



## A Simple Venoplasty to Place the Lead in Occluded Venous Access

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### Abstract

Pacemakers and cardiac defibrillators are an essential life-saving implantable devices with more than 600,000 implantations each year. There are more than 3 million people worldwide with pacemakers and the number of these device implants increases with each passing year. As of 2016, it was estimated that there were about 1.14 million pacemakers globally and by the year 2023 that number is expected to increase to 1.43 million units.

The venous approach is the most common method used for permanent pacemaker lead implantation because of its ease and safety and the various veins used are the subclavian, cephalic (cut down) and axillary veins. Venous thrombosis and stenosis at the implantation site are probably more common than previously thought of because most patients remain asymptomatic due to the adjoining bridging venous collateral formation and the condition remains undetected. Variable incidence has been reported in the literature, but up to 50% of patients may develop at least moderate subclavian vein stenosis, defined in most studies as a greater than 50% luminal narrowing by contrast venography.

Despite the increasing use of pacemakers and implantable cardiac defibrillators, a lack of understanding remains with regard to the risk factors for development of these device-associated venous obstructions. The shear wall stress, adjoining blood flow velocity, blood pressure and the stasis at the implantation site are all the risk factors for increasing the propensity of thrombus formation and subsequent venous occlusion.

An awareness of the venous complications of transvenous cardiac pacing is important because prompt diagnosis and therapy may decrease the potential morbidity and mortality. Various management strategies have been employed, including anticoagulation, lead extraction, percutaneous venoplasty with or without stenting, tunnelling and epicardial lead surgery. However, no consensus regarding the optimal treatment of this problem exists and there is limited evidence to support the success and safety of one approach over another. Venoplasty is one of the simplest and safest approach to overcome venous obstruction during pacemaker/ICD lead implantation.

**Keywords:** Venoplasty; Occluded Venous Access; Pacemakers; Cardiac Defibrillators

### Introduction

An occluded venous access is an impediment for cardiac implanted electric device (CIED) implantation. The venous occlusion may be primary (i.e. absence of prior instrumentation or external

compression) or secondary (i.e. result of prior instrumentation or due to external compression). Repeat venous access on the side of previous implant may be required in conditions of device upgrade or pacing lead failure. In such situations, an occluded venous ac-

cess may complicate the procedure. Through this case we discuss a minimalistic approach to perform venoplasty restore patency and successfully implant a pacing lead.

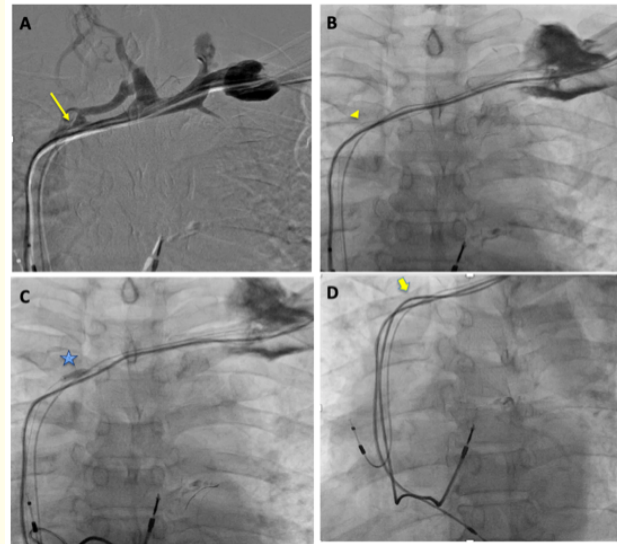
### Clinical Case

A 61-year-old man, a known case of arterial hypertension, type 2 diabetes mellitus, coronary artery disease, complete heart block (CHB), with dual chamber permanent pacemaker implanted in 2006 through left subclavian venous access. He had pulse generator replacement done for end of battery life in 2014. Now, he had presented with episodes of syncope for which his device interrogation showed noise on right ventricular (RV) lead with low impedance. It was due to insulation break of RV lead. This resulted in oversensing and device failure resulting in syncope. Patient was completely dependent on RV pacing, so the patient needed a RV lead replacement.

A peripheral venogram was done to ensure left subclavian access patency. There was occlusion seen at superior vena cava (SVC) to Innominate vein junction (Figure 1A and 1B). Three options were considered: 1. Abandon the RV lead change from left side and do a fresh implant from right side; 2. Consider RV lead extraction, and 3. Attempt a venoplasty.

There was a whiff of dye seen to cross from innominate to SVC which suggested a microchannel hence a decision to perform a venoplasty was taken. The left subclavian access through a micro-puncture needle (Cordis) was taken under fluoroscopic guidance. Venous access was secured with a 5F sheath and a 0.035" Terumo wire was used to cross the lesion, but it could not be crossed. To successfully track the channel, a 0.014" Whisper ES PTCA guide-wire was taken with a microcatheter support. The stenosis could be crossed successfully by the Whisper ES wire, and it was followed by dilatation at stenosis with a noncompliant 4 mm x 9 mm PTCA balloon@ 10-12 ATM (atmosphere) multiple times (Figure 1C). The balloon was taken bare over the Whisper ES wire.

It created enough space for a Terumo wire to be passed across the stenosis, along the side of the Whisper wire. Serial dilatation was done with 7F dilator and 7F sheath was inserted through which the active fixation RV lead was passed and placed at RV apex with acceptable parameters (Figure 1D).



**Figure 1:** A. Micro channel on DSA (arrow). B. Whisper ES guide wire crossed with microcatheter support (arrow head). C. Balloon dilatation (star). D. RV lead successfully implanted (solid arrow).

### Discussion

Total venous occlusion is a common problem encountered at the time of device implantation. A primary obstruction still may have alternate option but secondary obstruction following previous lead implantation poses challenging scenario, particularly when lead replacement is needed or additional leads need to be inserted. In an occluded ipsilateral venous access options may be extracting the whole system from one side and placing it on the other side or using complex techniques like, contralateral implant of a lead with subcutaneous tunneling to the side of device. Surgical implant of epicardial leads is another alternative and patients with no option may be implanted leadless pacemaker. Predictors of venous obstruction are pre-existing narrowing at baseline, multiple leads/ICD lead implantation and atrial fibrillation. The Venous obstruction after Transvenous PPI at 6 months has been seen in 14% patients with complete venous occlusion in 3.6% patients [1]. The incidence of subclavian vein stenosis after device implantation varies widely in the literature, ranging from 30% to 50%. While the incidence of symptomatic subclavian vein stenosis in patients with cardiac devices is estimated at 1-5%.

Venous angioplasty on the ipsilateral side seems a viable and safe option. In a large study, the total angiographic occlusion was demonstrated in 65% of cases by peripheral venogram, but in only 20% of cases by contrast injection at the site of obstruction (selective injection) [2,3]. In 86% of patients the occlusion was successfully crossed with a hydrophilic wire and microdissection and excimer laser was used to cross three of the four wire-refractory occlusions. Complications were non-significant though contrast extravasation was common.

### Conclusion

Subclavian venoplasty is a safe, practical lead-management option that can be used by implanting physicians. By our case, we demonstrated that in some carefully selected cases, PTCA hardware and skills can be used to treat venous occlusion in post implant patient with successful implant of lead.

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