CJC Open 2 (2020) 708–710

Case Report

Deployment of a Covered Stent for Left Internal Mammary Perforation From Percutaneous Pacemaker Implantation

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ABSTRACT

A 79-year-old woman developed a hemothorax 2 days after implantation of a permanent pacemaker. Computed tomography angiography revealed active extravasation from the left internal mammary artery. A covered stent was deployed to manage the arterial perforation. This case report explores different venous access techniques to minimize the risk of arterial injuries and describes the use of a covered stent in managing a non-grafted left internal mammary artery injury from a pacemaker implantation procedure.

RÉSUMÉ

Une femme de 79 ans a présenté un hémothorax deux jours après l'implantation d'un stimulateur cardiaque permanent. Une angiographie par tomodensitométrie a mis en évidence une extravasation active à partir de l'artère mammaire interne gauche. Une endoprothèse couverte a été déployée pour la prise en charge de la perforation artérielle. Ce cas porte sur l'utilisation de diverses techniques d'accès veineux pour réduire au minimum le risque de lésions artérielles, et décrit l'utilisation d'une endoprothèse couverte pour la prise en charge d'une lésion de l'artère mammaire interne gauche non greffée découlant de l'implantation d'un stimulateur cardiaque.

A 79-year-old woman presented with symptomatic complete heart block. An experienced, high-volume operator inserted a dual-chamber, rate-modulated (referred to as DDDR) pacemaker. The puncture site was identified using anatomic landmarks, and cannulation of the subclavian vein was achieved using an 18-gauge needle on second attempt. The procedure was otherwise described as uncomplicated, and the patient remained hemodynamically stable post-procedure. A chest radiograph following the procedure did not reveal any sign of complication.

On post-procedure day 2, the patient became hypotensive and tachycardic. Hemoglobin dropped from 108 to 74 g/L. A chest radiograph showed complete opacification of the left lung field. A chest tube was emergently inserted, draining more than a litre of blood. However, despite ongoing blood transfusions and fluid resuscitation, the patient remained hemodynamically unstable. Hemoglobin dropped to 68 g/L post-transfusion. A computed tomography angiogram (CTA) showed active extravasation from the proximal left internal mammary artery (LIMA), 3.7 cm distal from the origin, and an associated 23 x 19 mm pseudoaneurysm (Figs. 1 and 2).

After a heart team discussion with an interventional cardiologist, a cardiovascular surgeon, and a cardiac radiologist, the patient was taken to the angiography suite for the percutaneous implantation of a covered stent. During catheterization, findings on the CTA were confirmed (Video 1, view video online). Implantation of a BIOTRONIK PK Papyrus 3.0 X 20 mm covered stent (BIOTRONIK, Berlin, Germany) achieved complete stoppage of the extravasation (Video 2, view video online). The patient remained hemodynamically stable for the remainder of the hospital stay and was discharged on post-procedure day 8.

Discussion

This is an important case describing the use of a covered stent for the management of a LIMA perforation following percutaneous pacemaker implantation. It is likely that the internal mammary artery was punctured upon introduction of the Seldinger needle. The left subclavian vein is a continuation of the axillary vein at the lateral border of the first rib and courses posterior to the clavicle, where it connects to the internal jugular vein medially to form the brachiocephalic vein. The LIMA branches off the subclavian artery, courses behind the sternal end of the clavicle, and descends along the inner

Received for publication April 26, 2020. Accepted June 28, 2020.

Ethics Statement: The research reported has adhered to the relevant ethical guidelines.

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See page 710 for disclosure information.

https://doi.org/10.1016/j.cjco.2020.06.018

Novel Teaching Points

- Injury to the LIMA during subclavian vein access is a rare complication of percutaneous pacemaker insertion.
- To minimize the risk of arterial injuries from subclavian vein cannulations, alternative venous access techniques, including axillary vein puncture or cephalic vein cut-down, and the use of micropuncture needles or ultrasound-guided cannulation, should be considered.
- The formation of a pseudoaneurysm can delay the presentation of an arterial injury from a percutaneous procedure.
- The deployment of a covered stent for arterial punctures can be considered as an alternative to percutaneous embolization.

surface of the anterior chest wall (Supplemental Fig. S1). The LIMA is in close proximity to the left subclavian vein, which lies immediately posterior to the LIMA at the level of the first rib and clavicle (Supplemental Fig. S2). Injuries to the LIMA following subclavian catheter placements and lead extractions have been reported,[1,2] though perforation of the LIMA remains an extremely rare complication from percutaneous pacemaker insertion. Chemelli et al.[1] reported 2 cases of internal mammary injury following pacemaker implantations. Another case report from Spain described the discovery of an internal mammary pseudoaneurysm 10 days after the implantation of a pacemaker.[3]

The subclavian vein approach is a commonly used technique for pacemaker implantation. Common errors in subclavian vein puncture include inadequate landmark identification, improper insertion position, and advancement of the needle too medially.[4] To mitigate these issues, more lateral approaches, such as axillary or cephalic vein access, can be considered. A recent meta-analysis evaluating the efficacy and safety of venous access techniques for cardiac device implantation found a higher risk of pneumothorax and device/lead failure with a subclavian vein access, although there was no significant difference in the incidence of hematoma/bleeding, device infection, or pericardial effusion among the 3 approaches.[5] The use of a smaller 21-gauge micropuncture needle for venous access may also limit injury to adjacent blood vessels should they be accidentally punctured.[6] Alternatively, ultrasound-guided cannulation of the subclavian vein may reduce the rate of complication and improve the success rate. The most recent guideline from the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists does not support the routine use of ultrasound for uncomplicated patients undergoing subclavian vein cannulation, although it recognizes there is emerging evidence in support of this practice.[7] Risk factors of complications from subclavian vein cannulation include a high body mass index, a history of previous catheterization, multiple attempts at venous puncture/cannulation, as well as previous medical conditions or interventions that could have disrupted classic anatomy (eg, major surgery, clavicle or first rib fracture, and radiation therapy).[7] For high-risk patients, ultrasound-guided cannulation should be considered to reduce the risk of arterial injury.

It is important to note the delayed presentation of an arterial injury in this patient 48 hours after the initial procedure. The pseudoaneurysm may have provided some

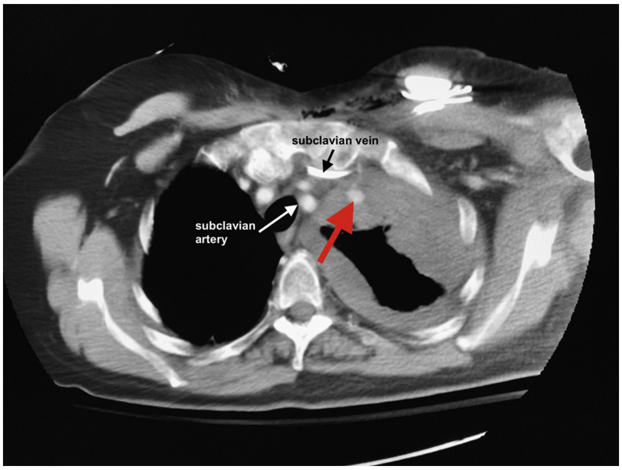

Figure 1. Axial view of a contrast-enhanced computed tomography scan showing extravasation of contrast (**arrow**) from the left internal mammary artery into a pseudoaneurysm.

Figure 2. Contrast within the pseudoaneurysm (**arrow**) located anteriorly in the left hemothorax seen on sagittal computed tomography angiography.

containment of the ongoing bleed. Previously reported LIMA injuries involving the formation of pseudoaneurysms varied widely in presentations, with symptoms emerging during the procedure to 4 weeks post-procedure.[1,3] Although one may expect rapid deterioration from an arterial bleed, clinicians should be mindful that pseudoaneurysms may mask and delay the presentation of such complications. In cases of suspected arterial injuries during subclavian vein cannulation, patients should be monitored closely, and a post-procedure CTA should be considered.

In previously reported cases, perforations of the LIMA were mostly treated by coil embolization,[1-3] although the deployment of covered stents is an alternative solution. Baldi et al.[8] have described the endovascular repair of a LIMA injury by deploying a covered stent via a left radial approach. In this case, a covered stent was similarly utilized to occlude the source of bleeding. The advantage of using a covered stent is the ability to preserve the LIMA, should the patient become a candidate for coronary artery bypass surgery in the future. However, if the injury is situated too proximally near the origin, distal migration of the stent can lead to re-exposure of the arterial lesion. Stent thrombosis is another potential complication. After deployment of a covered stent, the patient was discharged home on dual antiplatelet therapy with acetylsalicylic acid and clopidogrel, to minimize this risk.

Conclusions

We have described a case of a LIMA perforation as a complication of percutaneous pacemaker implantation. Although arterial injuries from subclavian vein cannulations are uncommon, alternative venous access techniques including axillary vein puncture or cephalic vein cut-down, and the use of micropuncture needles or ultrasound-guided cannulation, should be considered, particularly in patients whose anatomic landmarks are difficult to identify. The LIMA perforation was successfully managed by the deployment of a covered stent. Clinicians should be aware of this possible complication following percutaneous procedures. The use of a covered stent can be considered as an alternative to coil embolization.

Funding Sources

The authors have no funding to declare.

Disclosures

The authors have no conflicts of interest to disclose.

References

1. Chemelli A, Chemelli-Steingruber I, Bonaros N, et al. Coil embolization of internal mammary artery injured during central vein catheter and cardiac pacemaker lead insertion. Eur J Radiol 2009;71:269-74.

2. Cruz C, Langberg J, Lerakis S, et al. Internal mammary arterial injury from lead extraction: a clinically subtle yet important complication of implantable device removal. Cardiol Res Pract 2011;2011:408640.

3. Pozo E, González-Ferrer JJ, Pérez Villacastín J, et al. Diaphragm paralysis due to pseudoaneurysm of internal mammary artery after pacemaker implantation. Europace 2010;13:592-3.

4. Kilbourne MJ, Bochicchio GV, Scalea T, et al. Avoiding common technical errors in subclavian central venous catheter placement. J Am Coll Surg 2009;208:104-9.

5. Atti V, Turagam MK, Garg J, et al. Subclavian and axillary vein access versus cephalic vein cutdown for cardiac implantable electronic device implantation: a meta-analysis. JACC Clin Electrophysiol 2020;6:661-71.

6. Murarka S, Movahed MR. The use of micropuncture technique for vascular or body cavity access. Rev Cardiovasc Med 2019;15:245-51.

7. Troianos CA, Hartman GS, Glas KE, et al. Guidelines for performing ultrasound guided vascular cannulation: recommendations of the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists. J Am Soc Echocardiogr 2011;24:1291-318.

8. Baldi GS, Trabattoni D, Teruzzi G, et al. Iatrogenic left internal mammary artery perforation treated with a covered stent via transradial approach. JACC Case Rep 2019;1:463-7.

Supplementary Material

To access the supplementary material accompanying this article, visit *CJC Open* at https://www.cjcopen.ca/ and at https://doi.org/10.1016/j.cjco.2020.06.018.