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Case Report

Veno-venous loop through coronary sinus for LV lead placement during cardiac resynchronization therapy

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ABSTRACT

Left ventricular lead placement in the appropriate branch of coronary sinus is the key to successful cardiac resynchronization therapy (CRT) and this step is technically challenging. We describe a case of non-ischemic cardiomyopathy with heart failure, taken up for cardiac resynchronization therapy with defibrillator (CRT-D) implantation. The quadripolar left ventricular lead was impossible to advance into the target lateral branch of the coronary sinus. We made a veno-venous loop, advancing the coronary guidewire through the middle cardiac vein to coronary sinus and then to superior vena cava. The guidewire then snared through the same left subclavian vein and exteriorized. Over this loop, the left ventricular lead of the CRT-D device was implanted successfully. This novel approach can be used to successfully implant the LV lead in difficult to implant situations, obviating the need for thoracotomy or other methods of LV lead implantation.

1. Introduction

Cardiac resynchronization therapy (CRT) is known to be useful in patients with systolic heart failure, significantly reduced ejection fraction, and a wide QRS complex, if remains symptomatic after treating with optimum medical therapy for heart failure.[1] The effectiveness of the CRT depends upon the implantation of the left ventricular (LV) lead in the proper position, which should be the most delayed activation site in the left ventricle.

2. Case report

A 30-year-old male was diagnosed as a case of non-ischemic cardiomyopathy three years ago and was on regular heart failure therapy. He had recurrent heart failure admissions

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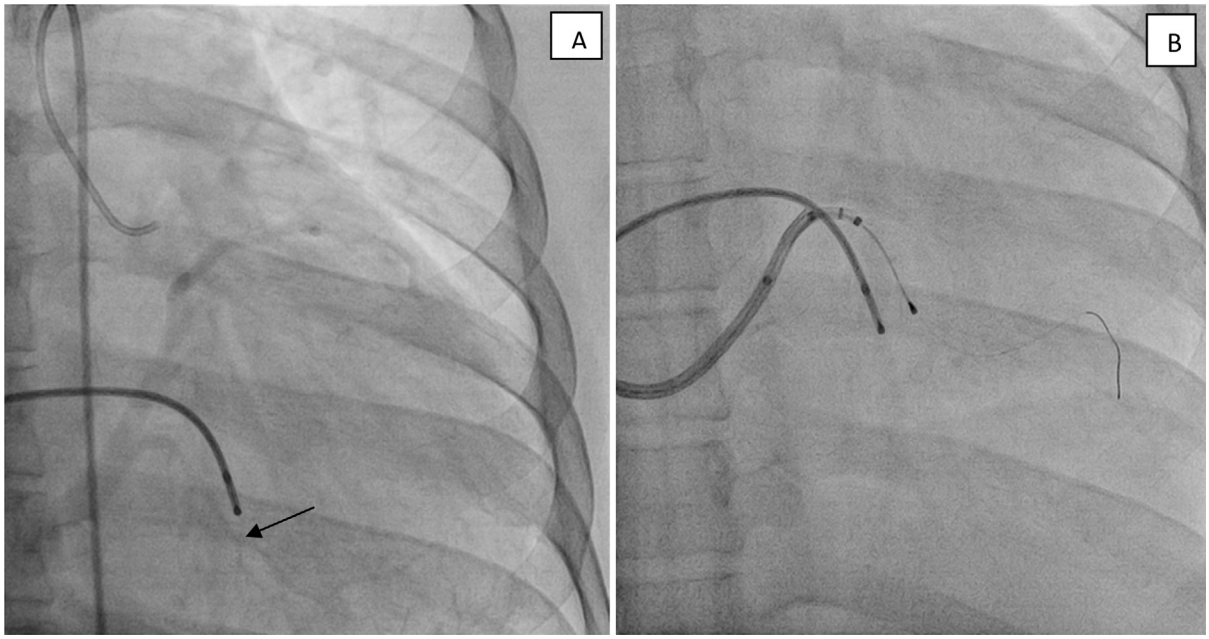

Fig. 1 – Levo phase of coronary angiogram in PA view showing CS and lateral branch (arrow) (A) and attempted delivery of quadripolar LV lead into the lateral branch with the help of a subselector (B).

requiring intravenous diuretics and inotropic agents for stabilization. During the last two admissions into another hospital, he presented with hemodynamically unstable rapid ventricular tachycardia, which was cardioverted. His ECG revealed sinus rhythm, left bundle branch block (LBBB) with QRS duration of 130 ms. Echocardiography revealed LV ejection fraction of 25% with moderate mitral regurgitation. Assessment of the two-dimensional speckle tracking of LV revealed lateral wall as the most delayed activated region of left ventricle. The patient was taken up for cardiac resynchronization therapy with defibrillator (CRT-D) device implantation in view of his persistent New York Heart Association functional class III and ambulatory class IV symptoms. Coronary angiography was done to delineate the coronary sinus (CS) and its tributaries in levo phase (Fig. 1A). There was a small, tortuous single lateral branch of CS as the target vein for LV lead implantation. The branch was wired with a floppy coronary guidewire. A quadripolar LV lead (Quartet™, St. Jude Medical)

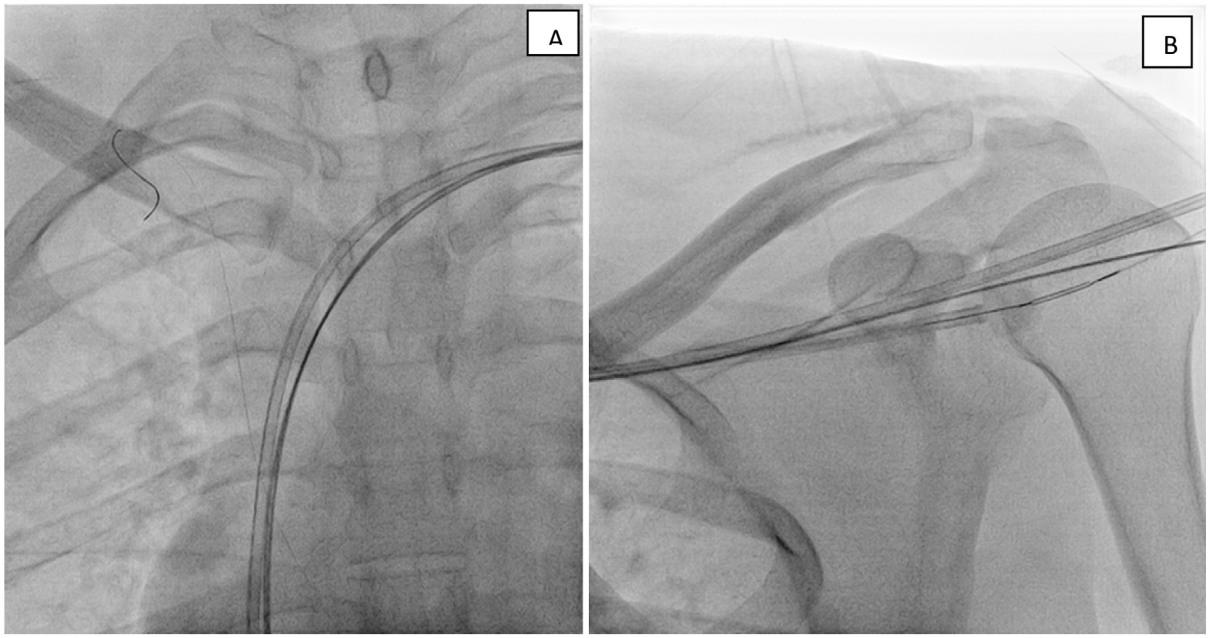

Fig. 2 – The 0.014″ guidewire advanced into SVC through RA (A) and the wire snared from SVC with the help of a goose neck snare from left subclavian vein through another access alongside the CS sheath (B).

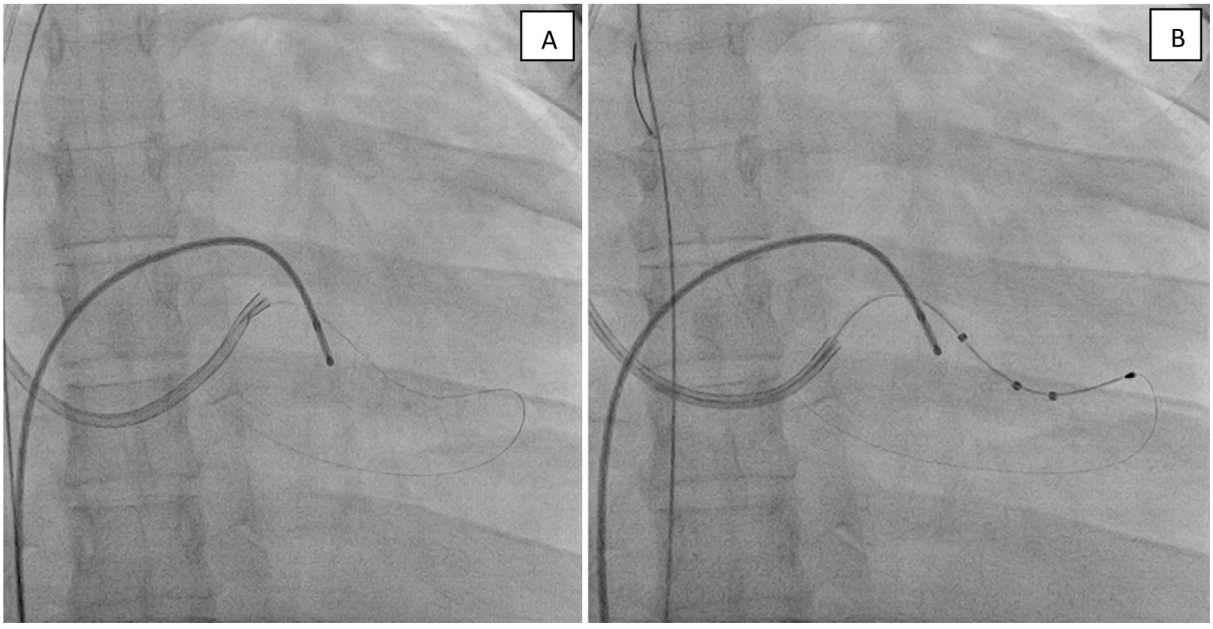

Fig. 3 – Formation of a veno-venous loop with both ends of the guidewires in the operator's hand (A) and advancing the LV quadripolar lead easily over the wire into the CS branch (B).

was tried to advance over the guidewire but was not successful. A CS 90 degree subselector (CPS Aim™ SL, St. Jude Medical) was used to advance the lead but without success (Fig. 1B). We also attempted to advance the LV lead with a support wire, but failed to advance the lead. A bipolar lead was also attempted, but was not successful. After exhausting all other options, we opted for making a coronary veno-venous loop for required support to advance the LV lead. We took a selective angiography of the lateral vein through the deeply hooked subselector, which showed multiple communicating collaterals between lateral vein and the middle cardiac vein. A Whisper extra-support 0.014″ coronary guidewire (Abbott Vascular, USA) was slowly advanced through the collaterals from the lateral vein, with the help of a microcatheter, into the middle cardiac vein. The guidewire was then gradually advanced into CS, and subsequently into superior vena cava (SVC) via the right atrium (Fig. 2A). The guidewire then was snared through the left infraclavicular pocket, through a 7F sheath introduced over the already punctured and positioned guidewire for the right ventricular lead, with the help of a 20 mm Amplatz Gooseneck

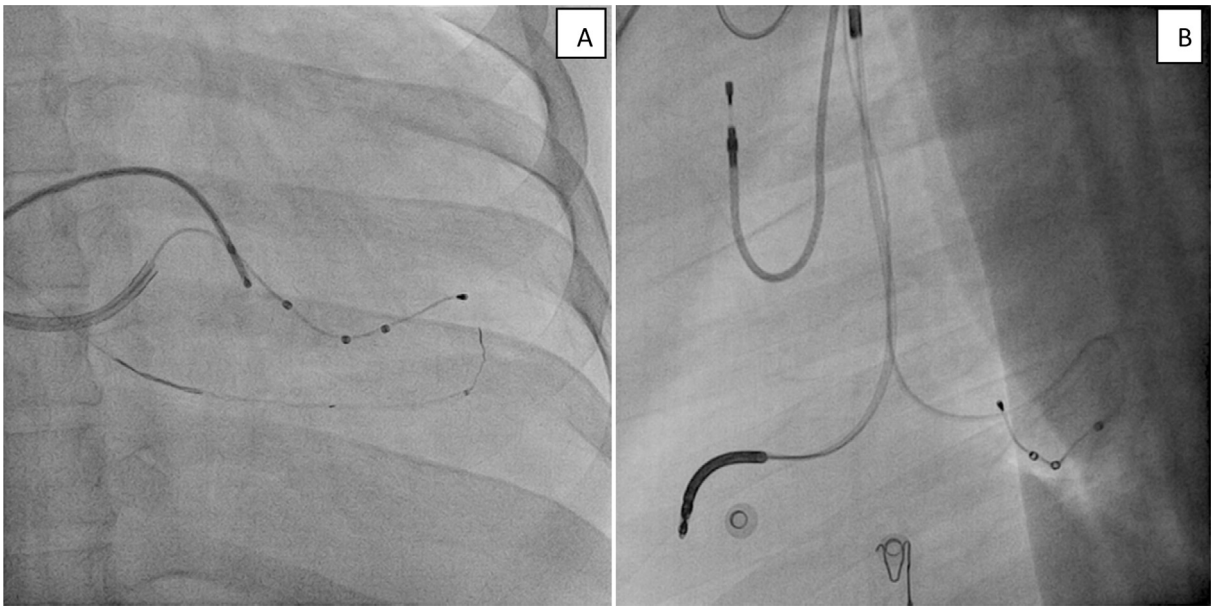

Fig. 4 – Snapped guidewire trapped by the snare in the middle cardiac vein (A) and final position of the leads of the CRT-D device (B).

snare (ev3, USA) (Fig. 2B). The guidewire was exteriorized and a veno-venous loop was made (Fig. 3A). Now both the ends of the guidewires were under the operator's control. The LV lead was then advanced easily over this stabilized veno-venous loop and positioned in a very stable position in the vein ahead of the tortuous segment (Fig. 3B). After the implantation of the LV lead, the guidewire got caught at the LV lead tip and it was not possible to take it out from the lead. The wire got snapped at the LV lead tip and the distal part, still caught with the snare, was taken out from the middle cardiac vein along with the snare (Fig. 4A) and the proximal part was pulled out from the LV lead. RV and RA leads were implanted subsequently and the CRT-D device was implanted with acceptable parameters of all the leads (Fig. 4B). The patient remained stable during the procedure and was discharged three days after the procedure.

3. Discussion

Implantation of the LV lead into the proper CS tributary draining the latest activated LV region is the most critical step of reducing the number of non-responders after implantation of a CRT device. Worley et al. first reported implanting LV lead with the help of a goose neck snare.[2] They introduced the snare through the same CS guide catheter through which the guidewire for lead was advanced and held the opposite end of the guidewire in the CS. The technique gave options of advancing the LV lead through either end of the guidewire depending upon the nearest access to the suitable region of LV. In another case, Rafael et al.[3] reported a case where the LV lead was implanted with the help of a loop. Two sheaths were placed in the CS and the guidewire was introduced through posterolateral vein and brought back to CS via anterolateral vein, followed by snaring the end with the help of a forceps snare and placing the LV lead in the desired position. Magalhaes et al.[4] also used a snare to catch the opposite end of the guidewire in the RA and forming a loop to implant the LV lead in the desired position in a case of CRT. We used the SVC to snare the opposite end of the guidewire and forming a veno-venous loop and advancing the LV lead into the small and tortuous lateral tributary of the CS, leading to successful implantation of the CRT-D device.

In conclusion, this case shows a challenging technique of forming a veno-venous loop with the help of a snare and implanting the LV lead in the target and the most appropriate tributary of CS for proper CRT. Innovative techniques of implantation may lead to a less number of non-responders and less need for thoracotomy for LV lead placement during CRT.

Conflicts of interest

The authors have none to declare.

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