Received: 5 April 2023 | Revised: 3 June 2023 | Accepted: 21 June 2023

DOI: 10.1002/joa3.12893

Journal of Arrhythmia Open Access WILEY

SPOTLIGHT

A novel approach for venous occlusion after endocavitary leads. The balloon-assisted tracking technique

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Keywords: left bundle branch pacing, pacing, venoplasty

After pacemaker (PM) or cardioverter-defibrillator (ICD) implantation with transvenous lead is not unusual to observe some degree of stenosis or even total occlusion of the homolateral upper limb venous system. This complication is present in up to one-quarter of patients requiring reintervention at follow-up.[1]

Numerous techniques have been described to treat venous occlusion related to cardiac device leads. The choice of strategy depends on individual anatomical considerations, the available tools, and the physician's experience with a specific technique.

A 77 year-old woman with prior history of third-degree atrioventricular block requiring PM implantation 5 years earlier presented in the outpatient clinic with mild symptoms of heart failure (HF). The echocardiogram showed a new-onset reduced left-ventricular ejection fraction (LVEF) of 33%, probably related to right ventricular pacing, and mild to moderate aortic stenosis (mean gradient of 30 mm Hg and peak gradient of 63 mm Hg). Despite the initiation of guideline-directed medical therapy no improvement in LVEF was observed, and the patient developed overt heart failure ultimately leading to hospitalization. With the suspicion of pacing-induced cardiomyopathy, the patient was referred to our center for device upgrading to left bundle branch area pacing (LBBAP).

In the first place, a peripheral venogram was performed to ensure left subclavian access patency. However, an occlusion from the superior vena cava (SVC) to the Innominate vein junction was observed (Figure 1). Recanalization of the venous occlusion was attempted to avoid contralateral venous access and subsequent tunneling to the left subcutaneous pocket, avoiding performing a second surgical field on the right side for greater patient comfort and with the aim of reducing the risk of infection. Fluoroscopy-guided left subclavian access with a 5F sheath was used. A standard 0.035″, a hydrophilic coating 0.035″ (Terumo Corporation), and a 0.018″ Nitrex guidewire (Medtronic Vascular) failed to cross the lesion. Then, a Pilot 200 coronary guidewire (Abbott Vascular) with Finecross microcatheter (Terumo Corporation) support was used to successfully cross the stenosis. Subsequently, dilatation with 2.5 and 3 mm semicompliant

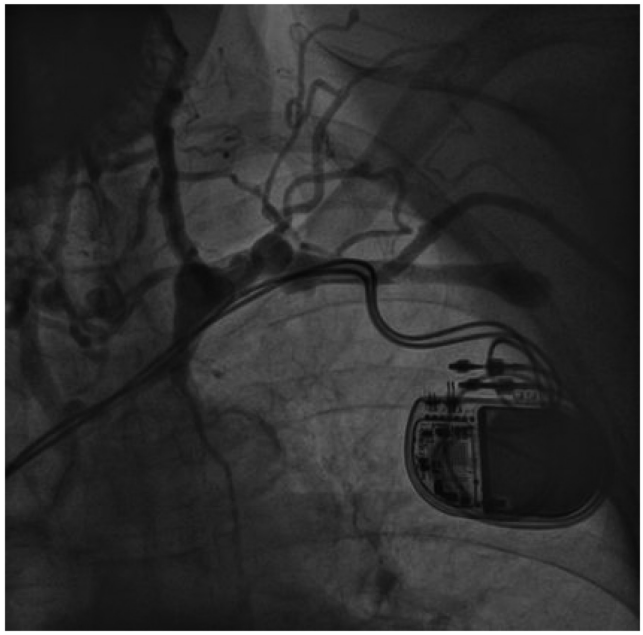

FIGURE 1 Venography with occlusion of innominate venous and recirculation.

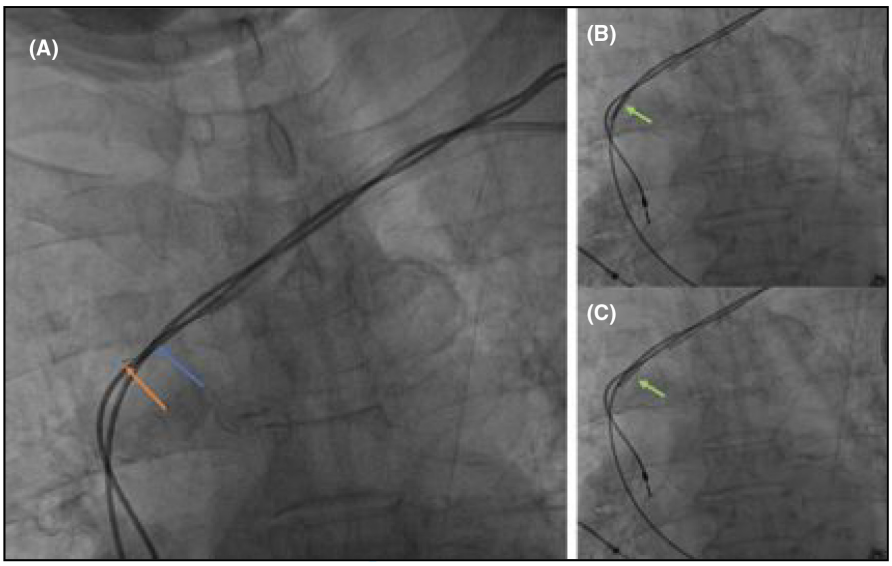

FIGURE 2 (A) Crossing the occlusion with coronary guidewire (orange arrow) and microcatheter (blue arrow). (B) Dilatation with 2.5 mm balloon, and (C) with 3 mm balloon (green arrow).

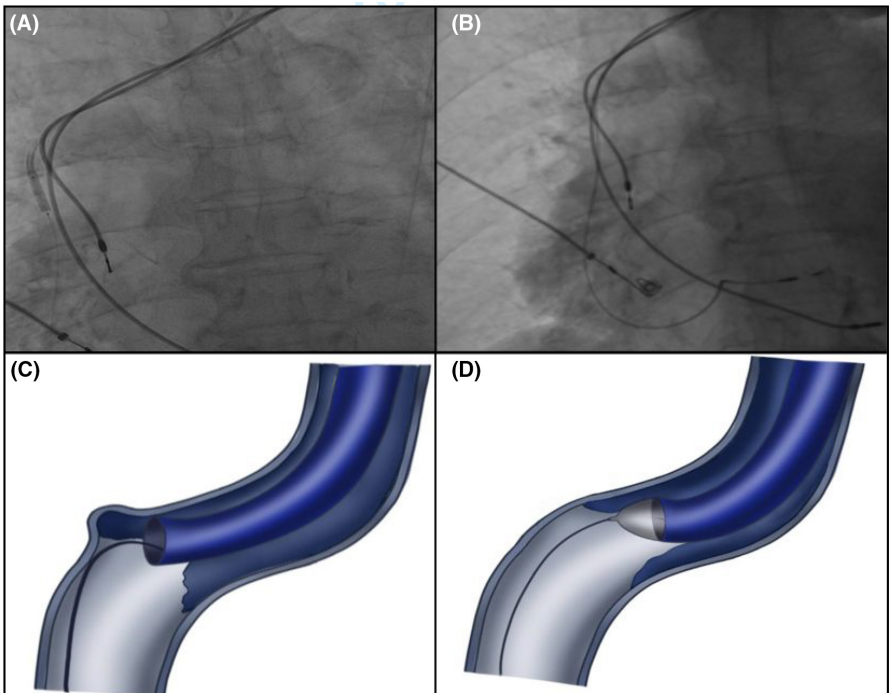

FIGURE 3 (A) Balloon-assisted tracking (BAT) technique, see main text for description. (B) Final electrode positioning in left bundle branch. (C, D) Schematic BAT technique.

angioplasty balloons (Figure 2) was performed. Since a Judkins right 4F coronary catheter (Medtronic Vascular) could not yet be progressed, a balloon-assisted tracking (BAT) technique was performed (Figure 3). A 3 mm semicompliant angioplasty balloon was inflated protruding across the distal end of Judkins right 4F coronary catheter (Medtronic Vascular). Then, the catheter and inflated balloon were advanced over Pilot 200 coronary guidewire (Abbott Vascular) allowing smooth and non-traumatic advancement through the obstruction (Video S1).

Finally, an exchange was made with a 0.035″ wire for the delivery sheath (C315 HIS Medtronic) and the procedure was carried out in the usual way, placing the ventricular pacing lead (SelectSecure™ Model 3830, Medtronic) in the left bundle branch area with adequate electrical parameters. The QRS narrowed from 170 to 124 ms with a V6-left ventricular activation time of 94 ms (Figure 4), the pacing threshold was 0.5 V at 0.4 ms, impedance 448 Ω and R wave detection 13.8 mV. The left bundle branch lead was connected to the auricular channel due to atrial tachycardia with rate control strategy and the previous ventricular lead was laid as backup.

At 1 month follow-up no complications related to the procedure were observed and adequate electrical parameters persisted. The pacing threshold was 0.625 V at 0.4 ms, impedance 409 Ω, and R wave detection 13.8 mV.

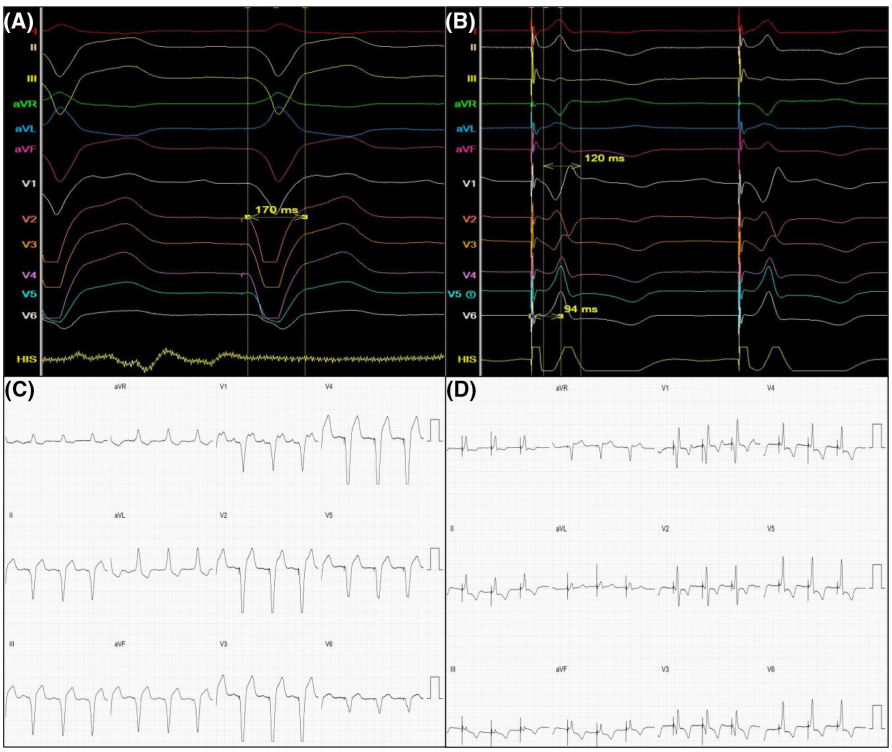

FIGURE 4 (A, C) Right ventricle pacing. (B, D) left bundle branch area pacing.

The BAT technique has been previously described in percutaneous coronary intervention with radial access. It is known that the advancement of a catheter through a stenotic, tortuous, or looped area can cause vessel perforation because of a blade effect on its wall.[2,3]

In a retrospective study of 62 patients undergoing the BAT technique, the catheter only failed to advance in one case and there was a low complication rate (11% of patients developed a complication in the first 24 h like hematoma, prolonged pain, or visible vascular damage at the end of the procedure. All completely recovered at the follow up).[4]

Venous obstruction/occlusion approach can be with venous angioplasty, lead extraction, or contralateral access, the decision will depend on the characteristics of the occlusion and the group experience. It is well-known that the presence of multiple leads is one of the strongest risk factors for vena cava syndrome, a condition that, if present, requires lead extraction. On the contrary, short venous occlusion recanalization with conventional balloon venoplasty without lead removal has a high success rate but not in all cases, and is in this situation when the venous BAT technique can be a useful tool.[5]

To our knowledge, this is the first report of the BAT technique for venous recanalization. As the venous wall is weaker than the arterial wall, this technique has to be used carefully in this population (low-pressure balloon inflation, careful catheter manipulation, etc.), with these considerations this technique could be feasible and with an expected low complication rate, however further research is needed to validate the BAT for venous recanalization in this setting.

CONFLICT OF INTEREST STATEMENT

All authors declare no conflicts of interest related to this work.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article because of the case report.

PATIENT CONSENT STATEMENT

The patient provided informed consent to the use and publication of her case for research and educational purposes.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Rodríguez Nieto J, Gutiérrez Ballesteros G, Mazuelos Bellido F, Pan Álvarez-Ossorio M, Segura Saint-Gerons JM. A novel approach for venous occlusion after endocavitary leads. The balloon-assisted tracking technique. J Arrhythmia. 2023;39:634–637. https://doi.org/10.1002/joa3.12893