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Case Report

Intraplug coils delivery for fast closure of giant arteriovenous fistulas (AVFs) aneurysm in dialyzed patient

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ABSTRACT

Aneurysm of arteriovenous fistulas (AVFs) created for hemodialysis, could be related with several complications including steal syndrome and cardiac abnormalities, requiring thus a fast closure. Considering the high comorbidity of surgical closure, percutaneous endovascular occlusion could be considered as effective and safe treatment. A 58-year-old white male with AVF aneurysm was treated endovascularly, using a combined approach with Amplatzer Vascular Plug II (AVP II) and intraplug coils delivery pricking directly and percutaneously the plug with a 20 G spinal-needle to obtain a fast closure and improving AVP thrombogenicity. To avoid the risk of migration due to the large diameter of these aneurysm, AVP was deployed at the narrowest point of AVFs, exploiting the maximum diameter of the plug using arteriography and fistulography. Patient described quick improvement of initial symptoms and during the follow-up a complete remission of initial symptoms, and no cases of plug migration were observed. There were no late complications related to insertion of the AVP with the coils. Our case report suggests that the endovascular approach is a feasible and safe technique also for the treatment of AVFs giant aneurysm which requires urgent treatment when open surgery is contraindicated.

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Introduction

The incidence of aneurysm formation on arteriovenous fistulas (also Cimino-Brescia fistula, AVFs), created for hemodialysis, is approximately 5%-7% [1]. Several complications have been reported from aneurysmal AVFs degeneration, including steal syndrome and cardiac abnormalities. The chronic volume overload induced by the AVF may induce structural and functional cardiac changes, leading to left ventricular remodeling [2]. Various previous reports have suggested high-output cardiac failure subsiding after AVF closure [3]. Therefore a fast closing it's necessary and considering the high comorbidity of surgical closure, in recent years, interventional radiologists have become increasingly involved in the evaluation and treatment of malfunctioning dialysis access [4].

Although percutaneous occlusion of tributaries and accessory veins as well as occlusion of whole access circuits as an alternative to surgical ligation has been reported [5], endovascular closure of giant AVFs aneurysm has not yet been reported.

We present a case report of a dialyzed patient who developed complication due to a giant true AVF aneurysm, in which a coils assisted plug closure was performed. In this case surgical ligation cannot be performed, and after a multidisciplinary consensus we decided to treat this with endovascular therapy. Thus we decided to use Amplatzer Vascular Plug II (AVP II) and coils to obtain a fastest occlusion of AVFs.

Case report

A 58-year-old white male with a pulsatile vibrating mass in correspondence of the AVF on the right arm (Fig. 1A). He had recurrent hypotensive crisis, and he was tachycardia (130 bpm) and he had steal syndrome. No signs of an active vascular inflammatory illness such as fever and/or elevation of the erythrocyte sedimentation rate were present. There was no evidence of tissue loss to the hand or forearm. An ultrasound examination confirmed the presence of giant AVFs aneurysm.

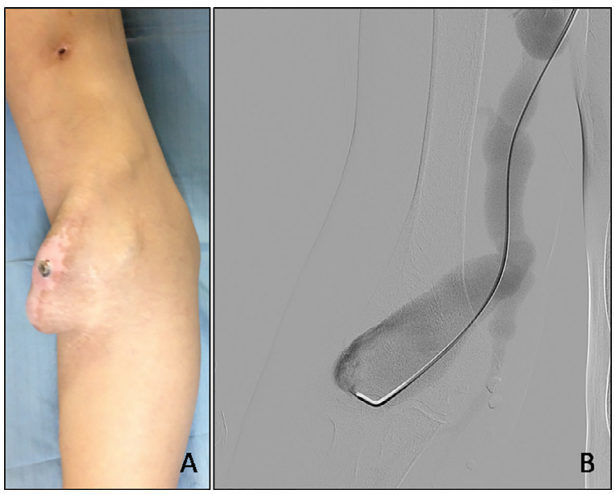

Fig. 1 – (a) AVF aneurysm in patients with cardiac abnormalities. (b) Diagnostic contrast fistulography shows giant aneurysm of AVFs.

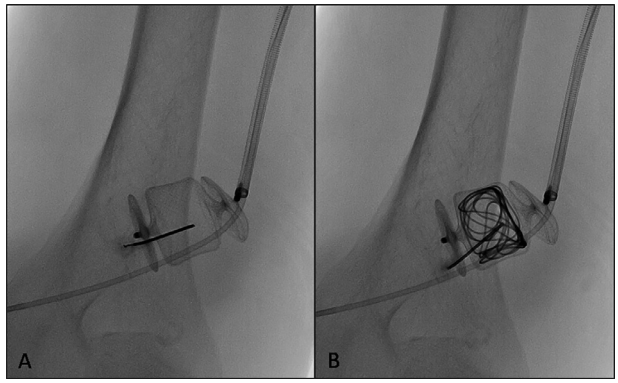

Fig. 2 – (a–b) Percutaneous plug puncture with a 20 G spinal-needle and 0.020" wide diameter Penumbra coils delivery. Figures show the optimal angle for performing a plug puncture (45°).

Before endovascular procedure an alternative dialysis access was provided. Written informed consent was obtained.

After skin disinfection and local anesthesia (10 mL lidocaine-hydrochloride) a preprocedural arteriography was performed to assess the patency of the vessels of the upper limb, through a 4Fr right femoral introducer sheath and selective catheterization of the brachial artery.

After skin disinfection and local anesthesia a venous access was performed in direction of the dialysis graft with the tip of a 25-cm long 7Fr introduce sheath proximal to the AVF surgical anastomosis. Diagnostic contrast fistulography was obtained also to detect any retrograde or collateral flow besides the main outflow vein and outline the anatomy (Fig. 1B)

The site of embolization was identified and measured using both modalities. To avoid risk of migration, due to the large diameter of aneurysm, AVP was deployed at the narrowest point of AVFs, exploiting the maximum diameter of the plug.

We used a 22 mm AVP II device. The device was deployed by retracting the sheath over the deployment wire, to obtain a closure of cephalic vein. To obtain a fast and effective closure, we decided to directly prick percutaneously the plug with a 20 G chiba-needle. Spindle has been extracted and replaced by a 0.020" wide-diameter Penumbra coil (28 mm × 60 mm). In this case we were able to replace 4 coils. The delivery of the coils was carried out to fill the plug as such as possible (Fig. 2A). In order to avoid that the coil push-out the needle, we found that the optimal angle for performing a plug puncture was 45° (Fig. 2B).

Fistulography and arteriography confirmed complete exclusion of the fistula, and showed the appearance of forearm arteries. Upon confirming accurate placement the deployment wire was removed by rotating it counter clockwise. Postprocedural control confirmed the occlusion of the AVF.

No procedure-related complications were observed. No radiologic or clinical signs of distal ischemia or perfusion defects

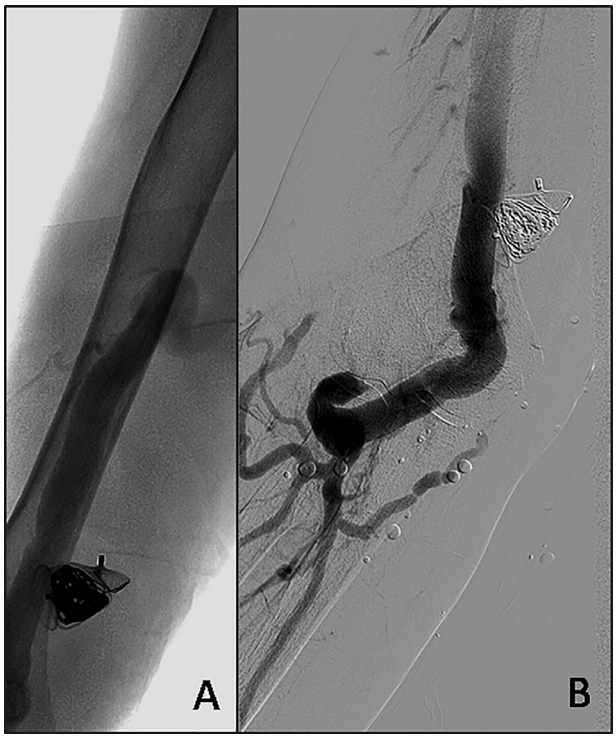

Fig. 3 – (a–b) Continuing occlusion was confirmed at 4 weeks by diagnostic contrast fistulography.

were seen. The procedural time was 29 minutes. Continuing occlusion was confirmed at 4 weeks by diagnostic contrast fistulography (Fig. 3A–B) and 3 months by duplex sonography.

Patient described quick improvement of initial symptoms and during the follow-up a complete remission of initial symptoms and we did not observe plug migration. There were no late complications related to insertion of the AVP with the coils.

Discussion

In AVF created for hemodialysis, rare cases of true aneurysms have been described [6]. Surgical closure of an AVFs aneurysm should be considered the first line procedure to occlude these accesses. However, surgery is not always easy to perform owing to comorbidities, ulcerations, or extensive swelling of the extremity. True AVFs aneurysms must be quickly treated due to the risk of local and systemic complications, including steal syndrome, cardiac abnormalities, embolization, thrombosis, skin erosion and infection, bleeding, and compression of adjacent nervous structures, producing paraesthesia, pain, and reduced mobility [7]. In addition to these factors, patients receiving hemodialysis on a chronic basis have delayed wound healing, which may be an indication for re-evaluation of the interventional procedure if surgery would require a wide incision, especially in presence of giant aneurysm. Moreover in critical cases, in patient who need a fast and noninvasive closure of AVFs due to the presence of heart complications and steal syndrome, percutaneous emblotherapy has become the treatment of choice [4].

Today, AVP has a wide use for extracardiac procedures such as arterial and venous embolization. Single cases of AVP use in embolization AVFs have also been reported [5,8,9]. To our knowledge only 3 cases of AVP use as a coil constrainer were described [5,8,9], and surely no cases of giant aneurysm.

In our reported case the patient had giant AVFs aneurysm with a maximum diameter larger than 3 cm and indications for a quickly and noninvasive embolization, (critical hand ischemia and cardiac symptoms). The progressive hand ischemia probably is due to a loss of arterial originating anywhere between heart and dialysis hand, and it's very important identify source of blood pressure loss. If angiography excludes a stenotic subclavian, axillary or brachial artery, a blood pressure decrease may be caused by the total venous outflow including main tract and its branches. As a consequence, closure of AVFs with preservation of the main tract is hypothesized to attenuate blood pressure loss.

Owens et al used successfully an AVP as a coil constrainer during the endovascular occlusion of a hemodialysis fistula, without aneurysm degeneration [5]. We certainly agree with the authors that a coil assisted plugging of AVFs or AVFs aneurysm may prove useful particularly when patients have severe symptoms and a rapid occlusion of the AVF aneurysm is mandatory.

The authors used a 3-Fr catheter as it was guided into the Amplatzer Vascular Plug and deployed a 6-mm diamond-shaped-18 fibered platinum microcoils. However the endovascular occlusion of a giant AVFs aneurysm, may burdened by a high risk of AVP misplacement and migration. In this case, we think that the use of a catheter in order to widening the metal mesh of AVP, may increase migration risks.

To avoid this issue we positioned the AVP at the narrowest point of venous anastomosis, working with the maximum diameter of the plug and we used a 0.020" wide-diameter Penumbra coil. The advantage to use a 0.020" coil was that we can use only a 20 G chiba needle to insert them in AVP, by a directly, safety and easy puncture of the plug. Moreover we found that the optimal angle for performing a plug puncture was 45°. Using this type of coil we were able to be still less invasive.

In other few cases described in literature the only use, in AFVs closure, of the AVP has been demonstrated not always sufficient, and coils and n-butyl-2-cyanoacrylate were necessary to achieve complete occlusion, with a satisfactory short-term follow-up [10]. A very interesting point of our reported case was that patients requiring an immediate care. Thus using this approach we were able to treat these symptoms quickly. Indeed the procedural time was only 29 minutes, without major or minor complication. The ability of the AVP II to adjust the shape of the vessel is a great advantage, and, if the device position is unsatisfactory, it can be repositioned or removed enabling more precise placement within the fistula. Its larger diameter compared with the first generation of AVP, will likely decrease the need for multiple AVPs however for the treatment of giant A-V aneurism adjunct embolizing agents were needed in order to obtain a prompt occlusion, confirming the optimal role of this device as coil constrainer. In conclusion we would like to emphasize that AVFs aneurysm are

complication, even if uncommon, that can be very dangerous to patient's health. As such, it is essential carried out a right diagnosis for proper treatment planning, since the appropriate treatment varies with each case. Our case suggests that the endovascular approach is a feasible and safe technique also for the treatment of AVFs giant aneurysm which requires urgent treatment when open surgery is contraindicated.

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