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Pseudoaneurysms in Peripheral Vasculature Following a Percutaneous Intervention, Different Diagnostic Approaches: Case Reports

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ABSTRACT

Pseudoaneurysm is defined as a vascular anomaly generated by the interruption of the arterial wall, which conditions accumulation and persistent confinement of blood. The incidence of pseudoaneurysm ranges between 0.2%-0.5% in diagnostic interventional techniques and up to 6% in therapeutic techniques, however, despite its low incidence, complications are potentially severe. We present 3 cases of pseudoaneurysm in the peripheral vasculature after percutaneous interventions, as well as the description of the diagnostic challenge and the assessment by the different imaging methods.

This case report article shows the diagnostic approach through the different imaging methods, as well as a brief review of the subject with a focus on the role of the interventional radiologist.

KEYWORDS: Pseudoaneurysm, Vascular injury, Percutaneous approach.

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INTRODUCTION

A pseudoaneurysm is a vascular anomaly generated by the interruption of the arterial wall, which conditions accumulation and persistent confinement of blood in a saccular defect, the latter in communication with the arterial lumen [1]. Arterial pseudoaneurysms can result from infection, inflammation, trauma, or iatrogenic causes such as percutaneous drainage, biopsy, surgery, central vascular access, or catheterization, the latter being the most common cause [1,2]. Pseudoaneurysms can appear anywhere in the arterial vascular network, the most frequent site being the common femoral artery, as it is the most common site of access in endovascular procedures, as well as due to the characteristics of the soft tissue itself that facilitates the development of the artery. fibrin capsule [2,3]. There is a risk that a pseudoaneurysm will progress in size, compressing neurovascular structures or adjacent tissues, even rupture, causing significant active bleeding [2,4].

In endovascular procedures, the incidence ranges from 0.2% to 0.5% in diagnostic techniques and can increase to 6% in therapeutic techniques [5]. The risk increases depending on factors related to the procedure: number of arterial accesses at the same site, emergency approaches, duration of the procedure, use of anticoagulants or antiplatelet agents during the procedure, as well as insufficient compression of the puncture site after the event [2.5]. Likewise, the risk increases with factors related to the patient such as advanced age, and chronic diseases (diabetes mellitus, systemic arterial hypertension, peripheral arterial disease, and thrombocytopenia) [6].

The pseudoaneurysm presents clinically as a pulsatile, painful mass associated with edema, and if it coexists with nerve compression, it can manifest with paresthesia. It has been laboratory associated with elevated D-dimer and platelets <200,000 [7]. Diagnosis is made by imaging, commonly by Doppler ultrasound [6]. A portion of small pseudoaneurysms will resolve spontaneously, so surveillance may be an option in the therapeutics used [8]. On the other hand, currently, minimally invasive interventional radiology techniques have acquired an important therapeutic role, generating less morbidity associated with surgery, decreased blood loss, complications, and prolonged hospitalization [1,8].

CASE REPORTS (1)

A 4-month-old male patient was admitted to the intensive care unit with a diagnosis of sepsis. Bilumen central catheter

placement is indicated, which is placed by a pediatrician; 10 days after catheter placement, an increase in volume was identified in the right infraclavicular region, which is why an ultrasound of the neck was indicated to rule out the presence of a hematoma. After performing ultrasound and B-mode, a saccular image is identified, with heterogeneous content, mobile, which generates a liquid level and depends on the right subclavian artery (SA) (figure 1), after the application of color Doppler it is observed presence of flow from the AS to the center of the previously described image, generating turbulent flow and a yin-yang sign (figure 2), pulsed Doppler application identifies a spectrum with the presence of prominent systole and inverted diastole in relation to the pattern in oscillation (figure 3), findings compatible with SA pseudoaneurysm.

Figure 1. Ultrasound of the right subclavian artery. In B-mode, a saccular-looking defect is identified, with heterogeneous content that generates liquid-liquid levels and depends on the anterior aspect of the vessel (white arrow). The central catheter is identified in the topography of the subclavian vein (arrowhead).

Figure 2. Ultrasound of the right subclavian artery. In power Doppler mode, adequate saturation of the subclavian artery is identified, as well as flow from the subclavian artery towards the saccular defect, generating turbulent flow and a yin-yang sign (white arrow).

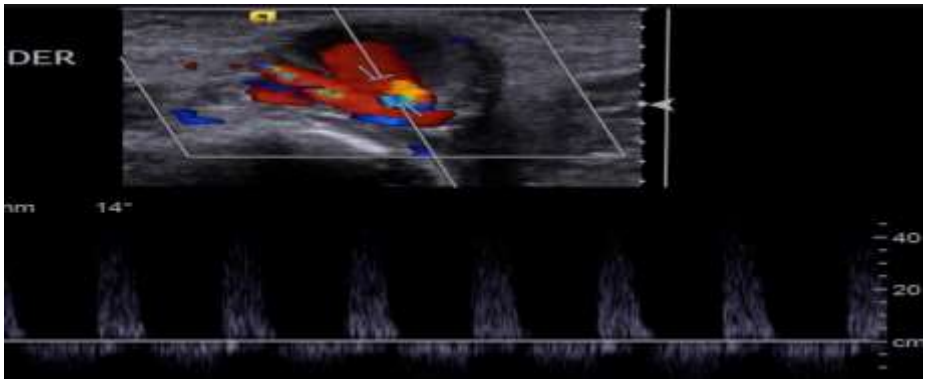

Figure 3. Ultrasound of the right subclavian artery. In spectral Doppler mode at the level of the arterial jet, a biphasic spectrum with increased systole and inversion of diastole is identified in relation to the to and fro pattern, findings compatible with the pseudoaneurysm of the right subclavian artery.

CASE REPORTS (2)

A 67-year-old male patient diagnosed with thrombosis of the posterior tibial artery was treated with percutaneous mechanical thrombectomy, without apparent alterations at the time of the intervention; Twenty days after the procedure, an increase in volume was identified at the level of the excised lesion, as well as a pulsatile mass on physical examination. A control angiotomography is requested to assess the vascularity of the right pelvic limb, evidencing the presence of an image with a saccular appearance and central hypodense content in the simple phase (figure 4a), which is contrasted phases show hyperdense content with a progressive increase in units. Hounsfield (figure 4b-4c) and dependence on the posterolateral aspect of the posterior tibial artery, data in relation to the pseudoaneurysm.

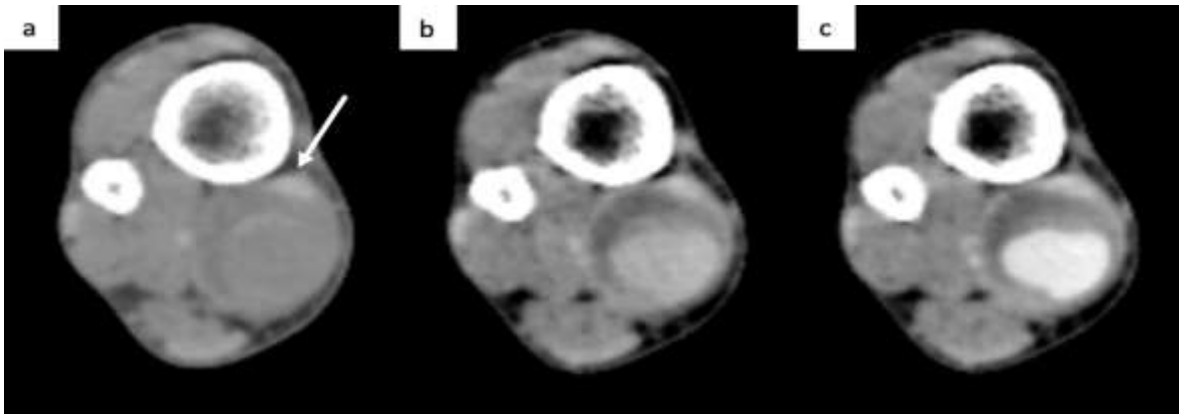

Figure 4. Computed tomography of the right lower limb at the level of the middle third of the leg. Panel (a) in the simple phase, an image of ovoid morphology, hypodense, and dependent on the posterior aspect of the medial gastrocnemius (white arrow) is identified. Panel (b) and (c) in arterial and venous phase show progressive enhancement and dependence of the posterior tibial artery, data related to the pseudoaneurysm.

CASE REPORTS (3)

A 55-year-old male patient who was admitted to the vascular surgery service with a diagnosis of infrarenal aortic aneurysm underwent placement of an aortic endoprosthesis with an approach through the right common femoral artery without incident during the procedure. The patient comes for a check-up 10 days after the procedure, referring to an increase in volume at the level of the right groin, as well as the pulsation of a "mass", an ultrasound is requested, identifying an image with a saccular aspect, with anechoic content and dependent on the anterior aspect of the right femoral artery (figure 5a), after the application of color Doppler, the presence of flow towards said sacculation is identified, with turbulent flow and a yin-yang sign (figure 5b), after the administration of ultrasonographic contrast medium, enhancement of the saccular defect (figure 5c), data in relation to a pseudoaneurysm of the right common femoral artery associated with a transarterial percutaneous approach. Given the diagnosis, it was decided to treat with covered stent placement, showing an adequate response in subsequent follow-ups (figure 5d).

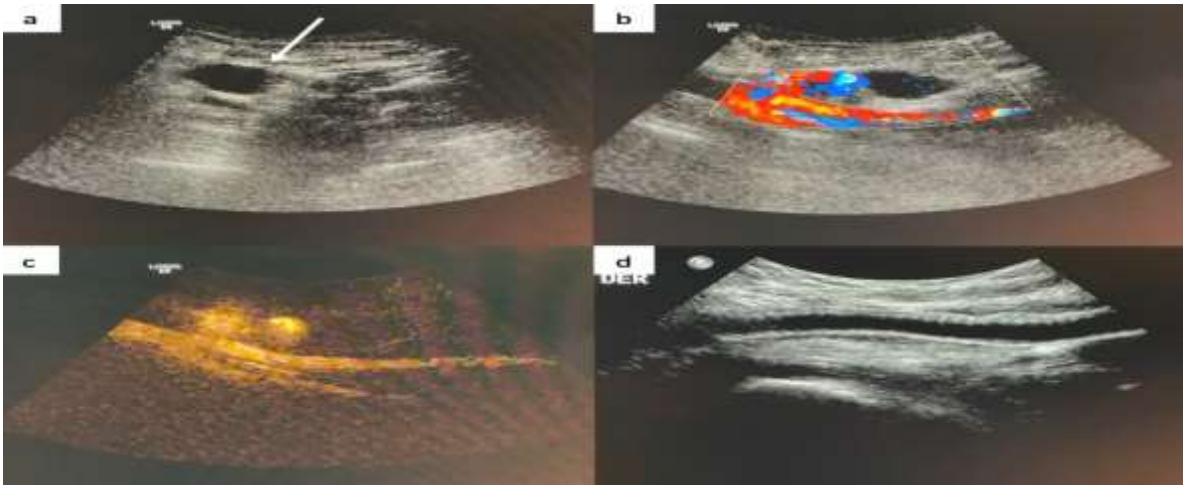

Figure 5. Ultrasound of the right common femoral artery, superficial femoral artery, and deep femoral artery. Panel (a) in B-mode shows an image of ovoid morphology, with anechoic content and in close relationship with the anterior wall of the superficial femoral artery (white arrow). Panel (b) after applying color Doppler, turbulent flow is identified towards the said image, generating a yin-yang sign. Panel (c) after the administration of ultrasound contrast, enhancement of a said image is observed in the arterial

phase as well as turbulent flow, findings compatible with pseudoaneurysm of the superficial femoral artery. Panel (d) shows the treatment of the superficial femoral artery with stenting.

DISCUSSION

Arterial pseudoaneurysms are the second most common complication of minimally invasive endovascular procedures [9]. Currently, minimally invasive endovascular techniques have gained popularity, increasing the use of anticoagulant and antiplatelet drugs, as well as a higher incidence and clinical relevance of pseudoaneurysms, even in less frequent sites such as the upper limbs [10]. The most widely used method for the characterization and diagnosis of this condition is Doppler ultrasound, with a sensitivity of 94-99% and a specificity of 94-97% [11]. What characterizes pseudoaneurysms and differentiates them from true hematomas or aneurysms is the "yin-yang sign", formed by the inflow and outflow of systolic and diastolic blood from the pseudoaneurysm [1,2,7,11]. Although it is not uncommon to use only grayscale ultrasound to detect blood eddies within the saccular defect and cyclical changes in the direction of blood flow [12]. However, it shows some disadvantages such as poor visualization of pseudoaneurysms in visceral arteries, deep planes, and the "operator dependent" factor [13]. Tomography angiography is a method that has reported a sensitivity of 95.1% and a specificity of 98.7%, it allows for determining the exact location of the pseudoaneurysm, locating complex origins, very useful in the retroperitoneal region. It has the disadvantage of using ionizing radiation and the application of an iodinated contrast medium, which is not feasible in people with kidney damage. Magnetic resonance imaging may be useful when the iodinated contrast medium is contraindicated, however, it is more time-consuming, not practical in an emergency setting, is more expensive and certain clinical conditions contraindicate the procedure such as the use of pacemakers and claustrophobia [1,11,13]. Diagnostic angiography is useful when there is high clinical suspicion and the pseudoaneurysm cannot be seen by other imaging methods; It has a better spatial resolution than computed tomography angiography and ultrasound, as well as an advantage. allow targeted treatment during diagnosis, with the disadvantage of being an invasive procedure and all the complications that this entails [1,13]. The pseudoaneurysm is a consequence of poor hemostasis, the main objective of treatment being to achieve thrombosis [8]. Already mentioned above, in small and asymptomatic pseudoaneurysms, treatment is controversial due to the possibility of spontaneous resolution, requiring a surveillance period of 21-40 days [11]. In cases of larger, symptomatic, and/or visceral pseudoaneurysms, intervention is recommended due to the high risk of rupture [2,13].

Previously, the "gold standard" of treatment was surgery, with effectiveness of 100% and with the disadvantage of an intra- and post-operative complication rate of 21%. Indicated for rapidly growing pseudoaneurysms, neuropathy, ischemia, and endovascular treatment failure [8,11,13]. Ultrasound-guided compression has been reported to be 63%-88% effective, requiring sedation or analgesia to tolerate the pain during the procedure[8]. It has the advantage of not having the adverse effects of thrombin use or its complications such as thrombus propagation [2]. A positive success factor is sac size >2cm and <4cm and a negative factor is anticoagulation [13]. It has a complication rate of 2.4-4.3% including rupture [1]. However, a Cochrane systematic review reports no difference in effectiveness between ultrasound-guided compression and blind compression at the puncture site.[8]

Percutaneous injection with thrombin has an effectiveness rate of 90% to 100% and is indicated for pseudoaneurysms <3cm; it is contraindicated for large pseudoaneurysms >5cm. Anticoagulation does not seem to be a factor influencing the efficacy of this method [1]. In case of failure or high risk of complications due to thrombin injection, there is a percutaneous arterial closure modality under ultrasonographic guidance [14]. Endovascular treatment is divided into two branches, embolization, and stenting. The choice depends on the morphological characteristics of the pseudoaneurysm as well as the donor artery. If the pseudoaneurysm meets the anatomical characteristics, if it does not have collateral arteries and is sacrificial, embolization can be performed [1,2,13]. There are several materials available for the embolization of a pseudoaneurysm, the most used in the endovascular approach being coil embolization. It is very useful in emergencies to prevent unfavorable events [15]. There are different techniques described, whose main purpose is to prevent the pseudoaneurysm from filling with blood through the collateral branches. On the other hand, coated stents allow the bleeding site to be sealed, with the disadvantage that this material is more rigid and larger than that used in coil embolizations. Therefore, it is an adequate option for a pseudoaneurysm located in arteries with a large diameter and little tortuosity [16]. Xu et al propose that combining embolization methods as well as endovascular techniques can improve prognosis, with a better success rate and fewer complications and associated mortality [15].

CONCLUSIONS

The pseudoaneurysm is a complication of endovascular procedures, the history of a percutaneous approach in the arterial vasculature, the sensation of a pulsatile mass, and the increase in volume at the access site will give us a high suspicion of pseudoaneurysm. Given this assumption, the clinician must be familiar with the different imaging methods, their advantages, and disadvantages, as well as the expected findings for diagnostic confirmation. The study protocol is generally performed with ultrasound since it represents a low

cost and high diagnostic value in expert hands; However, as we observed in the present study, the use of other imaging modalities will provide us with additional information in the characterization of the pseudoaneurysm, with the aim of arriving at the best therapeutic plan.

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