

CASE REPORT

Transjugular Seldinger approach for permanent pacemaker implantation in octogenarian with inaccessible upper limbs venous system

Alexander Edo Tondas MD^{1,2}  | Rido Mulawarman MD³  | Monica Trifitriana MD³  |
Savero Evan Abisha MD³  | Raymond Pranata MD^{4,5} 

¹Department of Cardiology and Vascular Medicine, Mohammad Hoesin General Hospital, Palembang, Sumatera Selatan, Indonesia

²Biomedicine Doctoral Program, Faculty of Medicine, Universitas Sriwijaya, Palembang, Indonesia

³Faculty of Medicine, Universitas Sriwijaya, Palembang, Indonesia

⁴Faculty of Medicine, Universitas Pelita Harapan, Tangerang, Indonesia

⁵Department of Cardiology and Vascular Medicine, Siloam Hospitals Lippo Village, Tangerang, Indonesia

Correspondence

Alexander Edo Tondas, Department of Cardiology and Vascular Medicine, Mohammad Hoesin General Hospital, Palembang, Indonesia.
Email: edotondas@fk.unsri.ac.id

Funding information

There is no external funding and this report has no relationship with any industrial company.

Abstract

In up to 13.7% of device implants, lead entry through the cephalic, axillary, or subclavian veins might be unfeasible. Transjugular permanent pacemaker (PPM) implantation may be considered as a bailout strategy in the difficult anatomy of conventional veins, before resorting to epicardial pacing lead, which requires general anesthesia and thoracotomy. We described a case report of a single chamber PPM implantation in an 83-year-old man using transjugular Seldinger approach without surgical cut down of the internal jugular vein, due to spasm, stenosis, and thrombosis of the upper limbs venous systems. Acceptable lead impedance and threshold were maintained during 2 months follow-up.

KEYWORDS

internal jugular vein, permanent pacemaker, Seldinger technique, upper limb deep vein thrombosis

1 | INTRODUCTION

Due to ease of access and low complication rates, the cephalic, subclavian, and axillary veins are the most common veins used in clinical practice for cardiac device implantations. However, the upper limb venous system might not always be readily accessible due to obstruction. The incidence is estimated to be as high as 13.7% in de novo implants, mostly located in the left innominate vein.¹ For

cases in which the conventional veins are occluded or unusable, the iliofemoral, internal jugular, external jugular, brachiocephalic, and azygos veins have been reported as alternative approaches.² However, most reports of transjugular approach involved an extensive surgical cut down and ligation of the internal jugular vein.³ Here, we reported a single chamber permanent pacemaker implantation in an octogenarian using the Seldinger method to access the internal jugular vein, which is more familiar to cardiologists.

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited and is not used for commercial purposes.

© 2019 The Authors. *Journal of Arrhythmia* published by John Wiley & Sons Australia, Ltd on behalf of the Japanese Heart Rhythm Society.

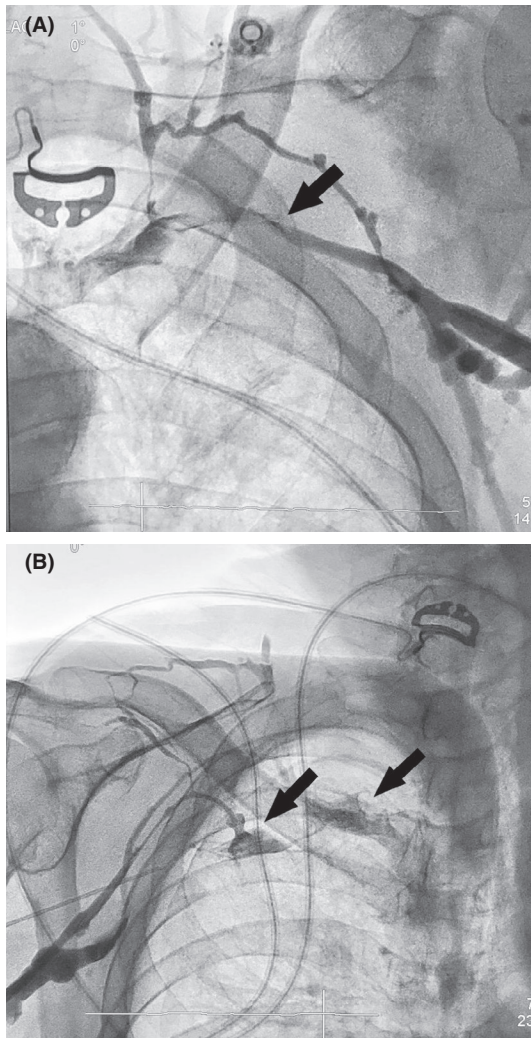


FIGURE 1 A, Left venogram showed left axillary vein collapse and apparent stenosis in the proximal part. B, Right venogram showed a large thrombus causing a near-total occlusion of the right axillary vein and subclavian vein

2 | CASE REPORT

An 83-year-old man was sent from another province to our center with complaints of chest pain 3 days before admission. He also had several repeated episodes of syncope for the last 5 months, most frequent 10 days ago, with up to eight times of fainting in a day. A previous history of hypertension was noted, but he denied having diabetes mellitus. ECG showed total AV block (TAVB) with junctional escape of 35x/minute. Laboratory findings revealed normal cardiac enzyme level, and echocardiography exam showed normal LV contractility (LVEF > 55%) without regional wall motion abnormality, which excluded acute coronary syndromes. Coronary angiography in the referring hospital demonstrated nonsignificant coronary disease, implying a TAVB with degenerative origin. A single chamber permanent pacemaker implantation was planned, with a temporary pacemaker backup during transfer.

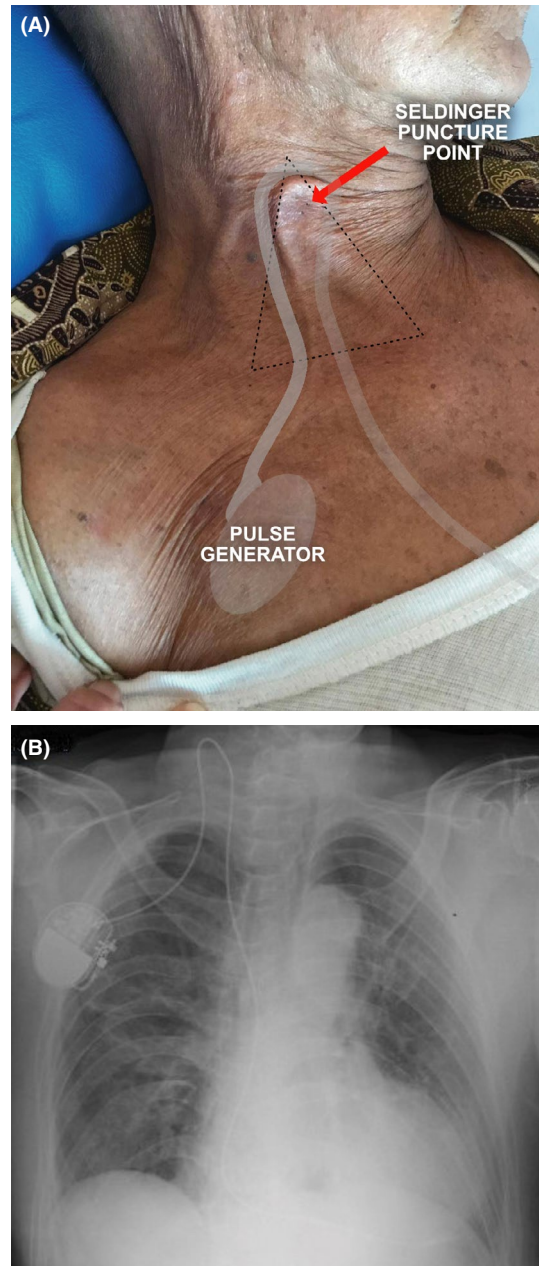


FIGURE 2 A, Diagram showing the relative position of the pacemaker generator and leads. The lead part outside the vein is depicted in thicker shade. B, Postimplantation chest x-ray. Notice the low sternoclavicular junction anatomy and wide clavicular tilt angle, exposing more upper lung part above the clavicle

An initial attempt to access the left axillary vein failed due to vein collapse and apparent stenosis in the proximal part (Figure 1B). Cephalic vein isolation was not tried due to apparent severe stenosis and irregularities from venography. Subclavian puncture from the left side resulted in air inside the syringe, indicating that the risk of pneumothorax was imminent. Considering that the oxygen saturation did not drop, we decided to carry on with the procedure. The right deltopectoral area was prepared, but venography from this side showed a large thrombus causing a near-total occlusion of the axillary vein (Figure 1A). Fortunately, the superior vena cava (SVC)

seemed to be patent. We refrained from puncturing the right axillary and subclavian veins, in concern of causing pulmonary embolization. The right cephalic vein anatomy also did not show a better prospect compared to its left counterpart.

Therefore we tried to puncture the internal jugular vein (IJV) using the Seldinger technique with 18G needle, around 1-2 cm below the classic jugular triangle apex point (Figure 2A). A guidewire was inserted to the puncture needle until it reached the IVC and the needle was removed. A 7F peel-away sheath was inserted and then a 58 cm-long pacemaker lead (CapSureFix Novus®; Medtronic) was directed and actively fixated to the right ventricular apex. A small vertical incision was made over the guidewire and the access site was bluntly dissected up to the sternocleidomastoid muscle (SCM) level. Thus, a smaller subcutaneous pocket was created to fit the suture sleeve which was then tied to SCM to secure the PPM lead. A second, larger pocket was created on the right deltopectoral area for pulse generator placement. From this pocket, we tunneled the skin using a hemostat forceps above the clavicle up to the jugular pocket and grabbed the lead connector tip, then pulled it to reach the deltopectoral pocket. Lead test parameters were acceptable: R wave, current, impedance, and threshold of 17.1 mV, 1.4 mA, 619 Ω , and 0.8V, respectively. The pacemaker generator (Sensia SR®; Medtronic) was then attached to the lead and slid subcutaneously inside the pocket. Pneumothorax was not seen from the next day's chest x-ray (Figure 2B), and therefore the patient was discharged safely on the third day after the procedure with warfarin.

Follow-up pacemaker interrogation 2 months later showed a stable threshold of 0.75 V and an impedance of 498 Ω . A slight but tolerable neck discomfort due to lead placement was noted, nevertheless, the patient was free from syncopal episodes.

3 | DISCUSSION

In cases when the conventional vein such as cephalic, axillary, and subclavian veins are not available, alternative transvenous pacemaker lead insertion technique must be acknowledged as a bailout before resorting to epicardial lead placement. It has been known that compared to endocardial pacing, epicardial pacing tends to have a higher threshold and requires thoracotomy and or sternotomy in terms of implantation and extraction. The Seldinger technique, which utilizes percutaneous puncture through the skin without having to surgically prepare the vein, has been a common method to access most of the transvenous routes.

A large case series had reported the feasibility of the iliac and femoral approach to permanent pacemaker implantation. Despite relatively simple to perform, this technique still adopted the cut-down technique and multiple incisions which require a more extensive surgical dissection. Another main issue was the high-lead dislodgement rate, which occurs in around 21% and 7% of atrial leads and ventricular leads, respectively.⁴ In Indonesia, where most religious practices require repeated bending down posture, transjugular technique may

likely offer a lower lead fracture risk compared to the iliac or femoral vein approach. Furthermore, using the Seldinger technique to puncture and access, these veins carry the risk of retroperitoneal bleeding, especially when performed above the inguinal ligament.

Our patient did not show either symptoms or signs of SVC syndrome due to obstruction or tendency of malignancy. The rare primary form of upper extremity deep vein thrombosis may be idiopathic or effort induced (Paget-Schroetter syndrome). The last-mentioned was likely to be the case, considering the fact that the patient was still very physically active until right before the syncope episodes and no other iatrogenic risk factors were present. A previous report had suggested the safety and benefit of 6-month warfarin prophylaxis to prevent venous obstruction in high-risk patients undergoing device implantations.⁵ Considering SVC patency, we set our eyes on the right jugular vein as the candidate to insert the ventricular pacemaker lead.

We did not choose the external jugular vein because this vein usually can be very tortuous and angulated at its junction to superior cava vein, and also harbors more valve structures, even though it is quite easily used for the cut-down technique. On the other hand, the internal jugular vein is actually not ideal for cut-down technique since it's surrounded by important arterial vasculatures and nerves, especially the recurrent laryngeal nerve.¹ It is also important to puncture the vein at the lowest point possible, to minimize the distance to the generator pocket while taking caution not to cause pneumothorax (Figure 2A). Some operators prefer to create a tunnel underneath the clavicle, rather than above it, to minimize a long-term risk of lead crush; however, this will require a more extensive muscle dissection.² We noticed a very low anatomical position of sternoclavicular junction and very wide clavicular tilt angle in our patient from fluoroscopy, which may explain the difficulty of subclavian access and higher risk of pneumothorax, since the upper lobe of the lungs we more exposed. This is also the reason why we avoided infraclavicular tunneling.

4 | CONCLUSION

In an urgent situation where the upper limb veins are not usable, the internal jugular vein can be accessed using the Seldinger technique as an alternative approach for permanent pacemaker implantation, without surgical cut down or extensive dissection for tunneling.

ACKNOWLEDGMENT

None.

CONFLICT OF INTERESTS

The authors declare that they have no conflict of interests.

AUTHORS CONTRIBUTION

AET admitted and treated the patient in General Hospital Mohammad Hoesin, Palembang. AET, RM, and RP drafted the manuscript. RM,

MT, and SEA performed extensive research on the topic and designed illustrations for the manuscript. AET made critical revisions to the manuscript. RP prepared the manuscript for publication. All authors read and approved the final manuscript.

ORCID

Alexander Edo Tondas  <https://orcid.org/0000-0002-2317-5212>

Rido Mulawarman  <https://orcid.org/0000-0003-2169-0971>

Monica Trifitriana  <https://orcid.org/0000-0002-9454-1961>

Savero Evan Abisha  <https://orcid.org/0000-0001-5575-3219>

Raymond Pranata  <https://orcid.org/0000-0003-3998-6551>

REFERENCES

1. Oginosawa Y, Abe H, Nakashima Y. The incidence and risk factors for venous obstruction after implantation of transvenous pacing leads. *PACE—Pacing Clin Electrophysiol*. 2002;25(11):1605–11. <https://doi.org/10.1046/j.1460-9592.2002.01605.x>
2. Seow SC, Lim TW, Singh D, Yeo WT, Kojodjojo P. Permanent pacing in patients without upper limb venous access: a review of current techniques. *Heart Asia*. 2014;6(1):163–6. <https://doi.org/10.1136/heartasia-2014-010546>
3. Brodman R, Furman S. Pacemaker implantation through the internal jugular vein. *Ann Thorac Surg*. 1980;29(1):63–5. [https://doi.org/10.1016/S0003-4975\(10\)61629-3](https://doi.org/10.1016/S0003-4975(10)61629-3)
4. Ellestad MH, French J. Iliac vein approach to permanent pacemaker implantation. *Pacing Clin Electrophysiol*. 1989;12(7):1030–3. <https://doi.org/10.1111/j.1540-8159.1989.tb01921.x>
5. Da Silva, K. R., Costa, R., Rached, R. A., Filho, M. M., Caldas, J. G. M. P., Carnevale, F. C., ... Stolf, N. A. G. (2008). Varfarina previne obstruções venosas pós-implante de dispositivos cardíacos em pacientes de alto risco: Análise parcial. *Brazilian Journal of Cardiovascular Surgery*, 23(4), 542–549. <https://doi.org/10.1590/s0102-76382008000400015>

How to cite this article: Tondas AE, Mulawarman R, Trifitriana M, Abisha SE, Pranata R. Transjugular Seldinger approach for permanent pacemaker implantation in octogenarian with inaccessible upper limbs venous system. *J Arrhythmia*. 2020;36:199–202. <https://doi.org/10.1002/joa3.12287>