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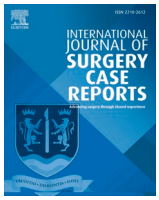

Case report

Open resection for a large iatrogenic radial artery pseudoaneurysm. Case report

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ABSTRACT

Introduction and importance: We present the case in which a large symptomatic pseudoaneurysm (PSA), 6 × 5 cm, with one year of evolution on the path of the right radial artery (RRA) appeared after its punction and cannulation for performing cardiac catheterism in an atrial fibrillation (AF) indefinite anticoagulated patient. Diagnosis and surgical planning were consolidated only by using color duplex ultrasound (CDU), contrasted images were not indicated.

The open surgical management was performed during a short-time supraclavicular blockade of peripheral nerves without stopping nor bridging anticoagulant therapy. Complete excision of the deforming mass with no blood loss, decompression of the adjacent structures and direct closure of the arterial defect without compromising of its lumen and path were also achieved.

Case presentation: A 74-year-old, Hispanic male patient and former smoker underwent coronary catheterization for thoracic typical pain. One year after, he is admitted for move restrictive pain in distal right forearm and hand paresthesia related to a rapidly growing right radial artery PSA of 6 cm in diameter where the indefinite anticoagulation, indicated for chronic AF, confers a risk of major bleeding.

After clinic and exclusive CDU assessing, the patient granted us written authorization for performing an open surgery.

One year follow up showed an asymptomatic patient with no RRA residual lesions.

Clinical discussion: Although contrasted are the preferred diagnosis methods when arterial issues are suspected especially angiography since, when indicated, the endovascular treatment may be performed immediately after diagnosis. The CDU performed with a high-sensitivity transducer is the image of choice for an immediate differential diagnosis (Meola et al., 2021 [1]). In addition, it allowed us to see both, the particular PSA inside structure and the patency of ipsilateral ulnar artery, necessary details to propose the successful open surgical treatment finally conducted.

Conclusion: Vascular and trauma surgeons should be trained to ensure the correct diagnosis based on preexisting medical conditions, clinical findings and those provided by CDU in order to offer an appropriate and definitive management to peripheral vascular iatrogenic lesions with potential bleeding risk, especially in anticoagulated patients. Since large limb deforming PSAs are recommended to be excided through open access, they should also be trained to perform it without additional risks nor sequelae.

Since the number of AF patients is increasing worldwide, main aspects on anticoagulation therapy have to be taught to every surgical team.

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1. Introduction

The increased incidence of iatrogenic vascular injuries is linked to the number of percutaneous endovascular procedures these days. The transradial access could have a lower probability of damage than the classic transfemoral access, however, the radial artery (RA) is prone to suffering serious injuries.

We describe an infrequent case where at least three medical specialties confluent.

The diagnosis strategies and the definitive open surgical treatment with complete excision performed to an indefinitely anticoagulated patient who had developed a large symptomatic PSA on his right RA after a coronary catheterization, in risk of rupture on the distal third of the forearm are analyzed.

The adequate interpretation of clinical findings and the correct performance of a CDU allowed the vascular surgical team of an academic third level hospital to resolve, without stopping direct oral anticoagulation, this situation in an atrial fibrillation patient. In transradial access, some of these injuries may go unnoticed or they may resolve spontaneously. Few patients will require surgical intervention due to their comorbidities or PSA anatomical conditions.

This case report has been reported in line with the SCARE Criteria [2].

2. Case report

We present the case of a retired, 74-year-old, Hispanic, right-handed, hypertensive male patient who used to be a heavy smoker, 1 pack a day for 18 years. The patient presented a rapid growth deforming mass in the right distal forearm; which appeared after undergoing a coronary catheterism. The right radial artery was the vascular access used for the procedure where no complications were reported during its cannulation, neither coronary artery required any interventions.

The procedure to stage the suspected pulmonary hypertension included right heart catheterization, the right cephalic vein was used for accessing.

During the procedure, atrial fibrillation with rapid ventricular response and mild pulmonary hypertension of valvular origin due to dilated heart disease were identified; no degree of stenosis in the mitral valve was detected.

The patient began an indefinitely direct oral anticoagulant treatment as well as pharmacological treatment for pulmonary hypertension.

From the moment this procedure was conducted, the patient noticed a mass in the area of the arterial puncture in which a progressive growth and throbbing sensation was perceived. It has to be mentioned that five days before RA punction, the patient had begun anticoagulant treatment initially with low molecular heparin, after undergoing coronary catheterization he received it no more and started direct oral anti-Xa anticoagulation.

When this mass reached 6 × 5 cm (Fig. 1a) it produced deformity, pain that limited limb movements and paresthesia in the first and second fingers of the right hand. The skin thinning in its most anterior region (Fig. 1b) was the alarming sign which motivated the hospital admission, where he presented on his own, in order to offer emergency surgical management.

Major clinical findings revealed a painful, rounded and throbbing mass of 6 cm diameter on the distal path of the radial RA, a low systolic murmur was also detected on its basal portion.

Presurgical CDU detected a PSA of similar dimensions located on the anterior wall of the RA, and an almost 4,0 mm permeable single leak point with no neck in between (Fig. 2a). The inside of the PSA showed heterogeneous content with coagulated material in its periphery as well as active flow in its center (Fig. 2b). Additionally, the right radial veins couldn't be observed because the mass had collapsed them. CDU explorations in the right ulnar artery showed its dominance with normal hemodynamic characteristics (Fig. 2c) and a diameter of 0.82 cm

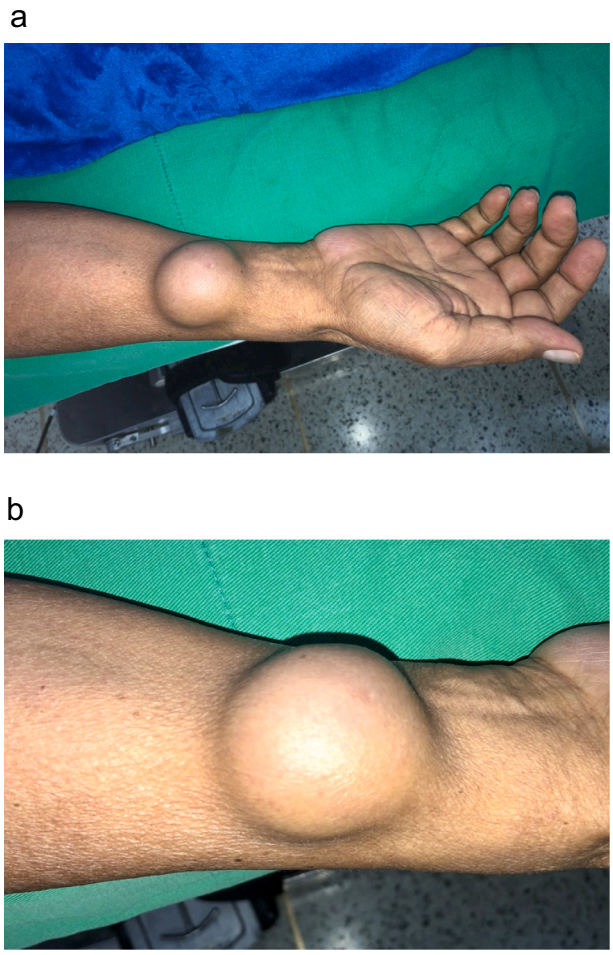

Fig. 1. a. Large radial artery pseudoaneurysm on right distal forearm.
b Skin thinning in its most anterior region.

(Fig. 2d), these were important presurgical findings in case ligation of RA was necessary.

Due to the anatomical mass conditions, especially because of its size and the deformity that it generated, we offered open surgical management.

After explaining his condition and the risks for both rupture and open surgery, the patient agreed to be taken into surgery room, hoping mainly to preserve the normal anatomical condition of the limb.

Direct oral anticoagulation dose was delayed to 4 h after surgery, and no bridging therapy was considered.

After a sensory and motor blockade of the right upper limb (RUL), Dr. Berrio; institutional vascular surgery leader, made a skin lateral incision and the dissection of the PSA was performed (Fig. 3a, b). Clamping of the RA allowed him the complete control of the artery and also the decompression of the adjacent nerve and vascular structures. Finally, the entire excision of the PSA was achieved (Fig. 3c). Damage in the anterior RA wall was fixed with polypropylene suture.

Early postsurgical and mediate observation ruled out hematomas and skin infection.

A year later, the patient is vascular asymptomatic in the RUL (Fig. 4a), and CDU reveals a totally normal patent RA (Fig. 4b).

From the beginning of the hospital management, the surgical team was granted a written consent to take as many pictures as needed and access to the whole related information on his files for eventual publication of the case.

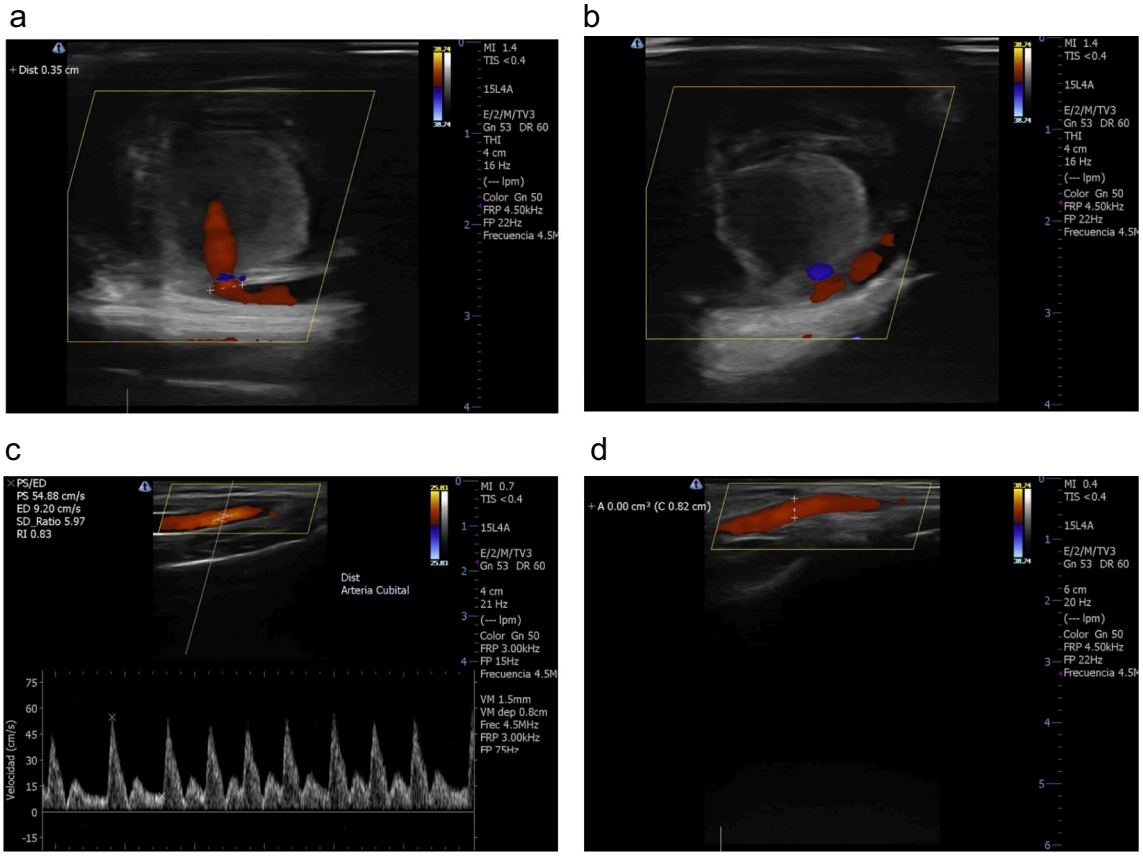

Fig. 2. a. Pseudoaneurysm on anterior wall of radial Artery, an almost 4,0 mm permeable single leak point with no neck in between.
b. The inside of the Pseudoaneurysm, heterogeneous content with coagulated material in its periphery as well as active flow in its center.
c. Right ulnar artery normal hemodynamic characteristics on Color Duplex Ultrasound.
d. Right ulnar arteria diameter on Color Duplex Ultrasound.

3. Discussion

PSAs are vascular tumors that appear on the wall of an artery as an uncommon manifestation of a direct traumatism like the arteriotomy necessary to reach its lumen and, in this case, gain access to the coronary circulation. After removing the introductory sheath, a clot is expected to seal the arteriotomy, when this is not formed or is inadequate, a continuous throbbing output of blood occurs. The surrounding soft tissue then lines around the leak forming a weak capsule that can contain the blood out of the artery lumen, but on time it is susceptible to rupture.

PSA may be present in 0.2 and 3.8 of the femoral artery catheterizations [3], with the emergence of transradial access for endovascular procedures this complication has been significantly reduced.

The RIVAL (randomized, parallel group, multicenter) trial, reported 7 radial artery pseudoaneurysms (RAP) that required blockage in 3507 patients (0.2%); while in the femoral artery 26 PSA were reported in 3514 patients (0.6%), $p = 0.006$ [4]. In 2015, Ersan Tatli et al. reported a single case of PSA among 10,324 patients who were taken to a transradial cardiac procedure, that is to say an incidence of 0.0009% [5].

Some PSAs are handled conservatively by a mechanical compression which leads to the thrombosis of its content. They may also be handled with ultrasound-guided thrombin injection; a procedure not free from complications such as arterial thrombosis and allergic reactions, some others may require the use of covered stents [6].

Small PSAs, less than 3 cm, may disappear after a few weeks due to spontaneous thrombosis.

For those greater than 3 cm, surgical reconstruction is recommended since its progressive growth related to Laplace law generates both, risk of rupture and compression on adjacent structures [7].

The surgical approaches include excision of the RAP with ligation of the RA or primary end to end repair [8].

There are several factors which predispose the development of this rare complication, such as an inadequate hemostasis after the procedure, multiple puncture attempts, introducing sheaths larger in length and diameter and receiving anticoagulation during the procedure [9] [10]. We have considered that the predominant factor in the case we report was the ongoing anticoagulation therapy since no other complications were reported during the RA puncture or cannulation.

We are not aware of any details related to the compression carried out after the removal of the sheath which is a limitation for this case report.

Although contrasted methods are the preferred diagnosis methods when arterial issues are suspected, especially angiography since, when indicated, the endovascular treatment may be performed immediately after diagnosis; the CDU performed with a high-sensitivity transducer is the image of choice for an immediate differential diagnosis [1]. In addition, it allowed us to see both, the particular PSA inside structure and the patency of ipsilateral ulnar artery, necessary details to propose the successful open surgical treatment finally conducted.

There are some points to be described as strengths for this case, the described use of CDU that let us not require any contrasted images at any moment. The complete resection in a single block without any RAP ruptures and blood loss (Fig. 3c). The closure of the lesion in the anterior wall of the RA during a short-time supraclavicular blockade of peripheral nerves, preserving its entire trajectory without ligation or anastomatic repair and finally, anticoagulation oral therapy had not to be stopped minimizing risks of systemic arterial embolism due to atrial fibrillation.

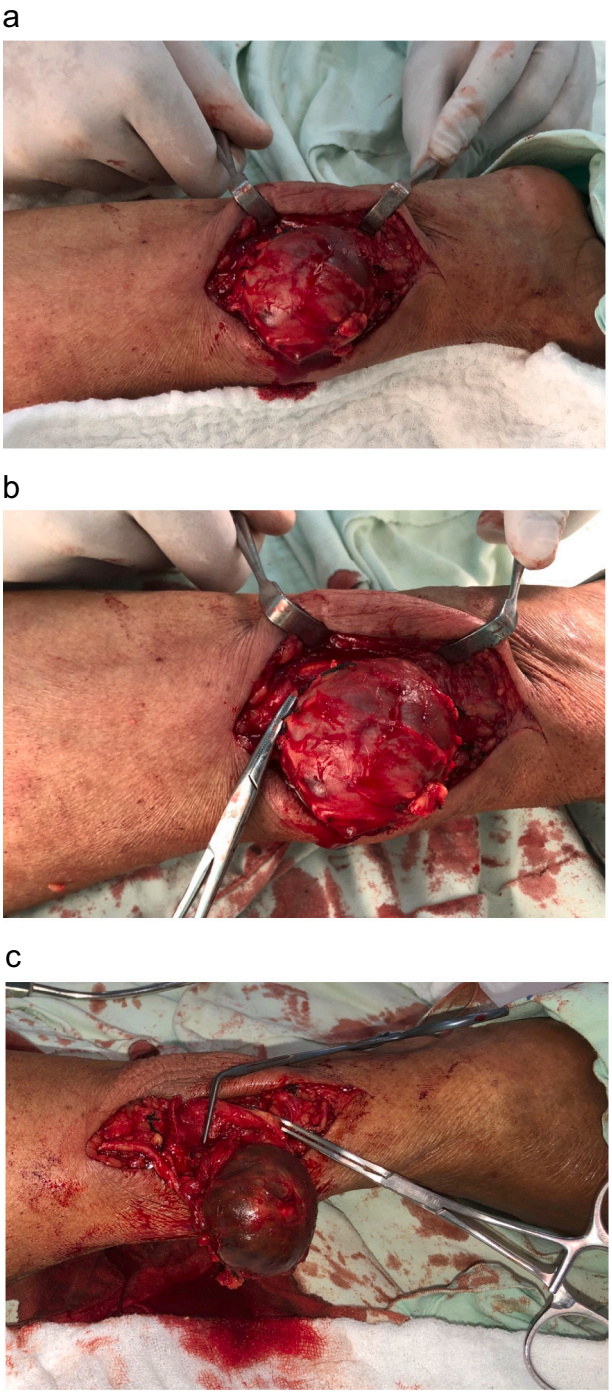

Fig. 3. a. Dissection of the pseudoaneurysm, after a lateral skin incision.
b. Still connected to radial artery pseudoaneurysm dissection.
c. Entire single block excision of the pseudoaneurysm.

One year after the procedure, the path of the right RA remains patented, UDC reveal no anatomical or functional sequelae (Fig. 4) in the intervened segment (Fig. 5).

Preferring transradial cardiac access confers advantages such as lower subsequent morbidity including iatrogenic vascular trauma. Although the incidence of complication is low, it could be lower or none if a longer compression in time is offered after sheath removal, especially in patients receiving anticoagulation during or soon after the procedure.

After any arterial catheterization patients like the one we report, should be offered frequent clinical follow-up and if necessary, eventual

Fig. 4. Right Upper limb scar with no vascular or functional sequelae.

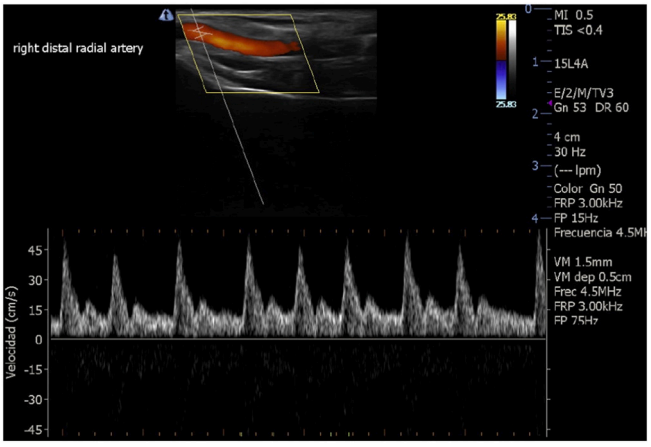

Fig. 5. Right radial artery intervened segment with no abnormality in Color Duplex Ultrasound.

CDU that allows early detection of arterial lesions specially when undergoing indefinite anticoagulation.

Both, vascular and trauma surgeons, should be trained to perform and interpret arterial CDU findings that would allow them to get an adequate visualization of the entire involved structures in order to propose an optimal approach, open or endovascular, without additional sequelae.

As the number of anticoagulated patients is increasing worldwide, surgical teams should be taught some punctual concepts especially those related to the need on stopping it or not for an urgent intervention.

In times of covid pandemic access to health services has worsened, it has to be the task of treating specialists not only to guarantee after discharge supervision but also to educate patients about further complications.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Ethical approval

This case report was exempt from ethical approval in our institution.

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Author contribution

Dr Jhon Jairo Berrio-Caicedo, Vascular Surgeon, is the main author, he did the entire treatment to the patient; he also worked on every single detail of this publication.

Dr Helio Espinosa and Dr Juan Paulo Benitez, worked on data collection and on writing the paper.

Guarantor

Jhon Jairo Berrio-Caicedo.

Research registration

N/a.

Declaration of competing interest

We have nothing to declare, there is no conflict of interest for this publication.

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