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The thrill is vanished: Percutaneous exclusion of post trans radial arteriovenous fistula using stent graft through transbrachial approach

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Abstract

Radial arteriovenous fistula (AVF) following radial intervention is exceedingly scarce. Here, we report a case of a 73-year-old man who was admitted with acute myocardial ischaemic syndrome and underwent transradial angioplasty of the proximal left anterior descending and circumflex artery. Fourteen months later, he presented with progressive swelling, dilated superficial veins, a palpable thrill, continuous bruit, and tingling at the local site. Doppler ultrasonography (DUS) diagnosed radial AVF with multiple fistulous communications draining into the cephalic vein, confirmed by contrast-enhanced computed tomography (CECT). Local compression using a prolonged compressive bandage (>12 hours) and a DUS probe was attempted but remained ineffectual. A 2.8 × 26 mm Graftmaster stent graft (Abbott Vascular, USA) was deployed into the radial artery across the fistula neck via a transbrachial approach, slowly expanded over 60 seconds at 12 atm pressure, and post-dilated with a 3 × 15 mm noncompliant balloon at 15 atm pressure. A post-procedure angiogram displayed complete closure of the fistula with restoration of palmar arch perfusion. This is the first reported case of successful exclusion of RAVF through transbrachial approach using a ever covered stent, and only the second case overall of percutaneous exclusion using a stent graft.

Keywords: Radial Arteriovenous Fistula; Trans-radial Catheterization; Vascular Ultrasound; Covered Stent

Introduction

Transradial access scores over transfemoral access by virtue of reduced vascular access complications[1]. The overall incidence of radial AVF (RAVF) is extremely low, reported at 0.04% in a study by Tatli et al. among 10,324 patients, which underscores its rarity. However, as the volume of transradial interventions continues to rise, many more cases are likely to emerge, highlighting the need for proper diagnostic workup and management[2]. During arterial stick, needle aberration may occur into a venous tributary in the vicinity of the artery, leading to arteriovenous communication, which usually seals instinctively. If it persists, it may result in RAVF[3]. Large RAVFs may lead to mechanical complications such as high-output heart failure, swelling, rupture, ischemic-like numbness, and, rarely, limb ischemia. Unlike the varied modalities such as surgical exploration, stent graft exclusion, and ultrasound-guided compression for femoral arteriovenous fistula, a clear-cut consensus for RAVF is lacking due to the paucity of cases and data[4]s

Case report

A 73-year-old man was admitted with acute myocardial ischaemic syndrome. Coronary arteriography through the right radial artery using a 6-French sheath revealed critical double-vessel disease involving the proximal left anterior descending and circumflex arteries, which were subsequently stented using 3.5 × 32 mm and 3 × 28 mm Vivo Isar dual-drug polymer-free Sirolimus-eluting stents (Translumina Therapeutics, Germany), respectively. The patient was discharged in stable condition.

Progressive swelling with dilated superficial veins, a palpable thrill, and an audible continuous bruit were noted, along with tingling at the local site fourteen months later (Fig. 1A). On clinical examination, vital signs were stable. Pulse rate was 78/min, with a high-volume pulse. There was no circulatory compromise to the hand, and the Barbeau test was normal. His electrocardiogram, skiagram postero-anterior view, and routine investigations including biochemistry were normal. Transthoracic echocardiography (TTE) revealed a normal ejection fraction with grade II diastolic dysfunction. DUS confirmed a radial AVF with multiple fistulous communications draining into the cephalic vein, showing turbulent high-velocity continuous jets on colour Doppler (Fig. 2A), which CECT further validated.

Figure 1. A: Swelling with dilated superficial veins in distal forearm at the local site of radial access; **B**: Complete disappearance of swelling and visible veins after stent graft placement

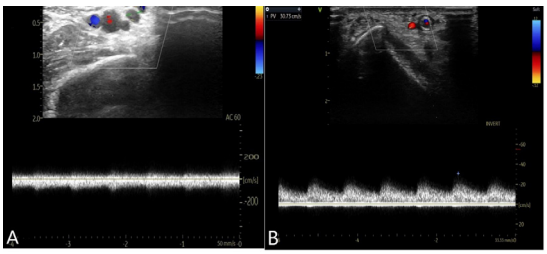

Figure 2. A: Vascular ultrasound showing high flow continuous turbulence, and vein dilation multiple fistulous communication; **B:** Complete exclusion of RAVF with visible stent in the lumen

In light of the above diagnosis, local compression using a prolonged compressive bandage (>12 hours) and a DUS probe was attempted but proved futile. Surgery was recommended, which was declined by the patient, leading to a decision for transcatheter percutaneous closure of RAVF.

Right transbrachial access was antegradely obtained using a 7-French, 6 cm sheath (Cordis Corp., Florida, USA). A cocktail containing 250 µg nitroglycerin (NTG), 3 mg diltiazem, and 6000 IU of unfractionated heparin was administered. Radial arteriography via a 6-French Femoral Right (FR) Mach 1™ guide catheter (Boston Scientific, USA) revealed a RAVF feeding into multiple large veins through a large vascular neck (Fig. 3A), with vascular steal as the palmar arch was barely visualized. A 0.014-inch Runthrough wire (Terumo Inc., Japan) was placed into the palmar arch to augment support. A 3 × 15 mm Minitrack semi-compliant balloon (Abbott Vascular, Illinois, USA) was inflated to delineate the fistula (Fig. 3B). Subsequently, a 2.8 × 26 mm Graftmaster stent graft (Abbott Vascular, Illinois, USA) was positioned across the fistula and slowly deployed over 60 seconds at 12 atm pressure, followed by post-dilation with a 3 × 15 mm noncompliant balloon at 15 atm pressure (Fig. 3C). A post-procedure arteriogram confirmed complete exclusion of the fistula and restoration of palmar arch perfusion (Fig. 4A). The local site was packed with a light pressure bandage following removal of the sheath after 60 minutes. The bruit quickly disappeared, and the local swelling was completely unobservable after 5 days (Fig. 1B), as confirmed by DUS (Fig. 2B). The patient was discharged the following day with relevant guidance.

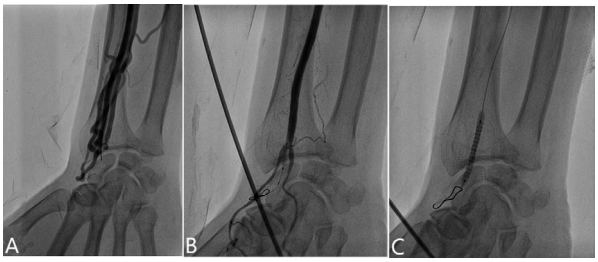

Figure 3. **A**: Radial angiogram unveiling RAVF feeding into multiple large veins through a large vascular neck with vascular steal; **B**: Contrast filling the palmar arch after inflation of semi compliant balloon; **C**: 2.8 x 26-mm Graftmaster stent graft (Abott Vascular, Illinois, USA) being deployed to exclude the fistula

Figure 4. **A:** Arteriogram displaying total elimination of the fistula and visualization of palmar arch; **B:** Volume rendered reconstruction of RAVF at a one year follow up

Discussion

Access site swelling following transradial catheterization may be attributed to hematoma, abscess, cyst, or radial artery pseudoaneurysm (RAP). Hematomas are painful and acute, while abscesses present with constitutional symptoms, are often tender, and rarely fluctuant. They feature an irregular thickened wall and internal debris with acoustic enhancement, which becomes mobile upon compression by the ultrasound probe. Cysts are smooth, painless, anechoic, and well-circumscribed. RAPs are soft, tender, and often non-pulsatile, with a distinct puncture point that may rarely be pulsatile; bruit can be audible, although dilated superficial veins and thrill are notably absent—unlike RAVF. RAPs have a short neck, variable echogenicity, and a wall lacking all three arterial layers, with swirling low turbulent flow appearing as a to-and-fro waveform on colour Doppler.

Most RAVFs tend to present early (<4 weeks), though late presentation (>6 months) has also been reported. Spontaneous closure has been observed in many patients[4]; however, a few have presented with functional disability very late, warranting treatment beyond conservative approaches. Delayed onset, wide neck, high-velocity turbulence, and ongoing antiplatelet treatment may be contributing factors in the failure of conservative management.

Besides surgery, RAVFs have been closed percutaneously using covered stents[5] and coils[6]. To the best of our knowledge, only one case of RAVF following distal radial intervention through the proximal part of the right radial artery has been reported[5]. One option could have been stent placement in the draining veins, but multiple feeders and sluggish flow may lead to stent thrombosis. As the fistula was arising at the conventional radial access site, another radial access was not considered, as it would have been proximal and deeper, carrying a risk of hematoma and perforation.

Transbrachial access was chosen in our case as it easily accommodated a larger sheath (>6 Fr), since delivery of the Graftmaster stent graft can be difficult with a 6 Fr guide catheter. Complete occlusion of the fistula by balloon inflation helped us in sizing the stent.

As far as the safety of transbrachial access and the patency of the covered stent in the radial artery are concerned, we have experience with successful exclusion of radial artery pseudoaneurysm, with excellent patency at 1 year[7]. This is the first report of successful transcatheter elimination of RAVF through transbrachial access using a stent graft, and the second reported case overall. At 12 months' follow-up, the radial artery was patent and the RAVF was completely closed (Fig. 4B).

Learning Objectives

1. RAVF should be considered in the differential diagnosis of access site swelling following transradial intervention.
2. Though rare, more cases are likely to arise as the volume of transradial interventions gradually increases.
3. Percutaneous exclusion of RAVF via stent grafting is a viable alternative to surgery, offering excellent long-term results.

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Conflict of interests

The authors declare no conflict of interest.

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Author's Contributions

Study Conception or Design: SKS; MJJ; MR; AKS
Data Acquisition: SKS; MJJ; AKS
Data Analysis or Interpretation: SKS; MJJ; MR
Manuscript Drafting: SKS; MJJ; UP
Critical Manuscript Revision: SKS; MJJ; UP
All authors have approved the final manuscript and are responsible for all aspects of the work.

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