

Arteriovenous fistula between the left common carotid artery and left innominate vein following laser sheath pacemaker lead extraction

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ABSTRACT

Percutaneous extraction of pacemaker and defibrillator leads is considered a safe and effective procedure in up to 97% of cases, with lower morbidity compared with open thoracic surgery. This technique eliminates the need for surgical retrieval of retained leads and enables a minimally invasive approach, even in infected leads, with an average procedure time between 6 and 10 minutes. A 78-year-old male was admitted with an unusual case of arteriovenous fistula following laser sheath-assisted lead extraction that required open surgical intervention while using cardiopulmonary bypass. This surgical technique would be an important alternative in the management of these patients. (*J Vasc Surg Cases Innov Tech* 2025;11:101951.)

Keywords: Arteriovenous fistula; carotid artery; Device lead extraction

The development of an arteriovenous (AV) fistula following pacemaker lead removal requiring reoperation is rare, with an incidence of 0.16%, and which have also been reported to have a high mortality rate if not promptly managed.^{1,2} Although rare, the usually insidious presentation includes chest pain, limb edema, murmurs or thrills, and progressive dyspnea. Previously, few cases have described more than eight patients, with endovascular stent placement used in approximately 52% of cases.³ However, there are no clear guidelines on the appropriate timeline and surgical approach to this entity.^{1,4}

This report illustrates a viable alternative for achieving favorable outcomes using cardiopulmonary bypass-assisted surgical correction of an AV fistula between the left common carotid artery and left innominate vein following laser lead extraction.

This report contributes further insight into this rare, challenging-to-diagnose and treat condition, to support future research efforts.

Consent from the patient has been obtained for this case report.

CASE REPORT

A 78-year-old male from Ecuador with a history of sick sinus syndrome had a dual-chamber pacemaker implanted in 2003, with the last generator replacement in 2012. He reported

extrusion of the pacemaker generator through the skin after physical exertion 3 weeks prior to evaluation, with no associated symptoms. Upon admission, he was afebrile and showed no signs of systemic inflammatory response. Evaluation by the electrophysiology team led to a recommendation for device explant and laser sheath-assisted lead extraction.

The patient underwent generator exchange with laser sheath extraction of the atrial and ventricular leads. Adhesions were released from the left subclavian vein, left innominate vein, superior vena cava (SVC), and right atrium using controlled laser advancement and countertraction maneuvers.

On postoperative day 2, the patient exhibited progressive hemodynamic deterioration with tachycardia and hypotension, along with a continuous holosystolic murmur over the aortic area, raising suspicion for vascular injury. Chest computed tomography angiography revealed an AV fistula between the left common carotid artery and the ipsilateral innominate vein (Fig 1), with a small, prevascular right mediastinal and para-aortic hematoma with no signs of active extravasation. A multidisciplinary team recommended surgical exploration and correction of the fistulous tract.

Median sternotomy was performed, revealing extensive venous collateral circulation in the thorax, fibrotic tissue over the anterior aspect of the aortic arch, and a pulsatile mass with thrill at the site of the fistula. Communication was confirmed between the origin of the left common carotid artery, the innominate vein, and the SVC. The tissues were friable, but ventricular function was preserved, and no fluid collections were observed.

Dissection of the fibrotic tissue, aortic arch, and supra-aortic vessels was initiated to isolate and repair the AV fistula (Figs 2 and 3).

Given the intraoperative findings and the fibrotic process at the level of the aortic arch and supra-aortic vessels, exsanguinating hemorrhage occurred during the dissection process, which prevented adequate visualization of the surgical field and repair of the AV fistula. Once cardiopulmonary bypass

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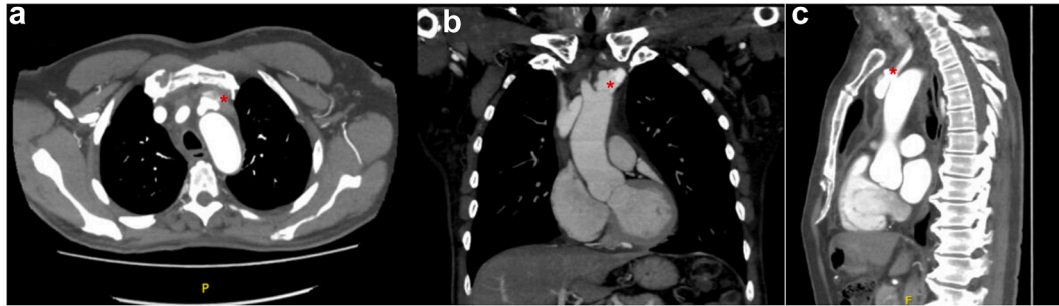


Fig 1. Left carotid-innominate fistula on computed tomography scan (*). Axial (A), coronal (B) and sagittal (C) sections.

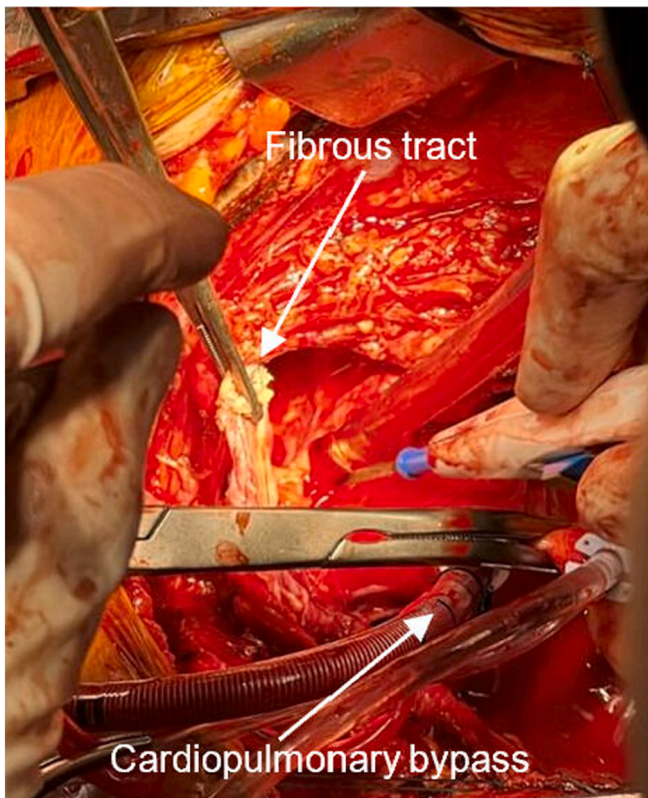


Fig 2. Dissection of the fibrous tract and supra-aortic vessels.

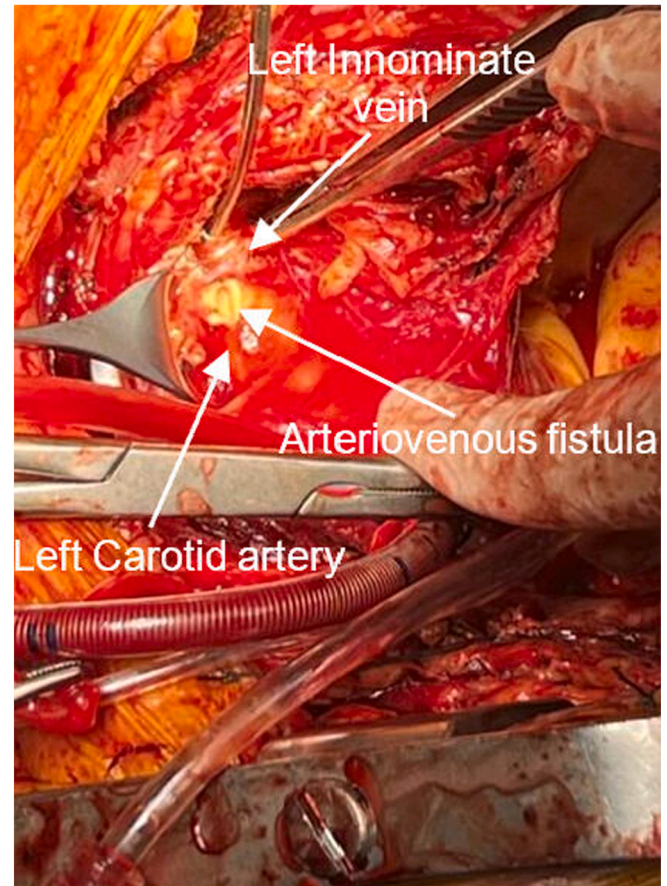


Fig 3. Identifying the arteriovenous (AV) fistula.

was initiated, the fistulous tract was resected and the defect repaired (Fig 4). The fistulous tract was resected, and an aorto-left common carotid arteriorrhaphy was performed. The SVC was reconstructed using a Dura-guard patch (Fig 5), and venorrhaphy was completed on the left innominate and subclavian veins (the latter with <30% circumferential injury).

The patient was weaned from cardiopulmonary bypass, but due to severe intraoperative coagulopathy, mediastinal packing was performed, with delayed sternal closure on postoperative day 3.

By postoperative day 5, following sternal closure, the patient showed gradual weaning from vasopressors and mechanical

ventilation. However, he developed a focal myoclonic status epilepticus episode so a cranial computed tomography scan was initially performed, which did not show expansive lesions, with evidence of a small, slightly hyperdense right posterior temporal cortico-subcortical sector surrounded by normal nervous tissue, which could correspond to a small vascular malformation. After this image, a brain magnetic resonance imaging was performed, with findings suggestive of hypoxic-ischemic encephalopathy with diffuse cortical involvement. Intensive



Fig 4. Resection of the fistulous tract.

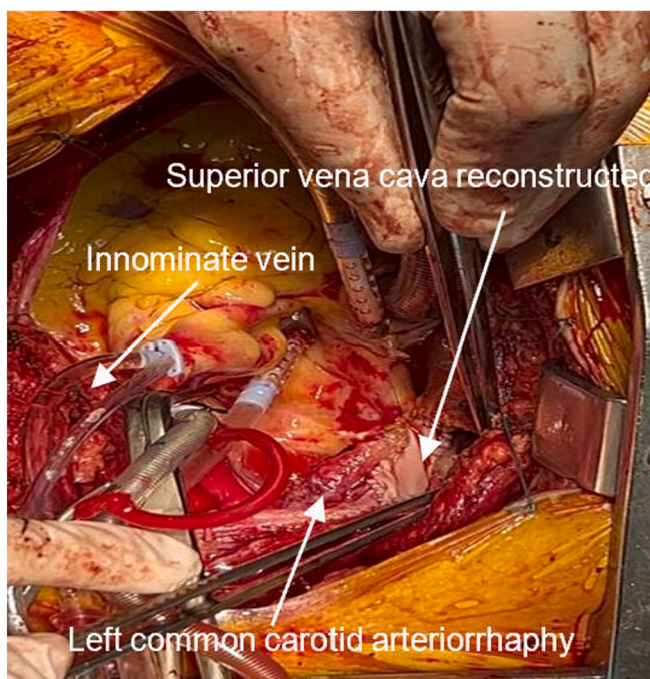


Fig 5. Superior vena cava (SVC) reconstruction using a Dura-guard patch and aorto left common carotid arteriorrhaphy.

Care continued with antiepileptic therapy and supportive measures. He progressively improved neurologically and hemodynamically, with no clinical or laboratory signs of bleeding. Comprehensive inpatient rehabilitation was initiated, and the patient was discharged home under chronic care approximately on postoperative day 14.

DISCUSSION

The development of an AV fistula following pacemaker lead removal requiring reoperation is rare, with an incidence of 0.16%, first reported in 1999.^{1,5}

The clinical presentation is usually insidious and may include chest pain, limb edema, murmurs or thrills, and progressive dyspnea. Few case series report more than eight patients, with endovascular stent placement used in approximately 52% of cases.³

Endovascular therapy has been described for the treatment of this rare condition, with brachial, direct carotid, and transfemoral access. Coil embolization, glue embolization, and coated stents are among the most commonly used and most extensively studied approaches. However, the tortuous anatomy may limit stent placement, and there may not be enough space for proximal sheath placement.⁶ Given the unfavorable anatomy in this case due to its tortuosity and short proximal section at the carotid level of the fistula, the decision was made to perform the procedure using an open approach.

Early surgical repair is crucial and is generally reserved for patients who are not candidates for endovascular management due to anatomical constraints or hemodynamic instability. Due to the low incidence and limited cases in the literature, there is still a significant gap in knowledge regarding surgical management.^{1,4}

As shown before, median sternotomy was performed that could allow confirm and correct the communication between the origin of the left common carotid artery, the innominate vein, and the SVC after cardiopulmonary bypass. The fistulous tract was resected, and an aorto-left common carotid arteriorrhaphy was performed. The SVC was reconstructed using a Dura-guard patch, and venorrhaphy was completed on the left innominate and subclavian veins and open chest reoperation due to coagulopathy. This approach may offer a viable alternative for achieving favorable outcomes when patients are not candidates for endovascular treatment.

CONCLUSIONS

Here, the authors present an alternative management of an AV fistula following pacemaker lead removal. Even do this approach is rare, it can allow optimal exposure, dissection, and safety correction of the fistula. Time to diagnosis and treatment is critical in optimizing patient outcome. Future research with larger, multicenter cohorts and standardized protocols is needed to standardize the optimal steps for the adoption of this technique.

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DISCLOSURES

None.

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