

Ultrasound-guided Thrombin Injection for the Treatment of Iatrogenic Pseudoaneurysm of the Right Brachial Artery

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ABSTRACT

Iatrogenic vascular injury is an abnormal state that occurs in patients as a result of inadvertent or erroneous treatment by physicians or surgeons. Pseudoaneurysms need to be distinguished from true aneurysms. Pseudoaneurysm is a dilatation of an artery with actual disruption of one or more layers of its wall, rather than with expansion of wall layers. Recently, several reports have suggested that ultrasound-guided thrombin injection is a safe, effective, and rapid therapy for the treatment of pseudoaneurysm and without being associated with the limitations of ultrasound-guided manual compression. We report a case of a 38-year-old patient who had brachial artery pseudoaneurysm and was successfully managed with ultrasound-guided thrombin injection.

Key words: iatrogenic; psuedoanuerysm; thrombin; ultrasound

Introduction

Iatrogenic vascular injury is an abnormal state that occurs in patients as a result of inadvertent or erroneous treatment by physicians or surgeons.^[1] Some common complications of vascular interventions include bleeding, pseudoaneurysm, arteriovenous fistula, acute arterial thrombosis, venous thrombosis, and arterial embolism. Pseudoaneurysms need to be distinguished from true aneurysms. Pseudoaneurysm is a dilatation of an artery with actual disruption of one or more layers of its wall, rather than with expansion of wall layers.^[2]

There has been an increase in the incidence of iatrogenic arterial lesions including pseudoaneurysm formation due to an increase in the number of cardiac and vascular diagnostic and interventional procedures.^[3] Currently, surgery or endovascular intervention is the only accepted definitive therapy for these lesions.^[4] Recently, several reports have

suggested that ultrasound-guided thrombin injection is a safe, effective, and rapid therapy for the treatment of pseudoaneurysm and without being associated with the limitations of ultrasound-guided manual compression.^[5-9]

We report a case of a 38-year-old patient who had brachial artery pseudoaneurysm and was successfully managed with ultrasound-guided thrombin injection.

Case Report

A 38-year-old man presented with right upper limb (RUL) claudication of 3-month duration. Clinical examination revealed viable limb with no skin changes. The radial and brachial pulses were feeble compared to the opposite side with RUL systolic blood pressure (SBP) of 60 mmHg compared to a left upper limb SBP of 114 mmHg. He had been prescribed

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oral anticoagulants at the time of initial presentation to an outside hospital, probably for the acute symptoms that developed 2 months ago. These were stopped a week before the current procedure. Doppler ultrasound examination of the RUL vessels showed a right subclavian artery (RSCA) ostioproximal stenosis of about 90%. Intra-arterial digital subtraction angiography (DSA) confirmed the diagnosis. The patient subsequently underwent a balloon angioplasty of the RSCA lesion through a right transbrachial access with a 7F-sheath, with control angiograms being performed through the right femoral sheath. Two guidewires were placed, one across the RSCA lesion and the other into the right carotid artery (to allow a carotid intervention in the event of a plaque shift). A 6 × 4 balloon and then a 7 × 4 balloon were used for balloon dilatation (BD) of the RSCA stenosis. Following BD, the translesional pressure gradient reduced from 60 to 5 mmHg, with no evidence of obstructive dissection flap. Therefore, a stent was not placed. At the end of the procedure, manual compression was given to the brachial and femoral puncture sites to attain hemostasis and patient was transferred to the ward.

Seven hours later, the patient developed acute pain and swelling at the brachial puncture site extending into the upper arm. The local site was swollen, tense, and erythematous. However, the distal pulses were well palpable, and vitals were stable. An immediate Doppler ultrasound revealed a large hematoma spreading along the medial arm muscles and a lobulated pseudoaneurysm measuring about 2.8 cm × 2.5 cm at the elbow level with a neck of around 2–3 mm [Figure 1a and b]. A conservative therapy with manual compression at the puncture site, oral antibiotics, and anti-inflammatory drugs was initiated. However, there was no improvement in the patient's symptomatology at 24 h. There were no signs of compartment syndrome. A blood sample was sent for serology and culture, and intravenous antibiotics were also added to the drug regimen.

In view of the failure of conservative treatment, the decision to attempt an endovascular or a percutaneous embolization

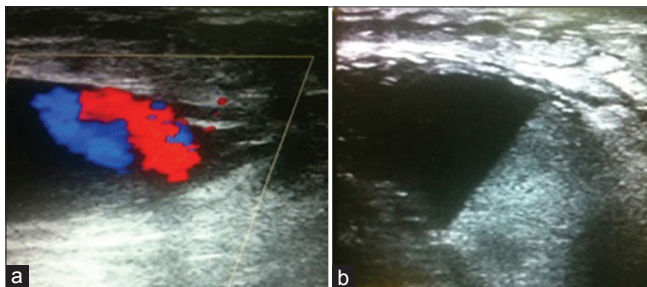


Figure 1: (a) Color Doppler image at the level of the elbow, in longitudinal view showing the pseudoaneurysm sac with yin-yang sign color pattern. (b) Grey scale ultrasound image of the pseudoaneurysm at 24 h after the procedure and intermittent compression, showing the presence of partial thrombosis with layering of the echogenic thrombus as a straight line

of the pseudoaneurysm was taken. Intra-arterial DSA from a left femoral access [Figure 2], confirmed the diagnosis of right brachial artery pseudoaneurysm. A percutaneous ultrasound-guided thrombin injection (PUGTI) for the lesion was then performed. The thrombin (human thrombin, Tisseel kit [Baxter, US]) was injected through a 22-gauge needle under direct ultrasound visualization through the superficial aspect of the pseudoaneurysm. With the needle tip lying peripherally within the sac, about 500 IU of the thrombin was slowly injected over 2 min, until no blood flow was seen within the lesion on color Doppler ultrasound [Figure 3]. A check DSA done at 30 min after the thrombin injection showed complete obliteration of the pseudoaneurysm [Figure 4] and no distal embolization. Distal pulses were well felt at the end of the procedure.

Discussion

Pseudoaneurysm is a dilatation of an artery with actual disruption of one or more layers of its wall rather than with expansion of wall layers.^[2] False aneurysms or pseudoaneurysms can be caused by trauma, iatrogenic vascular interventions, anastomotic disruption, and in intravenous drug abusers. Pseudoaneurysms are associated with the characteristic presentation of a painful, pulsatile swelling, with a palpable thrill, and an audible to-and-fro murmur. The diagnosis is confirmed by various imaging techniques.^[4,10,11]

Iatrogenic pseudoaneurysms occur most commonly following coronary arterial catheterization.^[12] Postcardiac catheterization lesions occur in approximately 0.05% cases after diagnostic catheterization and up to 1.2% cases after more complex procedures.^[13-15] The incidence of pseudoaneurysm during peripheral interventions is reported to be from 0.6% to 6%.^[15-22] They can also be encountered following the formation of arteriovenous

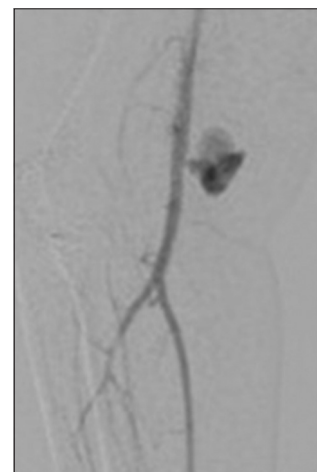


Figure 2: Digital subtraction angiographic image of the right distal brachial artery showing the lobulated pseudoaneurysm at the level of puncture site with a relatively short and narrow irregular neck

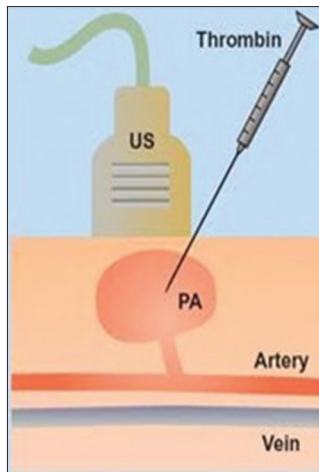


Figure 3: Schematic diagram showing the ultrasound (linear transducer) guided percutaneous injection of thrombin into the sac of the pseudoaneurysm using a 1 ml syringe

shunts, indwelling catheterizations and collection of arterial blood gases.^[4]

Most of the patients with pseudoaneurysm usually present with complaints of pain with swelling in the puncture site as in the case under review. The possible cause of the pseudoaneurysm in our patient could be as a result of early self-mobilization of the affected limb because after the procedure the punctured site was well compressed and bleeding was stopped. A possible residual effect of the oral anticoagulants (stopped for a week prior to the intervention) may have been contributory. Sometimes, there may be a local increase of heat and sensitivity at the site of the swelling which was also complained by our patient. However, our patient did not complain of paresthesia or any compartmental syndrome that would have warranted surgical intervention. Pulsations are generally decreased with the pressure to be applied proximal to the swelling.^[23,24] The distal pulses were palpable in the case here presented. Good medical history and physical examination are usually adequate for diagnosis.

However, Khan and Page stated that only half of the cases in literature were diagnosed accurately in the preoperative period.^[24] Clinically, pseudoaneurysm may be confused with an abscess, epidermoid cyst, arteriovenous fistula, foreign objects, ganglion cysts, benign, and malignant tumors.^[25,26] This diagnostic dilemma was not the case in our patient because the patient complaints of acute pain at the site of puncture few hours after an interventional procedure and accurate diagnosis was made with Doppler ultrasound and DSA.

Furthermore, early diagnosis is important to prevent complications associated with pseudoaneurysm such as infection neuropraxia, compartment syndrome, rupture, and hemorrhage.^[23,27] More importantly, there is a risk of distal thromboembolism.^[24,28] A possible distal thromboembolism



Figure 4: Digital subtraction angiographic image of the distal right brachial artery, postthrombin injection showing complete occlusion of the pseudoaneurysm sac with minimal irregularity of the brachial artery at the level of the neck

may compromise the circulation in extremity and lead to ischemic abnormalities and even to gangrene and necrosis.^[28] None of these complications was seen in our patient because of the prompt diagnosis and close monitoring as well as constant communication with the physician. Angiography and magnetic resonance angiography can also be used in diagnosis.^[28] However, Doppler ultrasonography is the first-choice diagnostic instrument since it is noninvasive, does not have adverse effects and is usually sufficient for diagnosing iatrogenic lesions since they are usually superficial.^[12]

The primary objective in treatment should be the exclusion of the pseudoaneurysm with the maintenance of an optimal blood flow.^[29,30] It is particularly important in young patients to avoid any impact on the developing extremity from any arterial failure.^[30] Treatment options include surgery, manual compression, and vascular intervention. Surgical treatment is chosen depending on the localization and severity of the pseudoaneurysm. Nonsurgical treatment options involve endovascular embolization, ultrasound-guided manual compression, and percutaneous thrombin injection.^[23,31] Percutaneous transcatheter embolization may provide an alternative to surgical repair, but this procedure is invasive and requires contrast administration that may be undesirable in patients with known contrast hypersensitivity or decreased renal function. Transcatheter embolization itself could potentially result in the development of a pseudoaneurysm.^[32] For the above reasons, a safe, rapid, minimally invasive, and comfortable treatment modality that does not require discontinuation of anticoagulant or antiplatelet drugs would be appealing.^[32]

Ultrasound-guided thrombin injection has emerged as a potential alternative therapy after failure of initial external nonguided compression, and in place of ultrasound-guided

compression.^[32] The advantages of ultrasound-guided thrombin injection over ultrasound-guided compression are that there are a greater technical success (96% vs. 74%)^[9] with a shorter procedural time (6 s vs. 41.5 min in one study^[32,33]). ultrasound-guided thrombin injection also has better patient toleration^[34] and does not require conscious sedation. The other advantages over other treatment options include: Not contraindicated in patients on heparin or warfarin,^[32,35] suitable for pseudoaneurysms arising above the inguinal ligament; can be performed as an outpatient procedure^[32] and lower relative cost.^[36]

The main concern with local thrombin injection is systemic activation of the coagulation system, demonstrated by elevated levels of thrombin-antithrombin III complex.^[37] The other concern is the risk of intra-arterial thrombin injection resulting in limb-threatening ischemia.^[37] Both, however, occur in small pseudoaneurysms without a clear neck.^[9] The neck of the pseudoaneurysm in our patient was well demonstrated in both ultrasound and DSA. Having considered all the risks and benefits of all the treatments modalities we opted for thrombin injection in our patient because the patient was stable and the neck of an aneurysm was not wide, and he has stopped his anticoagulant 1 week prior intervention.

Conclusion

We report a case of successful treatment of an iatrogenic brachial artery pseudoaneurysm by PUGTI. This is a highly effective, safe, and minimally invasive procedure to treat extremity artery pseudoaneurysms. Prompt diagnosis and early aggressive management with a team approach for these lesions are required to prevent complications and maintain circulation in the extremity.

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Conflicts of interest

There are no conflicts of interest.

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