HOSTED BY

ELSEVIER

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/IPEJ

# Overcoming a subclavian complete occlusion: Simple single lead extraction by the subclavian vein allowing implantation of two new leads and upgrade to CRT-P with multi-site pacing

*Miguel Nobre Menezes*[*], *Ana Bernardes*[1], *João de Sousa*[1], *Pedro Marques*[1]

*Cardiology Department, University Hospital Santa Maria, CHLN, Hospital de Santa Maria, Avenida Prof Egas Moniz, 1649-035 Lisbon, Portugal*

ARTICLE INFO

*Article history:*
Available online 29 July 2015

*Keywords:*
Venous occlusion
Lead Extraction
CRT

ABSTRACT

Central venous obstruction following pacemaker implantation is not uncommon, and can prove challenging in the case of system upgrade. We report a case of DDDR to CRT-P (with multi-site pacing) upgrade, where a subclavian occlusion was overcome resorting to an atrial lead extraction (using only a locking stylet). This allowed regaining of the venous access with subsequent implantation of not just one, but two new leads and subsequent successful upgrade.



## Case report

An 83-year-old male patient, with a history of hypertensive cardiomyopathy with severely depressed systolic function, permanent atrial fibrillation and end-stage renal failure (awaiting initiation of a haemodialysis program) underwent a pacing system upgrade (dual-chamber to biventricular triple site pacing device) procedure. The original device was implanted 7 years earlier. After obtaining subclavian vascular access, the guidewire would not progress through the vein. Contrast venography revealed a complete proximal subclavian occlusion (Fig. 1). In order to overcome this obstacle, the atrial lead (Medtronic Capture Sense®) was extracted using a locking stylet (Spectranetics®), without complications. This allowed the elimination of the occlusion and the passage of the guidewire (Fig. 2). A standard introducer was then advanced permitting dilation of the remaining partial obstruction. Afterwards a ventricular lead was implanted in the high inter-ventricular septum (Medtronic Capture Fix Novus®). Finally, a long introducer was used to cannulate the coronary sinus, a hydrophilic guidewire was advanced to a postero-lateral vein and the left ventricular lead (MedtronicAttain Bipolar OTW®) was implanted (Fig. 3). All leads were connected to the generator and thus the patient had a triple site biventricular pacemaker system implanted.

## Discussion

Obstruction of the subclavian vein in patients with pacemaker leads is not uncommon, occurring in 13–35% of patients [1].

* *Corresponding author*. Tel.: +351 217805351; fax: +351 218860151.
E-mail address: mnmenezes.gm@gmail.com (M. Nobre Menezes).
Peer review under responsibility of Indian Heart Rhythm Society.
[1] Tel.: +351 217805351; fax: +351 218860151.
http://dx.doi.org/10.1016/j.ipej.2015.07.008

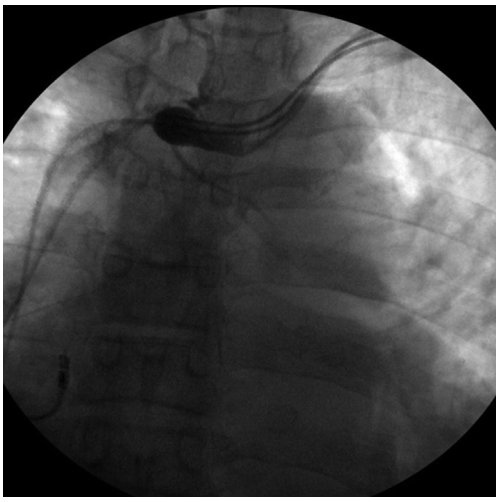

**Fig. 1 – Contrast venography depicting subclavian obstruction.**

When upgrading a pacemaker system these obstructions can prove a challenge difficult to overcome. There are several options available, and, as this case illustrates, the decision must be made on a case-by-case basis.

An obvious approach is to implant a new device on the opposite side. However, there is a growing trend favouring preservation of the vascular capital [2]. This is especially relevant in young patients, or, as was the case of our patient, patients who are expected to undergo haemodialysis on a short-term basis, where vascular preservation is paramount. Also, implantation of the device on the opposite side without extraction of the previous leads would lead to a large number of leads in the superior vena cava, a scenario clearly discouraged in the 2009 Heart Rhythm Society Expert Consensus on Lead Extraction due to the risk of superior vena cava syndrome [3]. In other to overcome these limitations, several cases have been published using alternative approaches, from direct puncture of the innominate vein [4], to a supraclavicular subclavian access [5], to passage of the leads using collaterals from the superior vena cava [6]. Experience with these approaches, however, is scarce, and the first two

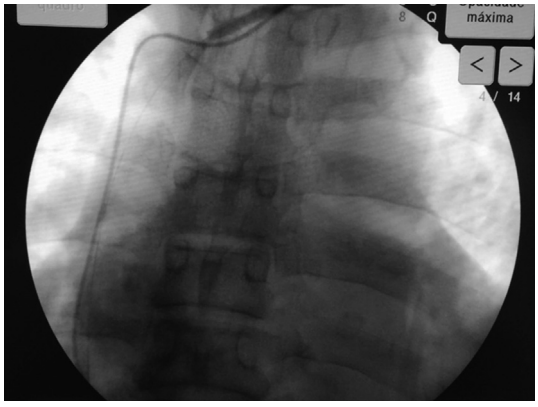


**Fig. 2 – Passage of a guidewire through introducer after extraction of the atrial catheter.**

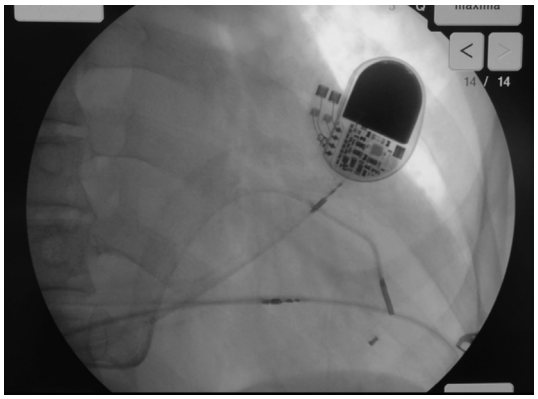


**Fig. 3 – Final catheter position just before connecting to the generator.**

require tunneling the new catheter, with the subsequent risk of erosion to the skin, chronic pain and infection [2].

One of the options to overcome a subclavian obstruction is to use balloon venoplasty, be it with the use of a compliant, a non-compliant or a cutting balloon. This technique is regarded as effective, even in the face of complete occlusion, with few and mild complications, mainly limited to balloon rupture with contrast extravasation and venous dissection [7,8]. However, despite having performed venous angioplasty in the past, our experience with this technique is limited.

Another option would be extracting the atrial lead. This patient had permanent atrial fibrillation, and therefore the atrial lead was unnecessary. By choosing extraction, not only would we remove an unnecessary lead, which would further burden the venous circulation if left in place, but would also create an opening in the venous system. Of course, lead extraction is associated with some risk of immediate complications, such as catheter fracture, myocardial avulsion, rupture, or venous laceration. However, in experienced centres and operators, complication rates are very low [2,3]. Indeed, in our centre, we have a significant experience with simple lead extraction (using only locking stylets), with exceedingly rare complications. Various authors have successfully undertaken lead extraction when facing venous occlusion, using multiple approaches. Kutarsky et al. reported the successful extraction of both leads of a DDD pacemaker via the subclavian vein resorting to locking stylets and Byrd dilators, with insertion of the two new leads using the same venous passage created by the previous leads, even in the face of extensive venous stenosis [9]. Other authors used a long guidewire inserted inside the lead insulation, having extracted the lead via a femoral approach, retaining the guidewire through the subclavian vein to the device subcutaneous pocket, and finally using that to implant the new lead [10,11]. Sohal et al. reported the largest case series to date regarding the use of laser sheath extraction in patients with central venous occlusion. Their technique consists on retaining the outer sheath after extraction in order to permit passage of a guidewire and the lead. In a total of 71 patients, 40% of extractions were carried out to allow system upgrade. A 94% success rate was observed, major complications (infection of generator site) occurred in 3% of cases and minor complications in 6% [12].

Therefore, considering the potential advantages of lead extraction for this patient, and the odds of success and complications considering both centre and operator experience for each technique, we chose to remove the atrial lead. The excellent outcome of the patient seems to have proved us right.

Our case illustrates several key points. First, like the above-mentioned articles, lead extraction to regain venous access in cases of central venous occlusion can be an adequate primary approach not only in malfunctioning or infected leads, but also in pacing system upgrades, especially in the presence of unnecessary leads. Second, there are simple means of conducting a safe and effective extraction. Yet the simplest one, as was our case (simple locking stylet extraction) can be effective and safe i.e. complex extraction systems aren't always warranted. Third, extraction of a single lead can create enough room for the passage of several new leads allowing not only DDD pacemaker reimplantation but even CRT upgrade (as observed in this case and several other cases in another series [12]), and therefore multi-lead extraction of functional sterile leads should be reserved for cases refractory to both venoplasty and/or single lead extraction. Fourth, whatever the chosen technique, pacing centre and operator experience are paramount in obtaining successful results with minimum risk of complications.

## Conflicts of interest

None to declare regarding all authors.

## REFERENCES


[1] Worley SJ. Implant venoplasty: dilation of subclavian and coronary veins to facilitate device implantation: indications, frequency, methods, and complications. J Cardiovasc Electrophysiol 2008;19(9):1004–7.

[2] Maytin M, Epstein LM, Henrikson CA. Lead extraction is preferred for lead revisions and system upgrades: when less is more. Circ Arrhythm Electrophysiol 2010;3(4):413–24. discussion 424.

[3] Wilkoff BL, Love CJ, Byrd CL, Bongiorni MG, Carrillo RG, Crossley 3rd GH, et al. Transvenous lead extraction: heart rhythm society expert consensus on facilities, training, indications, and patient management: this document was endorsed by the American heart association (AHA). Heart Rhythm 2009;6(7):1085–104.

[4] Aleksic I, Kottenberg-Assenmacher E, Kienbaum P, Szabo AK, Sommer SP, Wieneke H, et al. The innominate vein as alternative venous access for complicated implantable cardioverter defibrillator revisions. Pacing Clin Electrophysiol 2007;30(8):957–60.

[5] Antonelli D, Freedberg NA, Turgeman Y. Supraclavicular vein approach for upgrading an implantable cardioverter defibrillator to a biventricular device. Pacing Clin Electrophysiol 2010;33(5):634–6.

[6] Ranjan R, Henrikson CA. ICD implantation after crossing a totally occluded subclavian vein via collaterals from the superior vena cava. Pacing Clin Electrophysiol 2010;33(2):e14–6.

[7] Luedorff G, Grove R, Kranig W, Thale J. Different venous angioplasty manoeuvres for successful implantation of CRT devices. Clin Res Cardiol 2009;98(3):159–64.

[8] Worley SJ, Gohn DC, Pulliam RW, Raifsnider MA, Ebersole BI, Tuzi J. Subclavian venoplasty by the implanting physicians in 373 patients over 11 years. Heart Rhythm 2011;8(4):526–33.

[9] Kutarski A, Pietura R, Młynarczyk K, Małecka B, Głowniak A. Pacemaker lead extraction and recapture of venous access: technical problems arising from extensive venous obstruction. Cardiol J 2012;19(5):513–7. Available at: http://www.ncbi.nlm.nih.gov/pubmed/23042316 [accessed 20.05.14].

[10] Rogers DPS, Lambiase PD, Chow AWC. Successful coronary sinus lead replacement despite total venous occlusion using femoral pull through, two operator counter-traction and subclavian venoplasty. J Interv Card Electrophysiol 2007;19(1):69–71.

[11] Staniforth AD, Schilling RJ. Reuse of occluded veins during permanent pacemaker lead extraction: a new indication for femoral lead extraction. Indian Pacing Electrophysiol J 2002;2(4):97–103. Available at: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1557418&tool=pmcentrez&rendertype=abstract [accessed 25.05.14].

[12] Manav Sohal, Steven Williams, Majid Akhtar, Amit Shah, Zhong Chen, Matthew Wright, et al. Laser lead extraction to facilitate cardiac implantable electronic device upgrade and revision in the presence of central venous obstruction. Europace 2014;16(1):81–7.