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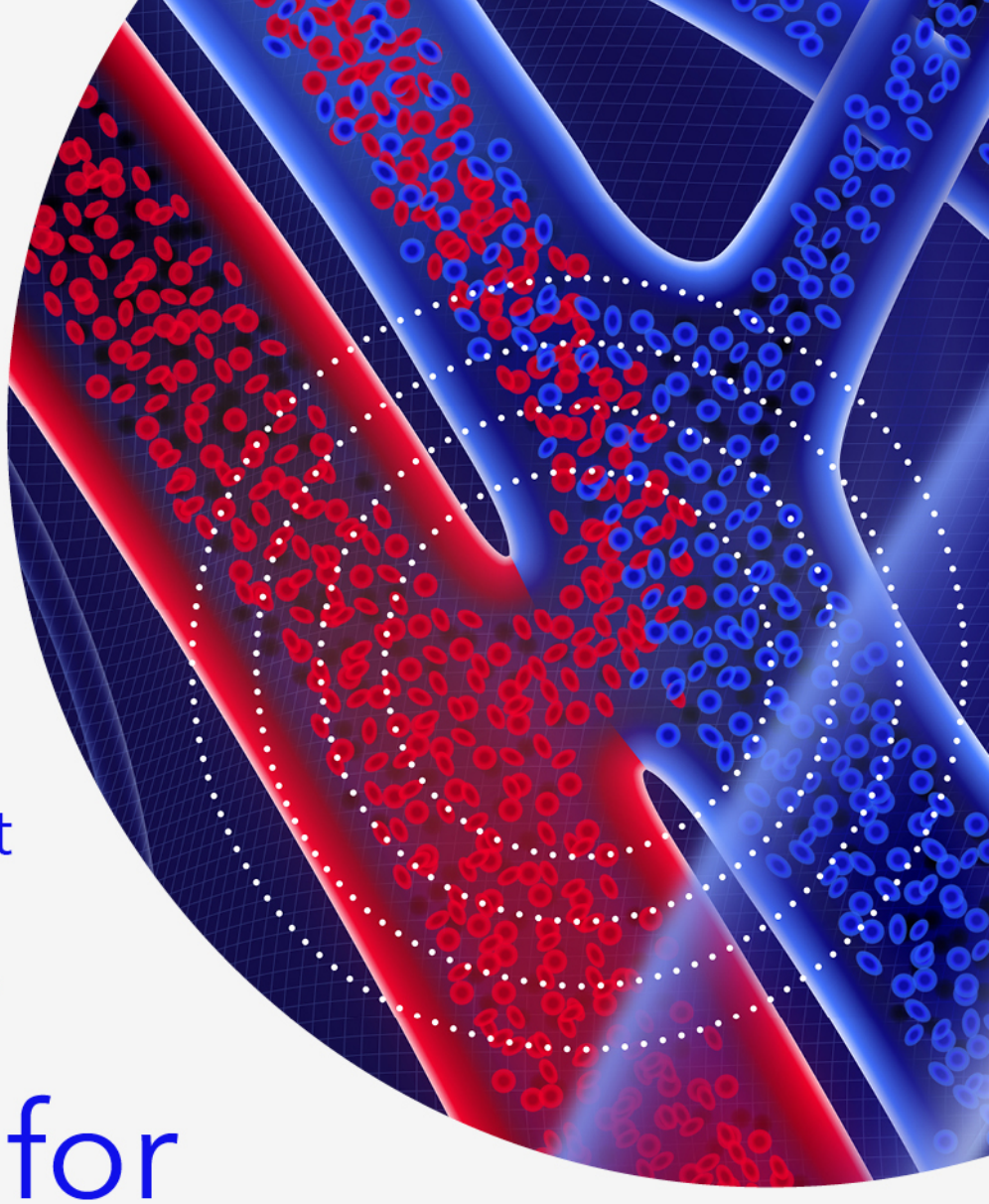

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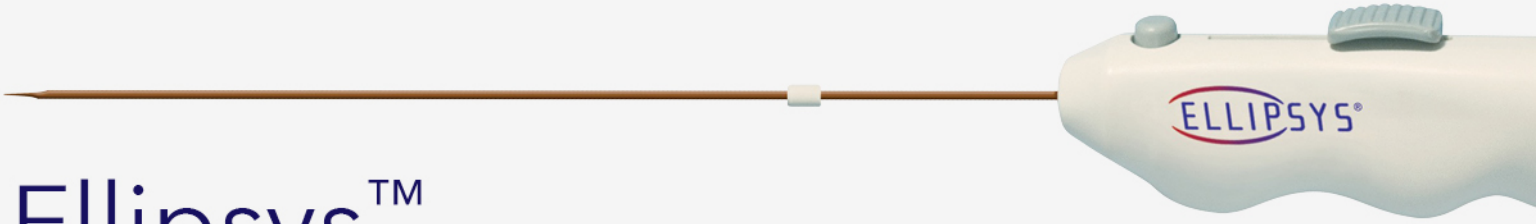

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CASE REPORT

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Ruptured arteriovenous fistula pseudoaneurysm treatment by balloon-assisted direct percutaneous thrombin injection

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Abstract

We present the case of a male patient on hemodialysis with a ruptured pseudoaneurysm in a brachiocephalic arteriovenous fistula (AVF) and with edema and pain in the right arm attended to in the emergency department. An ultrasonographic scan identified a ruptured pseudoaneurysm with hemorrhagic infiltration of the arm muscular tissues. We performed a percutaneous ultrasound-guided thrombin injection with an angioplasty balloon inflated in the lumen of the AVF achieving the pseudoaneurysm thrombosis. After 6 months of follow-up, the patient's arteriovenous access remains functional. Percutaneous ultrasound-guided thrombin injection assisted by an angioplasty balloon may be a good alternative to surgical intervention in the treatment of symptomatic growing pseudoaneurysms of the arteriovenous fistula with the benefit of preserving the vascular access.

1 | INTRODUCTION

The arteriovenous fistula (AVF) is the preferred vascular access for hemodialysis (HD) due to its longer patency and lower complication rate.[1,2] However, the AVF can develop some complications compromising vascular access patency.

Pseudoaneurysms in arteriovenous HD accesses are important and relatively common complications.[3] Our clinical practice has shown that pseudoaneurysm formation can be caused by access cannulation or needle removal. In fact, this problem can occur if, in the cannulation process, the nurse uses the area cannulation[3,4] or transfixes the posterior vein wall. Moreover, removal of HD needles after treatment involves compression for hemostasis. Sometimes, such compression is started with the needle still inside the vein, removing it while applying overt pressure. This maneuver can cause the puncture of the posterior wall of the vein, rupturing it, causing the pseudoaneurysm. Although asymptomatic in most cases, ruptures are the most feared complication. The occurrence of rupture can manifest itself by active bleeding or by subcutaneous hemorrhagic infiltration of the local tissues.[5] AVF ruptures are classically treated by open surgery.[3] However, it is not uncommon that the treatment of a pseudoaneurysm ends up with fistula ligation.[6]

We present the case of a ruptured pseudoaneurysm in an HD AVF, treated with percutaneous ultrasound-guided thrombin injection assisted by an angioplasty balloon to occlude the fistula lumen during injection.

2 | CASE REPORT

A 74-year-old male with chronic kidney disease of unknown etiology, attended to in the emergency department with referring lancinating pain in his right upper limb where a brachio-cephalic arteriovenous fistula was in use. He had a previous history of ischemic heart disease, cerebrovascular disease, and peripheral arterial disease. He was also being anticoagulated, because of a paroxysmal atrial fibrillation.

He had a tense, blushing arm with extensive hemorrhagic infiltration when he was admitted. Opioids had to be administered to achieve pain control. The patient reported that during the removal of

the venous needle he felt severe pain associated with a sting. After 24 h, his middle arm had a large hematoma with edema and the site of the venous cannulation was difficult to palpate. The thrill in the arm along the path of the cephalic vein was felt in the physical examination. The ultrasound scan showed a 1400 ml/min flow, a resistance index of 0.43 in the brachial artery and a pseudoaneurysm on the posterior wall of the venous puncture site with active bleeding into the flexor muscle compartment and adjacent tissues (Figure 1). Since the patient had a prior history of multiple failed autologous vascular accesses, we chose not to surgically approach the ruptured pseudoaneurysm because of the high risk of fistula ligation. Thus, we also chose to treat the complication with ultrasound-guided thrombin injection. The procedure was carried out under local anesthesia with an inflated angioplasty 6 × 40 mm balloon in the fistula tract in order to ensure complete thrombosis of the aneurysm and to avoid thromboembolic events (Figure 2). After the injection of thrombin, we waited for 2 min with the inflated balloon until complete thrombosis of the pseudoaneurysm was achieved and demonstrated by the ultrasound and the angiography (Figure 3). The patient reported immediate pain cessation. A new ultrasonographic control was carried out an hour after this procedure, ensuring complete thrombosis of the pseudoaneurysm and patency of the arteriovenous fistula. The patient underwent HD through the treated arteriovenous fistula on the following day. Six months after the procedure, the patient maintains a functional arteriovenous access with no intercurrences.

Our procedures followed the ethical standards of the *Centro Hospitalar Universitario do Porto* and were conducted in accordance with the Declaration of Helsinki.

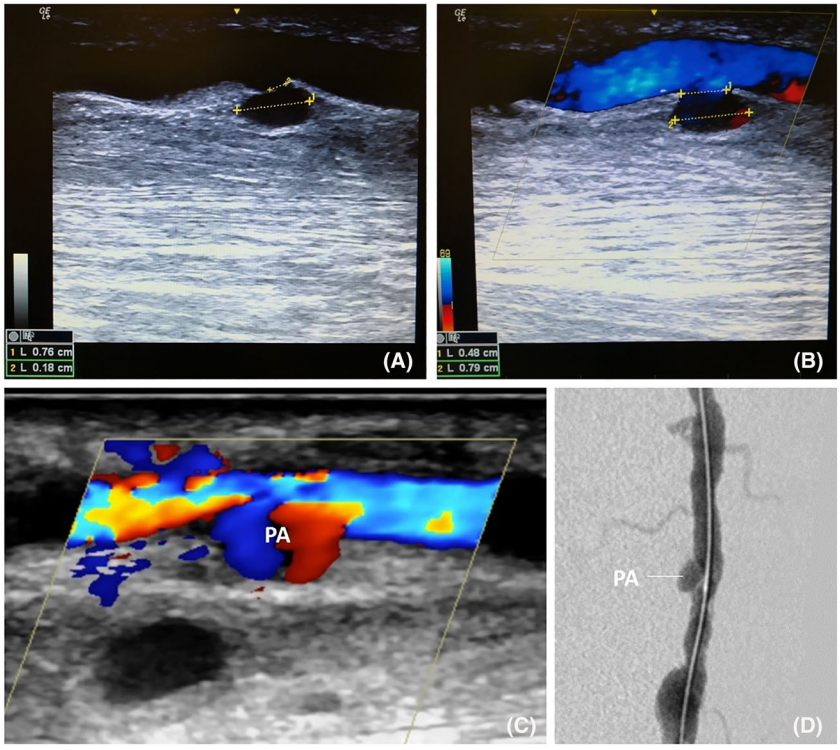

FIGURE 1 (A–C) B-mode and color-Doppler ultrasound images revealing a pseudoaneurysm (PA) with about 7.9-mm diameter and a 4.8-mm neck. (D) Baseline angiography showing contrast extravasation into the pseudoaneurysm

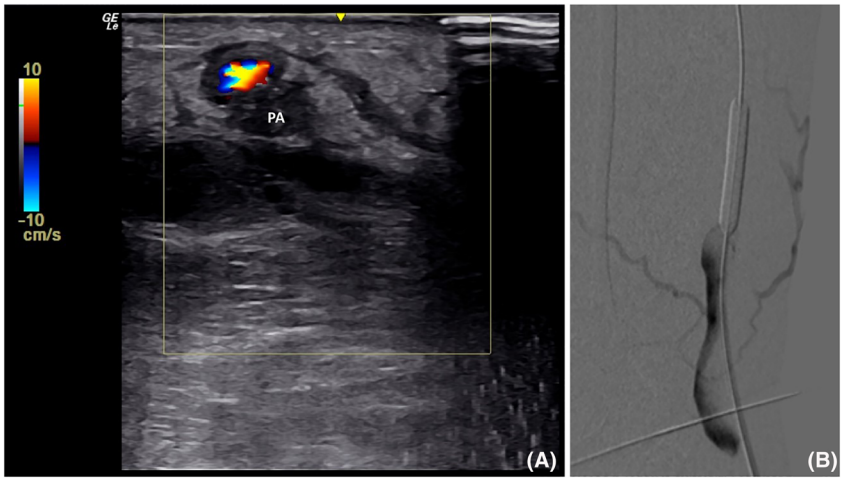

FIGURE 2 (A) Ultrasound image showing occlusion of the arteriovenous fistula lumen with angioplasty balloon and the pseudoaneurysm where the injection of thrombin was applied. (B) Inflation of an angioplasty balloon in the fistula tract under the pseudoaneurysm site guided by fluoroscopy

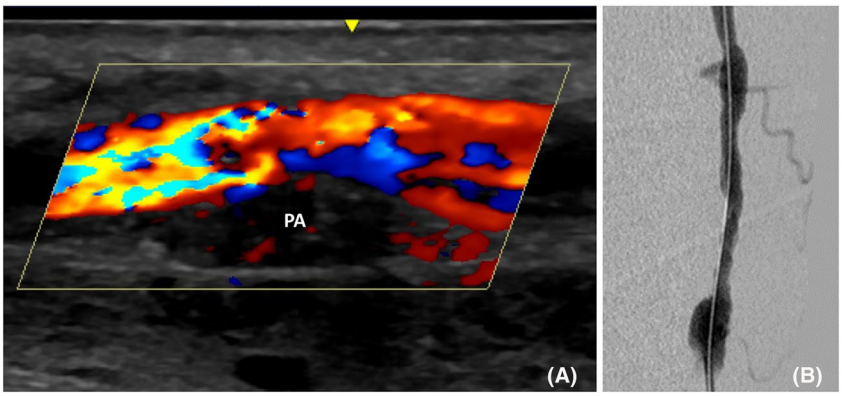

FIGURE 3 (A) Ultrasound image confirming complete thrombosis of the pseudoaneurysm with preserved flow in the lumen of the arteriovenous fistula. (B) Final angiography showing total exclusion of the pseudoaneurysm

3 | DISCUSSION

Arteriovenous vascular accesses for HD have a finite life span, with their natural history comprising a series of multiple revision procedures for access saving and maintenance. Preserving the access route for dialysis should be a primary goal. Routine assessment of the vascular access through physical examination in the dialysis unit is very important in order to identify complications.[7] Each time a vascular access is lost, the risk of lack of autologous access increases, raising the risk of death.[8]

The incidence of pseudoaneurysms in grafts has been reported between 2% and 10%,[9] whereas it is a rare complication in arteriovenous fistulas as shown in the literature.[10] They are usually caused by traumatic injury to the vessel wall with cannulation needles at the time of removal.[4] Failure to change the puncture sites can lead to weakening and thinning of the vein wall with consequent rupture due to elevated venous pressure.[3,4] Additionally, rupture of the posterior vein wall may occur during cannulation or needle removal conditioning the formation of a pseudoaneurysm.

Therapeutic indications for pseudoaneurysm treatment are not well established. Nevertheless, prompt repair is imperative in case of rupture.[3] Conventional surgery is the treatment's golden-standard. In most pseudoaneurysms with long destruction of the wall vein, the intervention involves closing the injury with surgical stitches or the interposition of a prosthesis segment.

Despite proven success in the treatment of arterial pseudoaneurysms,[11] percutaneous thrombin injection is not used in the treatment of arteriovenous fistula pseudoaneurysms. In common femoral artery pseudoaneurysm, ultrasound-guided thrombin injection is currently the treatment of choice in many centers due to high success rate, availability and safety.[12] Although rare, complications include arterial thrombosis, venous thrombosis, infection, and allergic reaction to bovine thrombin.[13]

In the case discussed above, the initial approach would be surgical intervention, namely, with fistula ligation, and construction of a new access. However, the patient had no suitable veins to allow the creation of a new autologous arteriovenous fistula. Thus, we considered treatments capable of preserving the vascular access while treating the ruptured pseudoaneurysm. We first thought of placing a stent graft, but the pseudoaneurysm occurred in the puncture area. Therefore, we considered the ultrasound-guided percutaneous thrombin injection. In order to avoid the associated risk of AVF thrombosis and pulmonary thromboembolism, we decided to inflate an angioplasty balloon that allowed occlusion of the entire venous lumen until complete pseudoaneurysm thrombosis occurred. The effectiveness of such technique was assured since there was no relapse in the 6 months follow-up.

4 | CONCLUSION

Percutaneous thrombin injection, when assisted by the use of an angioplasty balloon inflated in the adjacent fistula tract, may be an effective treatment for AVF pseudoaneurysms. This endovascular procedure is highly successful and safe in the treatment of iatrogenic pseudoaneurysms but, as far as we know, it had never been applied to an AVF pseudoaneurysm before.

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CONFLICT OF INTEREST

The authors do not have any conflict of interest.

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