

Treatment of recurrent popliteal artery aneurysm with Onyx® embolization

Embolização da reperfusão do aneurisma da artéria poplítea com Onyx®

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Abstract

The popliteal artery aneurysm is the most frequent of the peripheral aneurysms. Although asymptomatic, it can complicate with severe limb ischemia due to embolization or thrombosis. The surgical correction presents well-established techniques and results, while the less invasive endovascular therapy is still evolving. The recurrence is very rare and can be related to collateral artery refilling. We report a recurrent popliteal artery aneurysm after two years of conventional ligation and bypass surgery, in which an alternative endovascular strategy was successfully applied.

Keywords: aneurysm; popliteal artery; embolization, therapeutic; dimethyl sulfoxide; endovascular procedures.

Resumo

O aneurisma da artéria poplítea é o mais frequente dos aneurismas periféricos verdadeiros. Embora seja assintomático, apresenta complicações isquêmicas por embolia ou trombose. A correção deste aneurisma pode ser cirúrgica convencional, com técnica e prognóstico bem estabelecidos, ou endovascular, técnica inovadora e menos invasiva. A reperfusão do saco aneurismático excluído, apesar de rara, está relacionada à intensa circulação colateral. Relatamos um caso de aneurisma de poplítea, que após dois anos de exclusão apresentou fluxo no saco aneurismático com sintomatologia, sendo tratado por técnica endovascular alternativa.

Palavras-chave: aneurisma; artéria poplítea; embolização terapêutica; dimetil sulfóxido; procedimentos endovasculares.

Introduction

Aneurysm is a permanent and localized dilatation of a blood vessel by more than 50% its normal diameter^{1,2}. Popliteal artery aneurysms (PAA) account for 12% of all aneurysm. They are the most common true peripheral aneurysms¹⁻³, far more frequent in males and are usually associated with aneurysms of other arteries¹⁻³. Most PAA have unknown etiology, are asymptomatic and the most common complication is lower limb ischemia from embolism or thrombosis¹⁻³. The elective treatment is indicated in most

cases, for the risk of limb loss is almost 50% in the event of complications⁴.

The treatment of PAA may be conventional or endovascular⁴⁻⁷. Conventional surgical treatment consists of proximal and distal ligation to the aneurysm, and revascularization through a bypass. Despite the well established technique and well known prognosis, cases of aneurysm reperfusion have been reported. The case we report herein is that of a patient submitted to conventional treatment with aneurysm left popliteal artery exclusion, who presented reperfusion two years after the procedure.

Study carried out at Hospital Municipal Salgado Filho (HMSF) – Rio de Janeiro (RJ), Brazil.

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Case Report

MFAMA, 52-year-old female patient with hypertension. In 2008, she was submitted to left popliteal artery bypass with reversed saphenous vein bypass and proximal and distal ligation of the aneurysm. She was followed in the outpatient clinic and two years later she presented with a recurrent pulsatile mass on the left popliteal fossa, and intense local pain.

Duplex scan mapping showed the popliteal bypass to be patent and aneurysmal sac filling.

Angiography showed a proximal ligation (at the supragenicular popliteal artery), a distal ligation (at the infragenicular popliteal artery), and patent popliteal artery bypass, with aneurysm sac filling by collateral circulation (Figure 1).

We chose an endovascular approach in the Angiography Suite, with the patient under spinal anesthesia. The access



Figure 1. CT angiography showing popliteal artery proximal ligation, patent popliteal artery bypassed, and infrapatellar popliteal artery distal ligation. Note the aneurysm filling by multiple collateral branches.

was performed by antegrade puncture of the ipsilateral common femoral artery and introduction of a 5Fr sheath. Angiography of the left lower limb showed the genicular branches of the popliteal artery filling the aneurysm sac (Figure 2). Selective catheterization of the left superior genicular branch using an IM 5F catheter supported by a hydrophilic guidewire of 0.035 pol x 150 cm was achieved. After contrast injection, it was observed aneurysm filling and reflux into the right superior genicular and medium genicular branches.

Next, superselective catheterization of the aneurysm sac (nidus) with a Rebar 10° microcatheter (ev3, MA, EUA) over a 0.010 pol x 180 cm guidewire was achieved (Figure 3). After confirmation of the position of the microcatheter tip by non-ionic contrast media, the exact volume of contrast needed to fill the aneurysm sac was estimated, and the collateral branches (Figure 4). The microcatheter was filled with dimethyl sulfoxide (DMSO) and 1.5 mL of Onyx® was injected into the sac. injection of (ev3, MA, EUA) (Figure 5). Next, catheterization of the right superior genicular artery using a MP 5Fr catheter was performed.

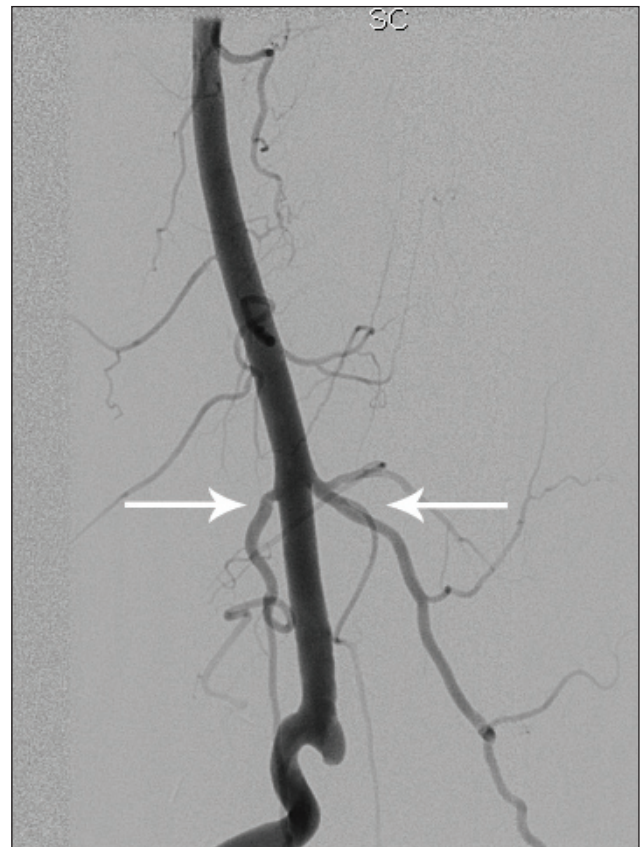


Figure 2. Preoperative CT angiography aiming at the identification of superior genicular branches origin (white arrows).



Figure 3. Roadmapping imaging showing the micro-catheter through the left superior genicular branch, with two radiopaque marks in the catheter's tip positioned inside the aneurysmal sac.



Figure 4. Right positioning of the catheter's tip with contrast injection into the aneurysm, and identification of the necessary amount of contrast to fill the nidus and the origin of genicular branches.



Figure 5. Embolization of the aneurysmal sac with Onyx® liquid at roadmapping.

A Rebar 10® microcatheter was used on a 0.10 guidewire was positioned in the aneurysm sac and a further 1.5 mL of vial of Onyx® was injected. Control angiography showed normal arterial flow thorough the bypass, but no longer filling of the aneurysm sac (Figures 6 and 7).The patient was discharged from hospital on the next day, and was completely asymptomatic on follow-up visits at the outpatient clinic. Duplex scan a month later showed absence of flow in the medium portion of the popliteal artery and in the aneurysm, and patent popliteal artery bypass with triphasic flow in distal arteries.

Discussion

Open conventional surgery is the treatment of choice for popliteal aneurysms, for it provides satisfactory and long-lasting results¹⁻⁴. Aneurysm exclusion plus femoro-popliteal bypass is the standard technique, presenting



Figure 6. Follow-up CT angiography showing good flow through bypass, the radiopaque embolic material in the aneurysm, and collateral branches.

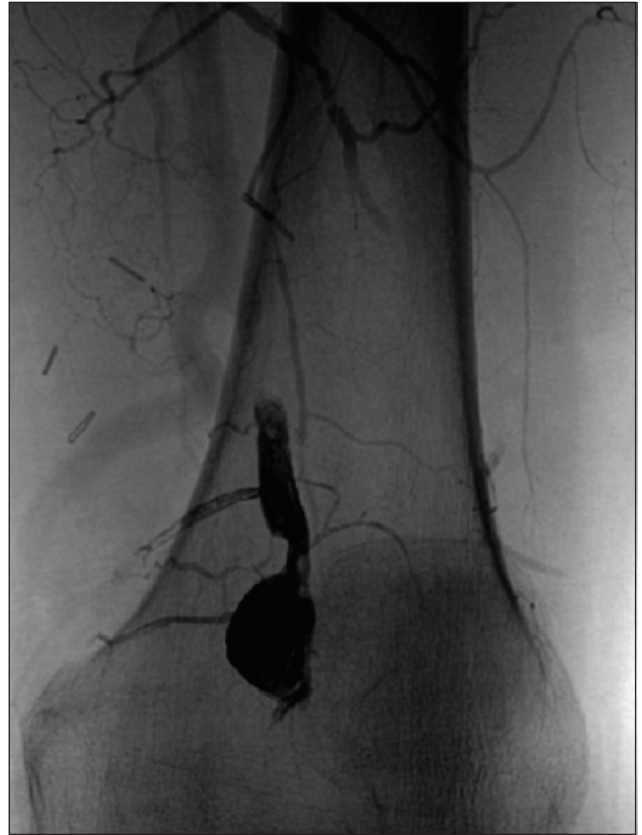


Figure 7. Late follow-up CT angiography showing radiopaque occlusive substance in the aneurysmal sac and the origin of genicular collateral branches.

success rate of 90%⁴. The most common complication of this surgery is bypass t occlusion, which may cause ischemic symptoms.

Popliteal aneurysm recurrence after conventional surgical treatment is rare. Its etiology is related to the presence of blood flow in the aneurysmal sac owing to intense collateral circulation of genicular branches¹⁻⁴. This way, the aneurysm may continue to grow, and cause symptoms of compression and even rupture⁵. Surgical treatment for this condition may be difficult due to the number of collateral branches and the difficulty in identifying them.

In the present case, the hemodynamic situation was similar to that of a type II endoleak frequently observed in aortic abdominal aneurysms. For this reason, we decided to perform endovascular embolization, with the objective of occluding the genicular branches filling the aneurysm sac^{8,9}. Onyx® was the embolization agent of choice because of its filling effect. It allows a controlled injection into the aneurysm sac, filling it with embolic material and with continuous diffusion to the feeding

arterial branches. Onyx® is a solution of ethylene vinyl alcohol copolymer dissolved in DMSO (dimethyl sulphoxide), an embolizing liquid agent designed for use in endovascular procedures. When this solution is mixed with an aqueous medium such as blood, it precipitates and forms layers of semi-liquid copolymer foam^{8,9}. This agent is safer compared to others, for it allows a slow and controlled injection because it is highly viscous and presents a longer polymerization period. Another interesting feature is the radiopacity added by the tantalum powder present in this agent. It allows a better visibilization of the images, compared with other embolizing agents. Filling the micro-catheter with DMSO immediately before Onyx® injection prevents its precipitation along its path. This maneuver allows a more predictable behavior, thus avoiding adhesion of the catheter's tip to the blood vessel, which is frequent in procedures using cyanoacrylates¹⁰. When Onyx® solution mixes with blood, DMSO rapidly diffuses, causing *in situ* precipitation and solidification of the polymer, forming a foam that does not

adhere to the vessel wall¹¹. Despite its off-label use for the treatment of type I and II endoleaks after endograft implantation in abdominal aortic aneurysm, Onyx® has been approved by the *Food and Drug Administration* (FDA) only for use in embolization of cerebral arteriovenous malformation (AVM)⁸. In this particular case, we followed the same strategy used for type II endoleak treatment. Some disadvantages of Onyx® include potential vasospasm and angionecrosis, especially associated with a fast injection of DMSO, which can be avoided by following the manufacturer's recommendation of not exceeding an injection velocity of 0.3 ml/min. Like with any embolizing agent, severe ischemia may occur in case of inadvertent distal embolization⁸. Artifacts in CT angiography caused by the embolization material can make postoperative imaging follow-up difficult. In this case, embolization was performed in a peripheral vessel that can be easily approached by duplex ultrasound, thus follow-up imaging should not be a problem.

Endovascular treatment was effective in this case, for it decreased the chance of recurrence by direct occlusion of the aneurysmal sac and feeding branches. The technique was easily performed despite being minimally invasive.

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