

# **A posttraumatic pseudoaneurysm of the left radial artery as a result of a stab wound in an 8-year-old girl**

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## **Introduction**

Pseudoaneurysms are a potential complication of arterial wall damage, generally caused by trauma [1]. They occur less frequently in the arteries of the upper extremities, especially the radial artery, in comparison to the lower extremity arteries [2]. In the pediatric population, pseudoaneurysms are mainly related to trauma, usually after bone fracture, or to surgical iatrogenic damage [3]. This paper presents a case of a pediatric patient who developed a pseudoaneurysm of the radial artery in her left distal forearm after a stab wound.

## **Case presentation**

An 8-year-old girl was admitted to the emergency department (ED) of University Children's Hospital in Belgrade due to a stab wound to her left forearm sustained on the same day. Parents indicated the injury had been self-inflicted, "while playing with a knife". Clinical examination revealed a 12 mm long, elliptical, longitudinally oriented stab wound on the volar surface of the left distal forearm. The proximal part of the wound appeared fish-tailed and slightly bruised, whereas the distal part was sharply pointed. Clinical examination excluded major blood vessel damage. The depth of the wound was not determined. The wound was tape-closed and dressed. As no other injuries were detected, the girl was scheduled for a follow-up and released home. There was no indication of child abuse or neglect. The girl missed her scheduled follow-up.

Twenty-six days later, the parents brought the girl to the ED because of an apparent tumefaction at the wound site. They stated that the tumefaction appeared about three weeks after the injury and initial admission. Since then, the

mass showed continuous growth, causing discomfort and pain in the forearm. Clinical examination revealed a pulsating subcutaneous soft mass lesion, measuring about 32 x 28 x 10 mm in all three dimensions (Fig. 1a). An 11 mm long soft scar in the lower lateral quadrant of the tumefaction was noted. No signs of inflammation were observed (Fig. 1b). A working diagnosis of arterial pseudoaneurysm was made based on the evident pulsation of the lesion, its location along the radial artery, and history of penetrating trauma. The girl was admitted for further diagnostics and treatment. Routine laboratory test results were within normal range. Anteroposterior and lateral radiography of the left forearm excluded bone pathology. The soft-tissue tumefaction was clearly visible as a sharply limited, oval, homogeneous shadow, 25 mm in largest diameter (Fig. 2).

Duplex ultrasonography (US) revealed a cystic vascular lesion, 20 mm in diameter, located next to the radial artery. Using color and power Doppler, swirling blood flow was detected in the lesion, as well as apparent communication with the radial artery. No abnormalities in arterial arborization or blood flow distal to the lesion were observed (Fig. 3). A diagnosis of posttraumatic pseudoaneurysm of the radial artery was obvious. Preoperative MRI was performed, with postprocessing volume rendering technique (VRT) analysis (Fig. 4).

After intraoperative incision, a saccular vascular lesion was exposed, measuring 28 x 25 x 9 mm (Fig. 5) and involving the left radial artery. Surgical treatment included aneurysmectomy and partial resection of the radial artery with end-to-end anastomosis. Without macroscopic signs of inflammation or complications, the patient was discharged on the third postoperative day.

Macroscopic analysis showed a thin-walled vascular lesion with intraluminal thrombosis. The histopathology confirmed a pseudocyst formation surrounded by a fibrovascular wall with loose elastic lamina and endothelium, with an adjacent intraluminal, organized thrombus. Foci of wall hemorrhage were present as a sign of traumatization. There was no evidence of inflammation or granulomatous reaction (Fig. 6). These changes implied pseudoaneurysm as the final diagnosis, with signs of traumatization and intraluminal thrombosis.

## **Discussion**

Pseudoaneurysms are potential complications of arterial wall damage mainly caused by trauma and generally regarded as late posttraumatic sequelae. Usually, pseudoaneurysms arise after a disruption of the vessel wall, when a hematoma is formed adjacent to the damaged artery. As the hematoma undergoes organization, it encases the

damaged portion of the artery, possibly compromising blood flow. With further organization of the hematoma, blood flow through the artery may eventually be restored [4].

Peripheral arteries are particularly prone to this type of posttraumatic complications, since they are surrounded solely by soft tissue and therefore insufficiently protected. Regarding location, pseudoaneurysms are less frequently found in the upper versus lower extremities [5]. Aneurysms at uncommon locations generally occur due to major trauma, infection (e.g. syphilis), the Marfan syndrome or polyarteritis nodosa [6]. Atherosclerotic aneurysms are often seen in large-caliber arteries and in patients of advanced age, however, pseudoaneurysms due to penetrating or blunt trauma are seen in patients at any age or location [7,8]. So far, most published cases of radial artery pseudoaneurysms in adults have reported penetrating trauma as the main cause [9]. But, in the pediatric population, cases of radial artery pseudoaneurysms have listed bone fracture as an important additional cause besides penetrating trauma and iatrogenic causes [3].

Minor blunt trauma may cause pseudoaneurysms in patients prone to hemorrhage [10,11]. Occasionally, patients with pseudoaneurysms are admitted to hospital months or even decades after a trauma [1,2]. Here, the patient's anamnesis did not indicate previous infection or predisposing disease. The period from trauma to subsequent pseudoaneurysmatic vascular complication was less than a month.

It is important that physicians consider pseudoaneurysm when evaluating pediatric patients presenting with various mass lesions on the upper or lower extremities – from an asymptomatic tumefaction to painful pulsatile masses after trauma – because this entity is seldom found in the pediatric population and may be missed during clinical examination [12].

Vascular color Doppler or duplex Doppler ultrasonography and MRI angiography are used as highly reliable diagnostic tools for pseudoaneurysm assessment, though selective upper extremity arteriography is the gold standard [13]. In this case, CT angiography was not performed, however, MRI VRT reconstruction appeared very illustrative and sufficient for planning surgical treatment.

Although the histological appearance of posttraumatic pseudoaneurysms is unspecific, the crucial role of pathological analysis is to exclude specific granulomatous inflammation or unspecific vasculitis as the cause of aneurysm. Also, it would be significant to rule out connective tissue diseases. In the absence of characteristic

histopathology, pseudoaneurysms formed as posttraumatic sequelae are a diagnosis of exclusion, usually established as the result of detailed anamnesis.

Radial artery pseudoaneurysms should be treated promptly as they are associated with higher risk of local and systemic complications e.g. thrombosis, embolization, skin erosion and infection, bleeding and compression of adjacent nerve structures, leading to paresthesia, pain and restricted limb mobility [2]. Depending on the vascular lesion severity, treatments can vary and can be performed under ultrasonographic guidance. Different therapeutic approaches include manual compression, ligation, endovascular graft implantation and embolization. This type of aneurysms can be treated with ultrasound-guided thrombin injection and by surgical reconstruction [1,7,9,14,15]. The treatment of choice is resection of the aneurysm and arterial reconstruction with primary end-to-end anastomosis. In our case, surgery was necessary and implied aneurysmectomy and proximal and distal ligation of the radial artery as the defect of its wall was longer than 2 cm. Payne described a similar case where a ligation was placed on the radial artery for removal of a pseudoaneurysm with transient swelling of the injured hand caused by inability of the ulnar artery to act as an anastomosis [16]. Here, imaging studies performed for surgical treatment planning (MRI VRT) did not reveal any pathology of the ulnar artery or blood flow disturbance. In accord with these findings, the postoperative recovery was rapid, with no disturbance of arterial blood flow distal to the site of intervention.

## **Conclusion**

Although uncommon, pseudoaneurysms in the upper extremity arteries distal to the axillary artery frequently arise as a complication of gunshot or stab wounds. They are associated with various common complications such as rupture and consequent bleeding, thromboembolisms leading to gangrene of the extremity and amputation. Therefore, appropriate diagnostic procedures, such as duplex ultrasonography and MRI angiography with volume rendering, followed by carefully planned surgical treatment of the pseudoaneurysm are important and highly recommended. If a pulsatile tumefaction appears in the region of a stab wound, a pseudoaneurysm should be considered as a consequence of blood vessel damage, since its possible complications could be life-threatening.

## **References**

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