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Snare technique for coronary sinus cannulation in cardiac resynchronization therapy

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ABSTRACT

Purpose: Biventricular pacing is a mainstay of therapy for patients with heart failure. However, lead implantations may fail due to anatomical reasons including the impossibility of coronary sinus cannulation.
Methods and results: A dual approach from the subclavian vein using a snare through a sheath and from the femoral vein using a steerable electrophysiology catheter was performed. Once the snare hooked the catheter, the latter was advanced into the coronary sinus and finally, the sheath could also be advanced in an "over-the-wire" technique.
Conclusion: The snare technique for coronary sinus cannulation offers a "bail-out" strategy for left ventricular lead implantation.

1. Introduction

Cardiac resynchronization therapy (CRT) is a cornerstone of heart failure treatment in patients with reduced left ventricular (LV) function and QRS duration of >130 ms or to prevent pacemaker-induced cardiomyopathy in patients with high-grade atrioventricular block and high burden of right ventricular pacing [1,2]. Demographic changes in the near future will result in a higher prevalence of heart failure patients and hence in an increase of CRT implantation and/or CRT upgrades from previously implanted devices [3]. Positive CRT response depends on successful implantation of a LV lead in a lateral or posterolateral coronary sinus (CS) target vein, a procedure that may exhibit many obstacles before successful completion. Apart from anatomical limitations of the CS with absent or too small target veins, the implantation procedure may already fail at the very basic presumption of successful CS cannulation. We herein propose an alternative and unusual, but easily adoptable, method for CS intubation.

2. Case report

A 66 years old patient was referred to our centre for lead extraction of his dual-chamber pacemaker (PM) because of noise-oversensing of the right ventricular electrode and upgrade to a biventricular pacemaker because of impaired left ventricular function. Device and electrodes had been implanted 8 years ago due to intermittent high degree atrioventricular block while permanent atrial fibrillation refractory to antiarrhythmic medication had been documented in recent years. After uneventful extraction of the atrial and ventricular lead by using mechanical rotating extraction sheaths (Cook Medical, Bloomington, IN), a new right ventricular lead was implanted and secured to the pectoral muscle. However, CS intubation was not possible using common techniques including different fixed-curve sheaths (Medtronic Attain Command MB2 and Extended Hook; Medtronic, Minneapolis, MN), a steerable electrophysiology (EP) catheter and/or contrast dye injection to visualize the ostium of the CS. In contrast, it was feasible to successfully intubate the CS by a femoral approach using a conventional steerable EP catheter but even with this "landmark", we were unable to successfully cannulate the CS from the pectoral side, presumably because of high-grade dilation of the right atrium (Area of right atrium on echocardiography: 29.5 cm2, normal values < 18cm2) and therefore insufficient reach of the tools from the superior vena cava to the CS ostium. We therefore changed to a dual approach involving both the femoral and left subclavian vein using a gooseneck snare (Medtronic Amplatzer 15 mm Goose Neck Snare; Medtronic). The extended hook fixed-shaped sheath was positioned in the superior vena cava and the snare advanced through the sheath and left opened in the high right atrium

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Abbreviations

CRT	Cardiac resynchronization therapy
CS	Coronary Sinus
PM	Pacemaker
EP	Electrophysiology
LV	Left ventricular

(Fig. 1A). A steerable EP catheter was advanced from the right femoral vein through the open snare (Fig. 1A, supplemental video 1) and the snare tightened at the distal third of the catheter. Next, the EP catheter was placed within the CS together with the snare (Fig. 1B, supplemental video 2). Using the snare's tail as a rail, the CS sheath could then be advanced in a "over-the-wire" technique into the CS (Fig. 1C, supplemental video 3). Consecutively, the femoral EP catheter and the snare were withdrawn (Supplemental video 4) and conventional venography confirmed successful positioning of the sheath within the CS (Supplemental video 5). Finally, a quadripolar lead was successfully implanted in an anterolateral vein (Fig. 1D).

Supplementary video related to this article can be found at https://doi.org/10.1016/j.ipej.2020.09.004

3. Discussion

Successful CRT implantation may sometimes be prevented by various obstacles but offers the potential to decrease morbidity and mortality in heart failure patients [4]. Since the introduction of transvenous LV lead implantation through the CS to offer biventricular pacing [5], newly developed pre-shaped sheaths further facilitated CS intubation [6]. However, an estimated 10% of attempted conventional CRT implantations still fail these days [7,8], necessitating either surgical or more experimental options such as his-bundle pacing or transseptal endocardial LV lead placement. Even though cannulation of the CS can be a major hurdle at the very start of the intervention procedure, the majority of reports describing solutions for difficult CRT implantations are focusing on target CS vein intubation [9–15], while described options and solutions for difficult CS cannulation have been sparse in the literature [16,17]. Traditionally, fix-curved sheaths in combination with guiding wires are used for CS cannulation in a "probe and pray" technique, while the use of a steerable EP catheters for the same approach seems to facilitate cannulation compared to guiding

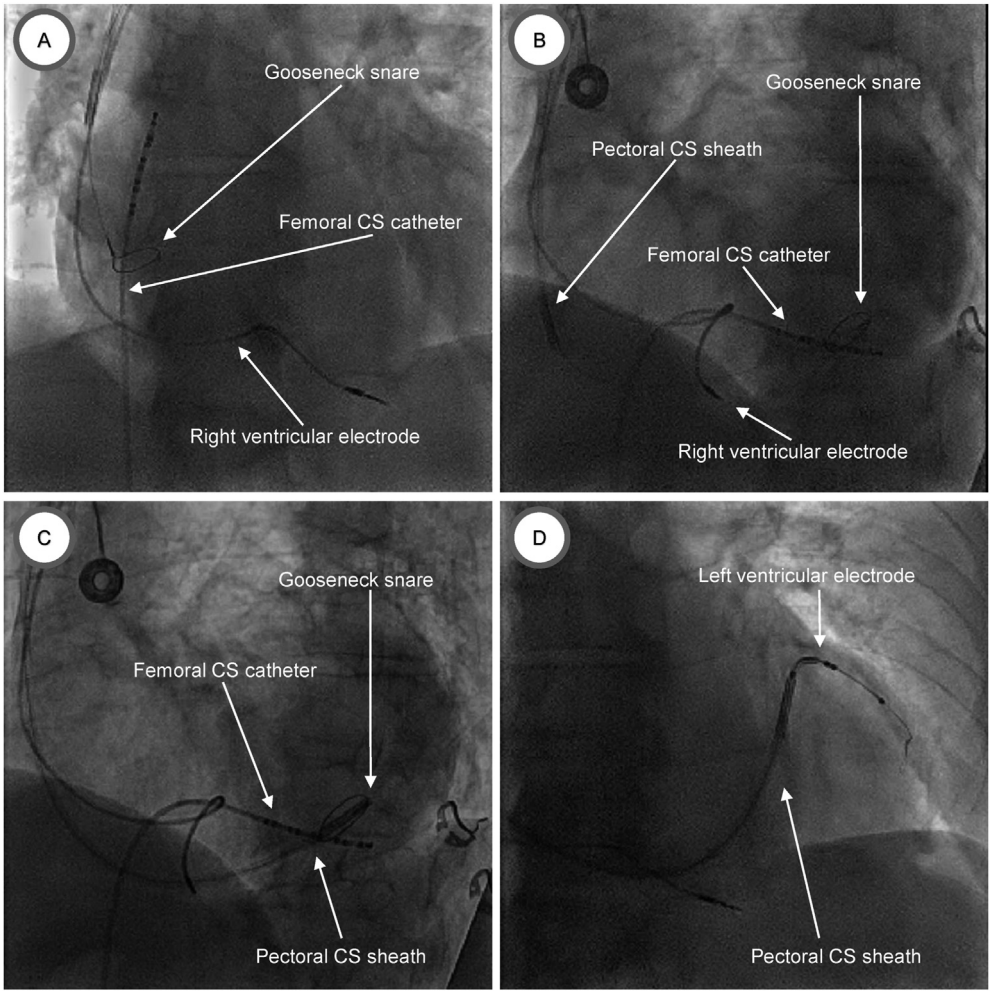

Fig. 1. A: AP projection. The femoral steerable EP catheter is being snared by a gooseneck snare (15mm) which is advanced through a coronary sinus guiding sheath from the subclavian vein.
B: LAO projection. The femoral EP catheter and the tightened snare are being placed within the CS.
C: LAO projection. The subclavian sheath was successfully advanced over the snare's tail into the CS. D: AP projection. Successful placement of left ventricular electrode in anterolateral target vein.

wires [18]. But the "probe and pray" approach may still be limited due to anatomic variations in the location of the CS ostium, dilated right atrium and prominent Thebesian valve [16,19]. Technical adoptions for these scenarios have primarily been industry-related adjustments in a variety of pre-shaped curved as well as steerable sheaths to accommodate for anatomic variations. Alternatively, contrast dye injection with or without a telescoping-support catheter can be used to facilitate locating and cannulating the CS [20]. In this case report, we present an alternative approach as a bail-out strategy if all conventional options for CS cannulation have failed. CS cannulation with a steerable catheter from a femoral approach may be easier due to variation in curve, push and bending of the catheter compared to a pectoral approach. Snare techniques have become relevant in lead extraction procedures and endocardial LV lead implantation [9,21–25], but to the best of our knowledge this has not yet been described for CS cannulation. By snaring the femoral EP catheter in the right atrium via a CS sheath advanced through the subclavian vein, the snare is subsequently advanced into the CS through the femoral EP catheter. With this technique, the snare can be used as a guiding rail for the subclavian sheath. After releasing the snare, the femoral EP catheter is gently withdrawn through the femoral access and the snare through the pectoral sheath. With this strategy, the subclavian sheath can safely be guided and intubated into the CS.

4. Conclusion

This novel snare technique for CS cannulation during CRT implantation presents a dual-approach if other options have failed. While it necessitates a femoral venous access, it offers another option in the armamentarium of "bail-out" strategies for CRT implantation.

5. Limitations

The nature of a case report prohibits conclusions regarding safety and efficacy of this procedure.

Funding

No funding has been received in context to this study.

Good clinical practice

This study was conducted according to the guidelines for good clinical practice and the Declaration of Helsinki.

Availability of data and material

Upon urgent request and associated need, our data is available, while our upmost intention is to protect our patient's privacy.

Consent for publication

Present.

Declaration of competing interest

Dr. Hofer reports educational grants, speaker fees or fellowship support from Abbott, Medtronic, Biotronik, Boston Scientific, Biosense Webster, Novartis, Bayer Healthcare. AB has received consultant and/or speaker fees from Abbott, Bayer Healthcare, Biosense Webster, Biotronik, Boston Scientific, Bristol-Myers Squibb, Cook Medical, Daiichi Sankyo, Medtronic, Pfizer, and Spectranetics/Philipps.

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Appendix B. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.ipej.2020.09.004.

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