



Surgical Repair of a Snuffbox Radial Artery Pseudoaneurysm

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Abstract

A rare case of a snuffbox radial artery pseudoaneurysm treated surgically is presented. Given the broad base, short neck and relatively large size of the pseudoaneurysm sac, compression techniques and intra-sac thrombin injection were deemed inappropriate, as they have been associated with ischemic complications within the sparse literature. Open surgical resection of the pseudoaneurysm with primary end-to-end repair of the radial artery was performed. Technical success was achieved with restoration of flow through the radial artery and the palmar arch with maintained patency and alleviation of symptoms immediately post-operative and at 3-months follow-up.

Introduction

Radial artery aneurysms are rare entities comprising only 2.9% of all upper extremity aneurysms [1-3]. Such degenerative processes affecting the radial artery within the anatomical snuffbox are even more sparsely reported. As with other arterial degenerative processes, these aneurysms or pseudoaneurysms are typically caused by traumatic, iatrogenic, infectious, atherosclerotic, or collagen vascular disease processes [1-8].

Given the superficial location within a highly mobile region of the wrist and proximity to the palmar arch, distal thromboembolism, digital ischemia, rupture, hemarthrosis, adjacent nerve irritation, paresthesias, limited wrist mobility, skin ulceration, and secondary infection are potential risks that prompt intervention [2,3,6,8]. Reported treatment options have included surgical excision with or without radial artery ligation, ultrasound-guided compression, and percutaneous thrombin injection.

Herein, we report a rare case of a symptomatic snuffbox radial artery pseudoaneurysm treated surgically based on the configuration and angioarchitecture of the pseudoaneurysm.

Case Presentation

Background

A 16-year-old, right-handed male presented with a 9-month history of amildly tender, pulsatile mass in the left anatomical snuffbox after suffering blunt trauma to his left hand (Figure 1a). The patient was initially seen by his pediatrician, who attempted to aspirate the mass, believing it to be a ganglion cyst, with no resolution. He was referred to vascular surgery for evaluation after a hand surgeon ordered a Magnetic Resonance Imaging (MRI) scan which revealed a 1.9 cm x 1.2 cm x 1.8 cm pseudoaneurysm of the radial artery emerging in between the extensor and abductor tendons of the anatomical snuffbox (Figure 1b and c).

Preoperative evaluation

Upon evaluation, patient was found to have 2 cm round pulsatile mass within the anatomical snuffbox of the left hand. A modified Allen's test using a pulse oximeter with waveform analysis was performed and suggested a radial artery dominant blood supply to the thumb and index finger.

The patient underwent duplex ultrasound evaluation, which revealed a patent ipsilateral arterial tree proximally with no evidence of hemodynamically significant stenosis or other degenerative pathologies. Within the anatomical snuffbox, a partially thrombosed pseudoaneurysm of the radial artery was identified (Figure 2). The pseudoaneurysm had a broad base with essentially no neck, making it unsuitable for percutaneous thrombin injection. After discussion with the patient and family, decision was made for surgical treatment.

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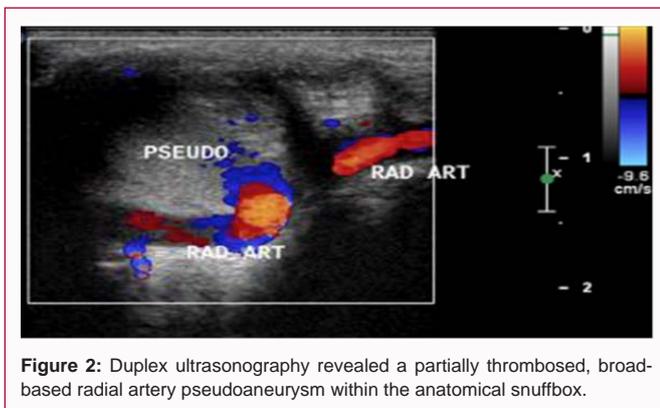
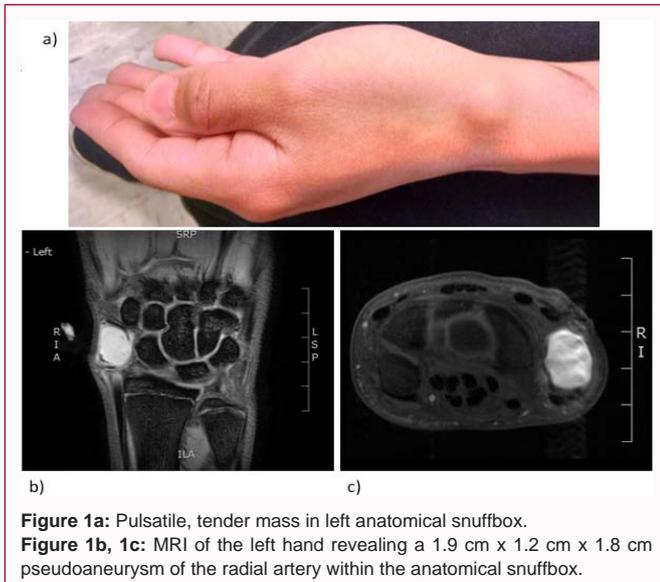
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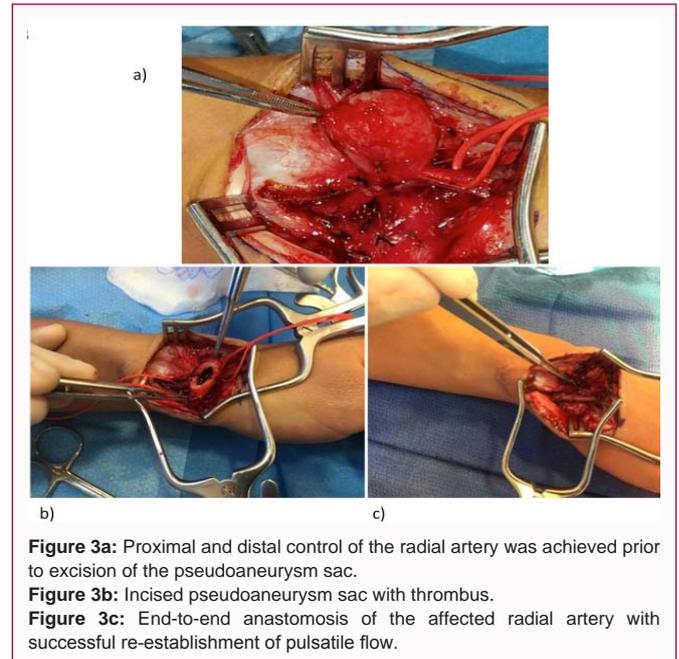


Operative technique

Under tourniquet exsanguination, a 5cm incision was made over the course of the pseudoaneurysm within the anatomical snuffbox. Using extensive sharp dissection, the pseudoaneurysm was dissected out circumferentially, as were the proximal and distal segments of the radial artery (Figure 3a). Once adequate lengths of the artery proximal and distal to the pseudoaneurysm was dissected and mobilized, the tourniquet was let down and the patient was systemically heparinized. Proximal and distal control was obtained and the pseudoaneurysm sac was incised, followed by suction of partially thrombosed contents (Figure 3b). Given the broad base of the pseudoaneurysm along the anterior wall of the radial artery, primary repair was not possible. Therefore, the pseudoaneurysm was resected and a spatulated, end-to-end anastomosis of the radial artery was performed using running 7-0 prolene sutures (Figure 3c). There was excellent re-establishment of flow within the radial artery confirmed by manual pulse palpation and Doppler interrogation. There were no perioperative complications. The patient was maintained in a gutter splint for 2 weeks post-op. Final pathology evaluation confirmed the presence of a partially thrombosed arterial pseudoaneurysm.

Discussion

Radial artery pseudoaneurysms and aneurysms in this unique location can have a variable pattern of presentation ranging from an asymptomatic, pulsatile mass to a rapidly expanding, painful lesion with distal ischemia, paresthesias, overlying skin ulceration,



and bleeding complications [5]. Even the less symptomatic lesions have the potential for growth over time with subsequent arterial impingement and potential for thromboembolic complications [8]. Diagnostic imaging plays an important role in diagnosis and traditionally includes contrast-enhanced MRI series. The latter can help identify the location, adjacent arterial involvement, and associated musculoskeletal abnormalities. Duplex ultrasonography can play an important role in distinguishing true arterial aneurysms from pseudoaneurysms and the quality of in-line flow proximal and distal to the lesion in question. In the case of a pseudoaneurysm, the so-called “ying-yang” sign is observed via duplex ultrasonography and is pathognomonic for the alternating pattern of systolic flow into the pseudoaneurysm and diastolic flow out resulting in the “to-and-fro” spectral waveform signal [9]. In rare situations, pre-operative angiography can also be a valuable tool to help identify associated vascular pathologies such as arteritides, arteriovenous fistulas and malformations, fibromuscular dysplasia, and venous anomalies. Transcatheter therapeutic options such as covered stent exclusion, coil and polymerizing agent embolization are extremely limited and ill advised given the local anatomical restrictions. Percutaneous thrombin injection and/or ultrasound-guided compression therapy remain the only viable non-surgical options locally. In the current case, the broad base and extremely short neck of the pseudoaneurysm precluded employment of such non-operative maneuvers, as the risk of distal digital ischemia from non-target embolization would be extremely high. Careful evaluation and scrutiny of the pseudoaneurysm morphology on duplex ultrasonography are paramount in ascertaining patient’s candidacy for percutaneous therapy.

Of the handful of reported cases of true aneurysms of the anatomical snuffbox, most have been managed with ligation of the radial artery followed by surgical resection of the defect [1-8]. A single report exists of a patient with MRI-confirmed idiopathic radial artery aneurysm within the anatomical snuffbox, who denied treatment due to lack of symptoms [10]. The decision to proceed with radial artery ligation at the time of surgical excision can be based on presence of collaterals on angiography, a negative Allen’s test, intraoperative

Doppler interrogation, or adequate back bleeding from the distal stump [3,6,8]. In this particular case, given the dampened pulse oximeter waveforms noted on the ipsilateral thumb and index fingers on manual compression of the radial artery, a pre-operative decision was made to proceed with surgical reconstruction of the radial artery at the time of pseudoaneurysm excision.

In Behar et al. [7] a radial artery aneurysm was reported in the right upper extremity from repetitive occupational injury. As a tailor, the aneurysm caused tenderness and numbness in the patient's hand causing difficulty using scissors to cut cloth. The development of the aneurysm was thought to be caused by back pressure of flow towards the wrist due to repeated compression of the radial artery from the handle of the scissors. The aneurysm was confirmed on duplex imaging and post-op pathology. Pre-op Allen's test was consistent with ulnar dominant supply to the palmar arch. The aneurysm was explored with temporary occlusion of radial artery demonstrating excellent flow through ulnar artery. Bypass was considered, but rejected due to high possibility of recurrence from occupation. Therefore, the aneurysm was excised with no reconstruction necessary.

Dryton et al. [5] reported a case of radial artery pseudoaneurysm in the right wrist after a cat bite, in a patient who presented with intermittent pain and discoloration of her right thumb and index finger. The patient had a history of systemic lupus erythematosus and deep venous thrombosis on anticoagulation. Bedside pulse oximetry Allen's test confirmed good collateralization across the palmar arch, and an uneventful excision of radial artery and pseudoaneurysm was performed.

Poirier et al. [8] reported a mycotic aneurysm of right radial artery. The patient presented with a pulsatile mass and fever. Arteriogram was performed consistent with a 1.5cm aneurysm fed by the dorsal branch of radial artery. He was taken to the operating room and surgical excision of the mycotic aneurysm and ligation of the feeding vessel was performed due to presence of adequate collateral flow and presence of infection.

Finally, two case studies demonstrated traumatic radial artery aneurysms that were also surgically treated with aneurysm excision and radial artery ligation. Gabriel et al. [3] described a healthy male patient with a pulsatile mass of the left hand after sustaining a dog bite 4 months prior with no active signs of infection or skin ulceration. Doppler arterial interrogation showed dilatation of the left radial artery consistent with a local aneurysm and decision was made for surgical treatment. Allen's test preop was negative, and thus radial artery was safely ligated. In two case reports by Wenger et al. [4] traumatic injuries to right anatomical snuffbox were sustained. Both patients were symptomatic in the area with post-op histopathology consistent

with pseudoaneurysms. Pre-op testing with Allen's test and Doppler ultrasound were consistent with acceptable collateral circulation by ulnar artery, and thus surgical resection of the pseudoaneurysms with concomitant radial artery ligation was performed in both cases.

Herein, we have described a rare case of symptomatic post-traumatic radial artery pseudoaneurysm treated by surgical excision and arterial reconstruction. The location of these rare lesions restricts transarterial endovascular treatment options. Ultrasound-guided compression and thrombin injection remain viable non-operative techniques only for treatment of pseudoaneurysms with appropriate morphological features such as long, narrow neck. Surgical excision with ligation remains the gold-standard therapeutic modality. However, in rare situations such as in the current case, arterial reconstruction may be necessary. Options include end-to-end anastomosis, interposition grafting via reversed vein or exogenous conduits. The latter can be compromising in the presence of an infections etiology and small caliber of the affected artery.

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