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CASE REPORT

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Iatrogenic subclavian arteriovenous fistula during permanent pacemaker implantation: Closed by endovascular coiling

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Abstract

Iatrogenic arteriovenous fistula is a unique complication during pacemaker implantation. A 55-year-old man was posted for pacemaker implantation for recurrent unexplained syncope with trifascicular AV block. After axillary/subclavian venous puncture and introduction of RV lead, arterial spurting was immediately noticed as the the sheath was peeled away. After dissecting the overlying pectoralis muscle, deep sutures and manual compression achieved hemostasis. However, Subclavian arteriogram revealed an arteriovenous fistula from a lateral thoracic artery branch to the innominate vein. Hilal coils were deployed near the fistulous orifice, leading to complete resolution of the leak. After 3 days, pacemaker was implanted from right side. A multidisciplinary approach was the key to successful outcome.

KEYWORDS
arteriovenous fistula, coil embolization, endovascular coiling, pacemaker implantation, subclavian AV fistula

1 | INTRODUCTION

Subclavian and axillary vein puncture are needed for various cardiac and noncardiac procedures, predominantly permanent pacemakers, implantable defibrillators, CRT implantation, electrophysiology procedures, central venous lines, and dialysis.[1] Although usually uncomplicated, this process can result in bleeding, pneumothorax, and hemothorax.[2] Rarely, subclavian venipuncture results in an arteriovenous fistula (AVF), which can be potentially life-threatening. Since the 1st report of such a fistula by James and Myers in 1973,[3] several case reports and series were published for subclavian AVF consequent to pacemaker lead extraction and hemodialysis catheter.[4–9]

2 | CASE

A 55-year-old gentleman presented with recurrent unexplained syncope. During the last episode, he also got a external head injury. The brain MRI was normal. Clinical examination did not show any evidence of focal neurological deficits or pre-existing cardiac disease. His ECG showed complete RBBB, left axis deviation, and prolonged PR interval (Figure 1). He was planned for dual-chamber permanent pacemaker implantation.

As per our routine protocol, a left subclavian venogram was taken as a pre-operative measure for axillary/extrathoracic subclavian vein puncture. After two successful venous punctures and confirming the passage of guidewire into IVC, a peel-away sheath was placed into the subclavian vein over one of the guide wires. Then a 58 cm screw-in ventricular lead (St Jude Medical) and introduced via this sheath into the right atrium. As soon as we peeled the sheath away, bright red arterial bleed was seen spurting beside the lead. As it did not stop after manual compression, our cardiovascular surgeon was called. The guide wires were pulled out. Although initial bites of 7-0 Prolene suture could control the external bleed, bulging of pectoralis muscle suggestive of internal tamponade was seen immediately thereafter.

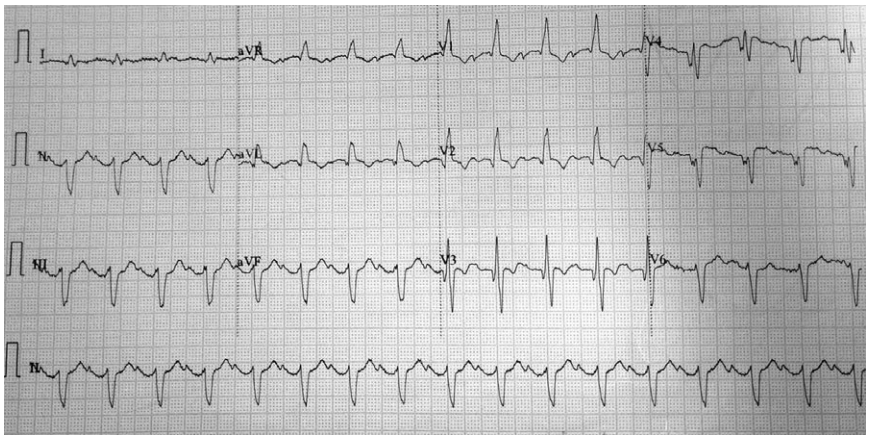

FIGURE 1 ECG showing complete RBBB, Left axis deviation and prolonged PR interval

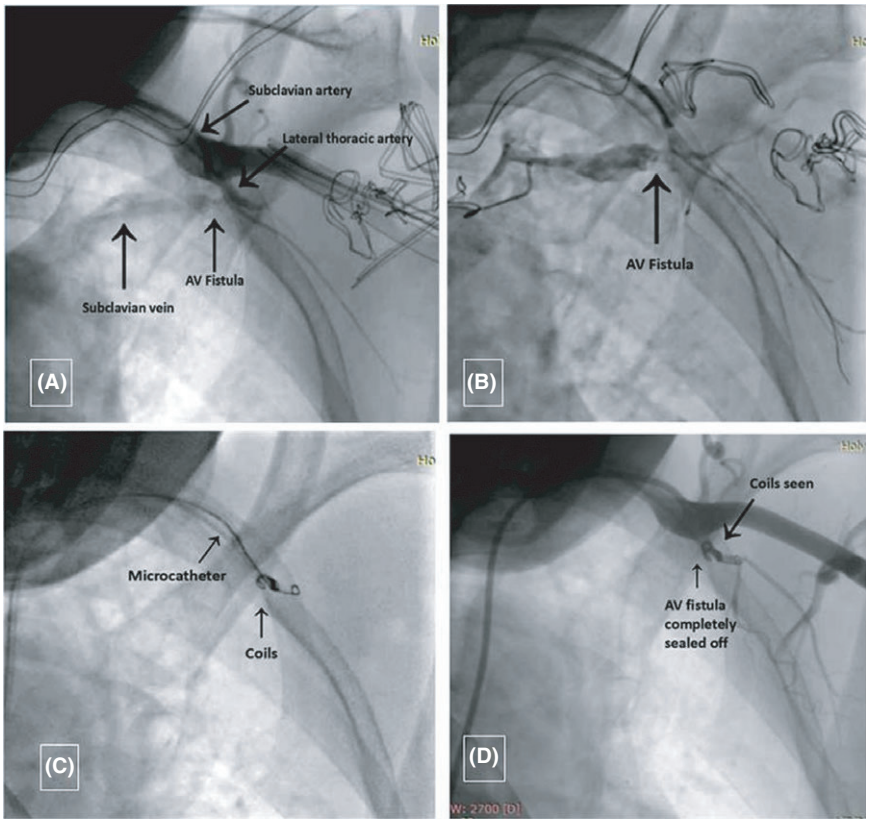

FIGURE 2 A, Digital subtraction angiogram (DSA) revealed arteriovenous fistula from a lateral thoracic artery to the innominate vein. B, Sion blue guide wire (Asahi) parked in the lateral thoracic artery. C, Hilal coils (COOK) deployed at the fistulous orifice. D, AV fistula completely sealed off at the end of procedure

Thus, the initial sutures were opened, the pectoralis muscle was split, deep sutures were taken, SurgiSeal gauze (Pfizer Inc.) was put into the wound to facilitate hemostasis, and with the suspicion of subclavian artery injury, further manual compression was applied.

After 40 minutes of manual compression, the pressure was released, and it was found that the active arterial spurting had resolved; however, there was a little gradual muscle ooze. A femoral artery puncture was taken, and subclavian artery angiogram was performed. The digital subtraction angiogram (DSA) revealed a significant AV fistula from a lateral thoracic artery branch to the innominate vein (Figure 2A).

The therapeutic options at that point considered were as follows:

1. Putting a covered stent at the site of leak to seal it off.
2. Coiling of the AV fistula.
3. Wait and watch policy (close later if it persists).

After discussion, a decision for percutaneous intervention was made as we felt the fistula was hemodynamically significant. We engaged the branch of subclavian with internal mammary artery guiding catheter. Selective lateral thoracic angiogram was performed to better delineate the fistula. A 0.014 inch nonhydrophilic guidewire (Sion Blue, Asahi INTECC, Japan) was parked in the lateral thoracic artery (Figure 2B). As the size of parent feeding vessel (lateral thoracic artery) was only moderate, we opted for endovascular coiling. A Progreat microcatheter (Terumo, Japan) was exchanged over the PTCA guidewire. Through the microcatheter, 4 Hilal coils (COOK

Medical, Indiana, USA) of 3 × 4 cm were deployed into the culprit artery branch near the fistulous orifice (Figure 2C) to seal off the leak. A check angiogram after 20 minutes of waiting showed complete resolution of leak (Figure 2D).

A dual-chamber pacemaker was implanted uneventfully from right side after 3 days. Now at 1 year follow-up, he is doing well without any recurrence of syncope.

3 | DISCUSSION

Subclavian vein catheterization is occasionally complicated by AVF formation; the incidence of this complication is estimated to be approx. 0.58%.[10] There are reports of subclavian artery-to-subclavian vein fistulae and few subclavian artery-to-brachiocephalic vein fistulae.[11] Such AVF could eventually lead to heart failure if left untreated, which can occur even after many years.[12,13] Long-standing AVFs can also lead to venous engorgement of the collateral veins, producing a continuous machine-like murmur, diminished radial pulses, and edema of the ipsilateral extremity when the shunt is large.[14] Infective endarteritis is another potential complication.

Surgical repair[15,16] involves considerable risk of morbidity and mortality; hence, the preferred treatment is covered stent-graft placement or endovascular coiling.[14] Our case is unique in the way it presented and was dealt with. Although there are several case reports of subclavian AVF during subclavian artery puncture for other reasons, till date there is no case reported during permanent pacemaker implantation. Our case also demonstrated that this entity needs multidisciplinary approach at times. After the bleeding is controlled, definite treatment could be stratified. Smaller AVF could be left alone, as some of them can close spontaneously. Moderate to large AVF should be closed with covered stent or endovascular coiling depending on the size of feeding vessel. In our index case, we planned to close it as the AVF shunt was significant. We chose coiling over cover stent-graft as the feeding vessel size was relatively small. Our interventional radiologist was called to deal with the final steps of coiling procedure.

We retrospectively analyzed the case what could have resulted in the AVF. We went through the venogram in detail. Although abnormal anatomy could be a possible cause of such complication, the anatomy was not abnormal in this particular case (Video S1).We believe it happened while the subclavian puncture needle went through the walls of a small arterial branch (lateral thoracic) before entering the subclavian vein (Figure S1). The punctures were extra thoracic (Video S2). The short J tip wire also passed through lateral thoracic artery into the subclavian vein. However, it was realized only after the outer sheath was peeled off.

We also would like to emphasize that often the standard subclavian arteriogram may not be able to delineate the fistula clearly and DSA more accurately delineates the site and magnitude of fistula which was pertinent for our index case too (Videos S3,S4).

Some precautions we can take to prevent such dreaded complication. We hypothesize the simple steps described below would help in avoiding inadvertent arterial puncture before the vein is entered:

1. Taking a subclavian venogram prior to puncture should be done to understand the variable venous anatomy (which was done in our case). It might allow us to avoid undesired arterial entry.
2. A gentle negative suction should be kept continuously while taking the needle inside so that even small arterial entry (before the target venous entry) could be identified and such puncture could be abandoned. A fresh puncture with different direction with the needle should be attempted. This is routinely followed by us and was carried out in the index case too, but probably we went inside little fast before realizing the small arterial puncture. We hypothesize that going in slowly would give a better chance to recognize even small arterial entry before the vein is finally accessed.

4 | CONCLUSION

Iatrogenic AV fistula is a unique complication during pacemaker implantation. At times, they can be hemodynamically significant and needs closure. A multidisciplinary approach is needed for proper decision making and successful treatment. Routine subclavian venogram, continuous gentle suction, and slower entry of needle might help in avoiding small arterial puncture resulting in iatrogenic AVF formation.

CONFLICT OF INTEREST

Authors declare no conflict of interests for this article.

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SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.

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