Compartment syndrome after spontaneous rupture of a left radial artery pseudoaneurysm

Síndrome compartimental após ruptura espontânea de pseudoaneurisma da artéria radial esquerda

Benjamim Massao Harada Neto, Rodrigo Daghlawi, João Ricardo Antunes Marcos, Gilberto Guilherme Ajar Marchiori, Micheli Zanoti Galon, Luciana Aparecida Salgado Rodrigues, George César Ximenes Meireles

ABSTRACT - The transradial approach is indicated to reduce the risk of death, vascular complications, or bleeding. In patients with stable ischemic heart disease, the radial approach is recommended to reduce vascular complications and bleeding on access site. The complications are rare, and hematoma, perforation, and pseudoaneurysm (very rarely) of the radial artery may occur. This case report describes a rare case of left radial artery pseudoaneurysm associated with compartment syndrome in the left forearm after elective catheterization. The diagnosis was confirmed by Doppler ultrasonography, which showed a left radial artery pseudoaneurysm, measuring 2.1x1.5cm, with a 0.3-cm long/wide neck. Surgical treatment of pseudoaneurysm and compartment syndrome restored full limb function.

Keywords: Radial artery; Aneurysm, false; Compartment syndromes; Surgical procedures, operative; Vascular system injuries

RESUMO - A abordagem transradial é indicada para reduzir risco de morte, complicações vasculares ou sangramento. Em pacientes com doença cardíaca isquêmica estável, a abordagem radial é recomendada para diminuir sangramento no local de acesso e complicações vasculares. As complicações são raras, podendo ocorrer hematoma, perfuração e, muito raramente, pseudoaneurisma da artéria radial. Neste relato de caso, é descrito um caso raro de pseudoaneurisma da artéria radial esquerda associado à síndrome compartimental no antebraço esquerdo após realização de cateterismo eletivo. O diagnóstico foi confirmado por ultrassonografia com Doppler, que evidenciou pseudoaneurisma da artéria radial esquerda, medindo 2,1x1,5cm, com colo de 0,3cm. O tratamento cirúrgico do pseudoaneurisma e da síndrome compartimental restaurou a função completa do membro.

Descritores: Artéria radial; Falso aneurisma; Síndromes compartimentais; Procedimentos cirúrgicos operatórios; Lesões do sistema vascular

INTRODUCTION

In acute coronary syndrome patients undergoing percutaneous coronary intervention (PCI), the radial approach is indicated in preference to the femoral access, to reduce the risk of death, vascular complications, or bleeding. In patients with stable ischemic heart disease, the radial approach is recommended to reduce bleeding at the access site and vascular complications. 1 Tatli et al., after analyzing 10,324 patients, of whom 2,652 underwent PCI and 7,672 underwent radial coronary angiography, observed vascular and hemorrhagic complications in 0.44% (45 patients): 0.31% (32 patients) with hematoma ≥6cm, 0.08% (8 patients) with perforation, 0.04% (1 patient) with arteriovenous fistula, and 0.009% (1 patient) with radial artery pseudoaneurysm. 2

Pseudoaneurysm is a hematoma encapsulated by fibrous tissue, creating a false sac as a result of a puncture through all three layers of an artery, i.e., intima, media, and adventitia, in contrast to a true aneurysm, which is composed of all three layers of the arterial wall.
the arterial wall. It can occur after using the radial technique and its main risk factors are inadequate technique and the compression time after removal of the radial introducer. Other risk factors are age ≥65 years, obesity, multiple punctures, large-caliber introducers, complex interventions, anticoagulation, and platelet antiaggregation.3

Current treatment methods for radial artery pseudoaneurysms are similar to those performed for femoral artery pseudoaneurysms, including manual mechanical or ultrasound-guided compression, percutaneous thrombin injection, and conventional surgery.3,4

This study was evaluated and approved by the Research Ethics Committee of organization do Instituto de Assistência Médica ao Servidor Público Estadual (Iamspe), with protocol 6.303.988, and CAAE 70792623.1.0000.5463.

CASE REPORT

A 65-year-old male patient with a history of hypertension, diabetes mellitus, stage IV chronic kidney disease, and smoking habit was admitted to the emergency room complaining of shortness of breath on mild exertion and at rest, associated with edema of the lower limbs, and orthopnea. An electrocardiogram was performed and revealed atrial fibrillation; a chest X-ray showed an increased cardiothoracic ratio, and a transthoracic echocardiogram showed a left ventricular ejection fraction of 33%, in addition to a mild left atrium and left ventricle enlargement, with decreased global systolic function due to akinesia of the inferior and septal walls. Laboratory tests showed creatinine at 0.9mg/dL, urea at 38mg/dL, and troponin at 0.001ng/mL (normal value <0.034ng/mL). The initial diagnosis was profile B heart failure, and a coronary angiography was indicated for etiological investigation.

The coronary angiography was initiated using the right radial access, but, due to non-progression of the 0.035” hydrophilic guidewire, the access was changed to the left radial artery (LRA). The 6F radial introducer was positioned in the LRA, and unfractionated heparin 5,000IU and 50mcg nitroglycerin were administered through the introducer extension tube. 6F Judkins JL4 and JR4 diagnostic catheters (Terumo Corporation, Tokyo, Japan) were used for selective contrast injection into the coronary arteries. The coronary angiography showed a 70% stenosis in the middle third of the left anterior descending artery, with no obstructive lesions in the diagonal branches. The left circumflex artery was free of obstructive lesions and had a 90% stenosis in the ostium of the first minor marginal branch. The right coronary artery showed a 40% stenosis in the middle third, and the posterior ventricular and posterior descending branches were free of obstructive lesions. Left ventriculography was not performed due to the risk of contrast-induced nephropathy. The procedure went uneventfully, and a compressive dressing was applied with Tensoplast elastic bandage and folded sterile gauze, covered with spherical tape in the LRA region, with instructions to loosen the dressing after 3 hours.

Four days after the procedure, the patient developed a significant hematoma on the left forearm, pain and decreased perfusion in the region of the left forearm and hand, in addition to paresthesia in the left fingers (Figure 1). The patient was evaluated by the vascular surgery team, and a Doppler ultrasound of the left upper limb was ordered, which showed post-puncture left radial pseudoaneurysm associated with compartment syndrome in the left forearm. With this clinical presentation, the Vascular Surgery team performed surgery initially in the LRA region, where a pseudoaneurysm orifice was identified and the orifice was sutured with discontinuation of bleeding (Figure 2). Then, a fasciotomy was performed in the left forearm. The skin was sutured only in the incision in the LRA region, due to skin tension caused by the left forearm hematoma (Figure 3).

The patient had a favorable clinical course of the compartment syndrome, with regression of the edema that allowed a skin suture and relief of pain, with normal perfusion of the entire left upper limb. The control Doppler ultrasonography, performed after 12 hours, showed resolution of the pseudoaneurysm. Hospital discharge occurred 7 days after surgery.

DISCUSSION

In the present case of transradial catheterization leading to forearm compartment syndrome, the patient had as clear risk factors, in addition to the procedure itself, the use of antiplatelet agents and anticoagulation. The LRA pseudoaneurysm rupture originated a compartment syndrome on the fourth day after catheterization via LRA. Surgical treatment of the pseudoaneurysm and compartment syndrome restored full limb function. Whereas the incidence of compartment syndrome as a complication of transradial catheterization is low (0.01%), this syndrome can quickly lead to complications if not immediately recognized and surgically treated.5

Figure 1. Hematoma on the left forearm.
Effective treatment and rapid diagnosis of pseudoaneurysm allow adequate hand perfusion and minimizing complications, such as spontaneous rupture, hand ischemia (especially if the radial artery is dominant), and compartment syndrome. Preventive measures should be used to reduce the occurrence of pseudoaneurysm and other vascular complications, including sterile preparation for the procedure; avoid multiple punctures in the same location; use proper technique and correctly handle endovascular equipment.5

The management of radial pseudoaneurysm aims to discontinue the communication between the artery and the hematoma and to repair the wall injury. Treatment usually depends on location, symptoms, presence of thrombi, etiology, distal circulation, and collateral vessel formation. Small (<3cm), nonprogressive, asymptomatic pseudoaneurysms are usually monitored because most present thrombosis spontaneously within four weeks. Ultrasound-guided compression can be used to occlude the pseudoaneurysm neck. Ultrasound-guided thrombin injection can also be used to convert fibrinogen to fibrin, leading to clot formation. This method is most commonly used to treat femoral artery pseudoaneurysms, but some successful cases have been reported for the radial artery.6,7 Ultrasound-guided compression is safe and effective. Direct compression at the neck of the pseudoaneurysm using a transducer probe causes stasis of blood and promotes local coagulation and occlusion of the pseudoaneurysm. Ultrasound guided percutaneous injection of thrombin into the femoral artery pseudoaneurysm has a success rate ranging from 93 to 100%. The technique increases the risk of thrombin embolization to the distal circulation, causing vascular thrombosis and peripheral ischemia. The combined maneuver of pseudoaneurysm compression followed by compression release at the time of thrombin injection may increase the safety margin.7

Figure 2. Surgical field with exposure of the left radial artery pseudoaneurysm.

Figure 3. Result after suturing the left radial artery and fasciotomy, showing skin tension in the surgical wound in the fasciotomy region.
Surgical treatment is generally recommended in patients with large, expanding, symptomatic, or infected pseudoaneurysms, or pseudoaneurysms which failed the initial conservative management. These pseudoaneurysms have a higher risk of thromboembolism and rupture.4

Ligation of the radial artery or surgical excision of the pseudoaneurysm of the radial artery can be safely performed, as has been demonstrated in studies on lacerations of wrist arteries and in the removal of the radial artery, for use as a graft in a coronary artery bypass grafting. Vascular reconstruction should be reserved for complicated or ruptured pseudoaneurysms, failure of conservative treatment, or critical hand ischemia, with a chance of limb loss.8,9

Early recognition of a compartment syndrome by the nursing staff and attending physicians is crucial. Whereas it is unclear whether this complication is preventable or not, prompt recognition and early surgical management can improve outcomes and prevent the most devastating complications, which include limb loss, ischemic contracture, and permanent loss of motor, and sensory functions.

SOURCE OF FINANCING

There were no sources of financing for this work.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest to disclose.

CONTRIBUTION OF AUTHORS

Conception and design of the study: BMHN, RD, JRAM, GGAM, MZG and GCXM; data collection: BMHN, RD, JRAM and GCXM; data interpretation: BMHN, RD, JRAM and GCXM; text writing: BMHN, GCXM, LASR and RD; approval of the final version to be published: GCXM.

REFERENCES