

## **Concomitant Pseudoaneurysm and Arteriovenous Fistula Formation of Brachial Artery: A Case Report**

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### **Abstract:**

Concomitant pseudoaneurysm and arteriovenous (AV) fistula formation of brachial artery after a penetrating injury has been rarely reported. False aneurysms of peripheral arteries are very rare. It is usually of infectious, post-traumatic or of iatrogenic etiology. In most cases, these are the result of penetrating injuries such as gunshot or stab wounds and iatrogenic arterial injuries. Brachial artery is not a common site for peripheral artery aneurysms. Its association with fistula formation with adjacent vein makes this a rare case. This case was diagnosed on colour duplex ultrasound and confirmed on subtraction angiography.

**Key Words:** Pseudoaneurysm, Brachial artery, Arteriovenous fistula.

### **Introduction:**

Post-traumatic pseudoaneurysm development is very rare in the peripheral arteries and is generally a late sequelae of trauma. The frequency of peripheral artery pseudoaneurysms is less common in the upper extremity as compared to the lower extremity (Wielenberg et al, 2000). Popliteal artery is comparatively a common site in lower extremity, but brachial artery aneurysm is an uncommon entity. Only few cases of brachial artery pseudoaneurysms have been reported in the medical literature to date but no case has been reported of its association with AV fistula. Their diagnosis and surgical treatment are extremely important, because they can cause severe disability, including loss of upper extremity and hand.

Here we report a case of a young man who came to us for colour duplex sonography and digital subtraction angiography for swelling in distal arm developed after trauma. We diagnosed it as post-traumatic brachial artery pseudoaneurysm with arteriovenous fistula formation, along with retained foreign body.

### **Case Report:**

A 32 year old male was referred to us from the department of Surgery for colour duplex sonography and digital angiography, with history of a progressive painless swelling on the medial side of left distal arm

for 3 month. He gave a history of penetrating trauma by an iron rod while cutting it, which caused a profusely bleeding wound. He took primary treatment in his local area. Later on he developed a painless gradually increasing swelling which did not cause any impairment in the functional capacity of the limb (Tetik et al, 2002). Only his apprehension about the nature of the swelling brought him to the hospital. He did not give any history of fever, numbness or tingling sensation at the site of swelling or palpitation. There was no history of venepuncture, arteriography, dialysis, intravenous drug abuse or surgery at the site of swelling. There was no personal or family history of diabetes, hypertension, connective tissue disorder or history of aneurysm.

On physical examination, a widely pulsatile ovoid mass was present on the medial side of the left distal arm, which was approximately 5 cm in size, with an old scar mark at the site of the swelling. There was no visible pulsation, skin pigmentation or prominent veins. Palpation of the swelling revealed a soft, compressible, mobile, pulsatile, expansile and non fluctuant mass. It was non tender, non reducible, not blanching on pressure and not attached to overlying skin or underlying muscle or bone. Cardiovascular and neurological examination was unremarkable. There was no evidence of embolisation to the digits; pulses were palpable distal to the swelling. The remaining physical examination was normal. The laboratory examination was normal. Plain X-ray showed a metallic foreign body in left distal arm.

On ultrasound, two anechoic collections of approximately 3.4×2.0 cms and 5.4×2.4 cms size were seen along the distal part of brachial artery which

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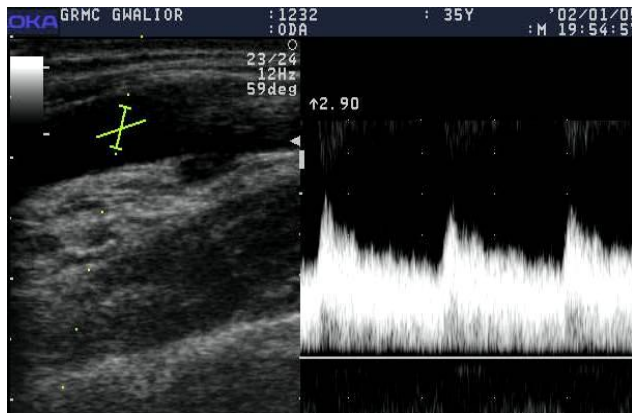


Fig. I: Spectral tracing shows high diastolic flow in brachial artery in proximal part which is an indirect evidence of fistula located downstream.

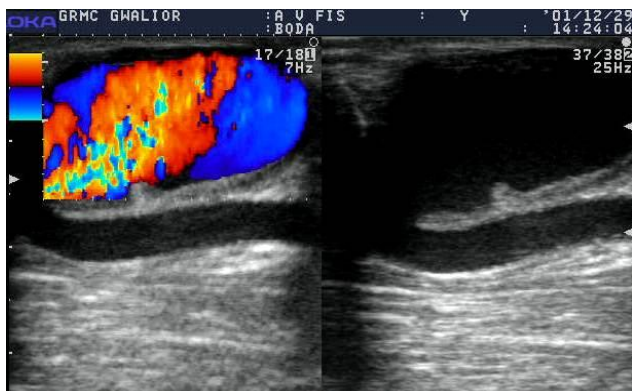


Fig. II: Colour duplex sonography of brachial artery pseudoaneurysm: shows yinyang pattern caused by swirling of blood in the pseudoaneurysm cavity.

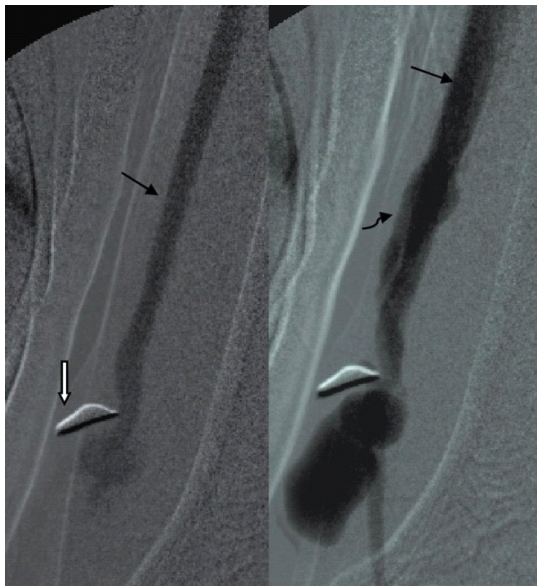


Fig. III: Selective digital subtraction angiography of brachial artery: (A) early arterial phase: filling of brachial artery (black arrow) with a small pool of contrast along the artery; (B) late arterial phase: showing a dilated, tortuous vein (curved arrow) alongside the brachial artery which is filling soon after injection of contrast. Two pools of contrast seen along the brachial artery. A metallic foreign body (white arrow) was seen adjacent to the pseudoaneurysm.

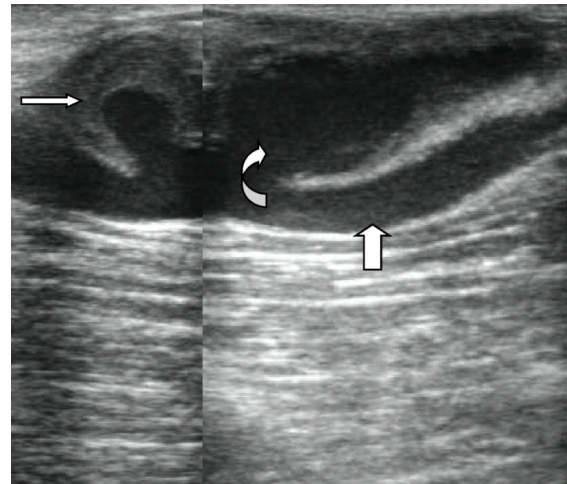


Fig. IV: Gray scale sonography of brachial artery: longitudinal image of brachial artery (thick arrow) shows two perivascular fluid collections (thin and curved arrow). Note the defect through which artery and collections are communicating.

were communicating directly with the artery. On colour doppler, these lesions were showing 'yin yang' pattern caused by swirling of blood in these cavities. The spectral tracing showed classic to-and-fro waveform pattern (turbulent flow). Along the side of these perivascular collections, a dilated anechoic vessel was seen which was also communicating directly (fistulous communication) with the brachial artery which was confirmed on high colour velocity settings (high colour pulse repetition frequency). This was a vein showing arterialised signals on doppler. The brachial artery above the fistula was showing relatively high diastolic flow on doppler which is an indirect evidence of a fistula located downstream. Evaluation of the abdominal aorta, femoral and popliteal arteries with duplex ultrasound identified no other aneurysm.

Selective digital subtraction angiography showed a dilated, tortuous vein along the side of brachial artery which was filling soon after injection of contrast in the brachial artery. The vein filled up immediately after contrast reached the distal part of the brachial artery and before it could reach the radial or ulnar artery, which indicates a communication between the brachial artery and the vein. Two separate pools of contrast were seen along the brachial artery, suggesting aneurysmal dilatation from the artery. A metallic foreign body was seen in the distal arm adjacent to the pseudoaneurysms.

## Discussion:

Arteriovenous fistula is an abnormal connection

or passageway between an artery and a vein. It may be congenital, surgically created for hemodialysis treatment, or acquired due to pathologic process, such as trauma or erosion of an arterial aneurysm (Fatimi et al, 2010).

Aneurysms at less common locations are generally due to major trauma, syphilis, Marfan syndrome or infection. Aneurysms can develop in all arteries of the human body. Atherosclerotic aneurysms are often seen in large arteries and in patients of advanced age, but pseudoaneurysms due to penetrating or blunt trauma are seen in patients of every age and at any location (Ho et al, 1987). Frequency of pseudoaneurysms in the upper extremities is much lower than that in lower extremities.

A pseudoaneurysm, also known as a false aneurysm, is a hematoma that forms as the result of a leaking hole in an artery. Note that the hematoma forms outside the arterial wall, so it is contained by the surrounding tissues. Also it must continue to communicate with the artery to be considered a pseudoaneurysm. This must be distinguished from a true aneurysm which is a localised dilatation of an artery including all the layers of the arterial wall. A pseudoaneurysm is also different from an arterial dissection, which is a separation of the layers of the arterial wall, and may be associated later with aneurysm formation. Distinctively, in a pseudoaneurysm, the hole in the arterial wall is generally the consequence of a iatrogenic trauma, most likely a previous invasive medical procedure that necessitated intrusion into an artery, for example to place a stent. Alternatively, a pseudoaneurysm can also occur as a complication of acute pancreatitis, due to enzymes leaking out from the pancreas and damaging nearby vessels. In contrast true aneurysms and dissections are usually the consequence of congenital or acquired deficiency in the arterial wall, for example due to atherosclerosis.

Infection, polyarteritis nodosa, congenital arterial defects, and especially trauma play a role in the pathogenesis of upper extremity pseudoaneurysms. Atherosclerotic aneurysm of the brachial artery is very rare (Napolitano et al, 1998). If the only causal factor is trauma, the aneurysm takes the form of a pseudoaneurysm. Minor blunt trauma may cause pseudoaneurysms in patients who are prone to haemorrhage. If no neurologic or thromboembolic complication develop, aneurysms of 2 cm or less in

diameter can be silent or asymptomatic for a long period. Such aneurysms can be diagnosed easily by detailed medical history and physical examination. Sometimes patients are admitted to hospitals with pseudoaneurysms months or years after the trauma. Due to their clinical appearance, peripheral artery aneurysms of the extremities can be easily misdiagnosed as hematomas or even as soft tissue tumors. In addition, pressure and hyperemia can result in resorption of adjacent bone. A biopsy in such cases may be hazardous. The history of trauma (recent or even previous) in conjunction with progressive soft tissue swelling should alert the clinician to a potential vascular injury as a differential diagnosis. However, as life span is increasing and diagnostic and evaluation processes are improving, the detection of such pseudoaneurysms is becoming more common (Yilmaz et al, 1997). Differential diagnosis includes hematomas, pulsating tumours, AV malformation, lymphadenopathy, lipomas and abscesses.

Plain radiographs can show fracture if it is there and any displacement of the fracture fragment which can cause vascular injury. Colour-flow Doppler ultrasonography is a non-invasive, low-cost and easily available imaging method that can provide sufficient diagnostic information to plan the surgical procedure. Magnetic resonance imaging (MRI) can also be used; an aneurysm appears on both T1- and T2-weighted images and the use of intravenous gadolinium does not enhance the signal. Upper extremity arterial Doppler ultrasonography and magnetic resonance angiography can be used as diagnostic tools, but the gold standard is selective upper extremity arteriography (Johnston et al, 1991). Selective catheterization of the injured artery allows not only the detection of the aneurysm, but also the preoperative embolization if there is a feeding artery. Doppler ultrasonographic evaluation is sufficient for late postoperative follow-up evaluation.

Treatment for pseudoaneurysm that can be performed under colour-Doppler ultrasonographic guidance are, manual compression, ligation, endovascular graft implantation, embolization, ultrasound-guided thrombin injection, and surgical reconstruction.

## Conclusion:

In conclusion, pseudoaneurysm distal to the axillary artery is rare and is frequently the result of a gunshot or stab wound. Concomitant brachial artery pseudoaneurysm and arteriovenous fistula formation

after a penetrating injury is rare (Fatimi et al, 2010). Axillary and distal peripheral artery pseudo aneurysms of the upper extremity are less dangerous than are thoracic and abdominal aortic aneurysms. However arterial doppler ultrasonography, magnetic resonance angiography and selective upper extremity arteriography (DSA- gold standard) are the modalities which are helpful in correct and timely diagnosis of the aneurysm. Treatment includes resection of the false aneurysm with end-to-end direct anastomosis.

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