch (D) and located more distally (E). Finally, all leads were implanted successfully (F). Panels A-E were in the left lateral view, and Panel F was in the anteroposterior projection

located with 0.014″ guidewire located in the branch (Figure 1 Panel C). Because of 9F (3.0 mm) CS catheter, the balloon was sized 1:1 with the CS diameter to prevent dissection and inflation of the balloon at nominal pressure of 7 mm Hg in the main body resulted in entrapment and immobilization of catheters. Therefore, stabilized catheters allowed further advancement of the CS lead beyond the steep angle found in the ostium of the side branch (Figure 1 Panel D, E, and Video S1). Then, balloon deflation and removal of both the balloon and the second catheter were performed. Good sensing and pacing parameters without diaphragm stimulation were obtained. Lastly, the RA lead implantation, CS catheter removal, and pulse generator placement in the pocket were carried out in the conventional manner (Figure 1 Panel F).

3 | DISCUSSION

Anatomic variations causing LV lead implantation difficult or impossible are tortuosity of selected branch of the CS, side branch arise at steep angles, smaller diameter side branch, stenotic segments in the body of the CS or selected side branch, and the absence of suitable side branches. Inner catheters, buddy wires, looped guidewires, and balloon anchoring are frequently used tools and techniques to facilitate CS lead implantation.[1–3] Some cases have been presented using balloon inflation in the body of the CS just distal to the selected branch.[4,5] This maneuver was also tried in our case but unsuccessful. There are several important clues in our case presentation: (i)—the axillary vein instead of the femoral vein was

used for the access to implant the balloon because readily accessible, locally anesthetized venous route was already present, readily available peel-away CS sheath was not appropriate for the femoral approach, and the risk of infection and complication from the femoral approach was eliminated; (ii)—the balloon was sized 1:1 with the CS to prevent dissection or rupture. Measuring the CS diameter obtained from the CS venography from only one projection might overestimate the CS diameter and determining the balloon diameter according to this measurement can be misleading because the CS diameter may be smaller if it is measured from other directions. To overcome this limitation, an IVUS catheter can be used to measure the correct diameter of the CS. Therefore, IVUS should be used, if available, to perform this technique in truly safe manner. Multiple fluoroscopic projections can also be performed to obtain the correct diameter if IVUS is not available. However, the use of multiple projections and contrast agents in such heart failure patients may worsen heart failure as well as impair kidney function. In addition, technically both 1:1 sized balloon inflated at nominal pressure and 1 mm bigger balloon inflated at lower pressure can be selected at the discretion of the implanter; (iii)—a relatively long balloon was chosen to obtain enough radial force along multiple sites of catheters. The CS angiography demonstrated no more branches between the targeted branch and the middle cardiac vein. Therefore, a 40 mm balloon was used to avoid the occlusion of both the targeted branch and the middle cardiac vein while maintaining radial force at multiple points. After inflation of the balloon, the CS lead was easily introduced in the targeted branch in few seconds and then prompt deflation of the balloon was performed. The selection of an appropriate-length balloon and prompt deflation prevent inhibition of the blood flow and coronary perfusion pressure especially in patients with low blood pressure and/or residual coronary stenosis. (iv)—A second peel-away CS catheter can permit removal of that catheter while continuing inflation of the balloon; therefore, stabilization of the CS lead can be achieved during removal of the first peel-away catheter; (v)—jailed catheter technique seems very useful if it is performed by an experienced implanter with paying enough attention to balloon size (diameter and length), its position, and inflation pressure.

CONFLICT OF INTEREST

Authors declare no Conflict of Interests for this article.

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SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.

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