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Original Research Paper

Radio-Diagnosis

A FALSE BULGE BUT A REAL THREAT – A REVIEW OF FOUR CASES OF PSEUDOANEURYSM

Dr. Mahaboob Khan A	MDRD,Associate Professor, Department of Radiodiagnosis, Tirunelveli Medical College & Hospital, Tirunelveli
Dr. Prasanth S	MDRD, Senior Resident, Govt. Rajaji Hospital, Madurai
Dr. Anand. A	MDRD, Senior Resident, Tirunelveli Medical College & Hospital, Tirunelveli

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INTRODUCTION

Pseudoaneurysm is a common acquired vascular abnormality that results from a local damage in the arterial wall continuity. It can arise due to a wide repertoire of causes ranging from inflammation and infection to trauma, including both blunt and penetrating trauma, and iatrogenic causes, including post-angiographic catheterization, percutaneous tissue biopsies and percutaneous drainage of collections. The local injury or disruption that these pathological processes cause in the arterial wall hampers its continuity and thus leads to perfusion of flowing blood in between the layers of this disruption. This results in the formation of a perfused sac like structure that is covered by intima media or adventitia or by the fibrous tissue surrounding the leaking blood [1, 2].The pseudoaneurysmal sac can then get bigger over time and can result in complications like rupture, compression of surrounding neurovascular structures, superimposed infection, and development of additional arterial feeders. Complications of pseudoaneurysm are known to be associated with high morbidity and mortality [1, 2].

The advancements in imaging techniques have permitted better visualization of pseudoaneurysms. Invasive conventional angiography is the gold standard method to accurately diagnose pseudoaneurysms and outline the associated treatment decisive parameters. It not only accurately delineates the exact location of the pseudoaneurysm, but also identifies the exact parent vessel, can give information about the expendability of the vessel, and can give information regarding additional arterial feeders if used appropriately. Although considered as gold standard, conventional arteriography is invasive and requires uniquely skilled personnel and specialized equipment [1].

Non-invasive modalities, namely doppler ultrasound and Computed Tomography angiography, are the workhorses of everyday diagnostic practice when it comes to identifying and characterising pseudoaneurysms. Imaging plays a role in delineating the exact morphology of the pseudoaneurysm, nature of the parent vessel and surrounding vascular anatomy so that appropriate treatment measures can be planned in tune with the clinical setting [7].

Treatment preferences have changed in recent years from invasive to minimally invasive and non-invasive image guided management methods like ultrasound guided probe compression of the pseudoaneurysmal neck, ultrasound guided injection of thrombin into the pseudoaneurysmal sac and endovascular approaches like embolization with gelfoam or polyvinyl alcohol particles or luminal stent placement or stent assisted coiling [6-10, 13]. In this article, we review four distinct cases of pseudoaneurysm that were diagnosed in a tertiary care institutional hospital in Madurai, Tamilnadu, India.

Review Of Literature

There have been multiple studies ranging from isolated case reports and case series to literature reviews and meta-analyses pertaining todifferent types of pseudoaneurysms based on their location (superficial or visceral; extremities or abdomen or head and neck) or the presence of complications (unruptured or ruptured; Large pseudoaneurysms with neurovascular compression vs small superficial pseudoaneurysms). These studies have demonstrated and outlined clear indications for diagnostic modalities like doppler ultrasound, CT angiography and digital subtraction angiography in the evaluation of pseudoaneurysms of various kinds [1, 2, 6-10, 13].

They also have outlined management strategies for pseudoaneurysms related to interventional radiology in various settings and scenarios [7]. Such interventional treatment strategies range from pseudoaneurysmal neck compression and thrombin injection to endovascular embolization and stent-graft placement [1-3, 4, 6-7, 9-10, 12-15].

Saad et al observed that these minimally invasive and non-invasive treatments had a significant decrease in both the morbidity and mortality statistic of pseudoaneurysms [1]. The physical and clinical parameters to predict the occurrence of pseudoaneurysms in the post-traumatic setting were identified by Mlekisch et al [4].Jesinger et al noted that visceral pseudoaneurysms, especially those pertaining to abdominal and pelvic arteries, could be effectively managed by exclusion of flow through endovascular approach, by methods like sandwiching embolization by injectable liquids, luminal stents or stent assisted coil techniques [2].

Different authors over the years have focussed and studied pseudoaneurysms in different arteries of the body and outlined their characteristics and management strategies like that of femoral artery (Mitchell et al) [16], peripheral pulmonary arteries (Shin et al) [3], uterine artery (Shayesteh et al)[11] and radial branch arteries (Sawano et al) [5]. Interventional radiological procedures as effective tools for the management of these pseudoaneurysms have also been looked at in multiple studies [2, 9-15]. Practicing appropriate patient selection and ruling out complications or contraindications is paramount for pre-assessment of patients before a particular management strategy can be initiated.

AIM

To review the clinical and radiological features with subsequent management follow-up of four cases of post-traumatic/iatrogenic pseudoaneurysms that were diagnosed in a tertiary care institutional hospital in Madurai, Tamilnadu, India.

CASES

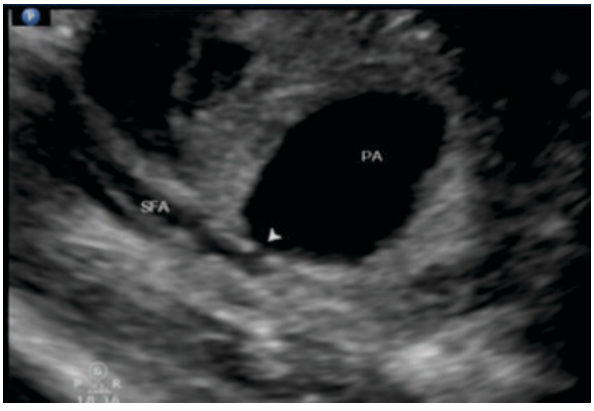
CASE 1

A 36-year-old male patient came with the complaint of swelling in the left thigh for 20 days.There was a history of penetrating injury to the same region of the body 3 months back. On clinical examination, the patient was found to have a well-defined pulsatile swelling in the inner aspect of left mid-thigh region.

Figure 1-CASE 1: Pulsatile swelling in the inner aspect of left mid-thigh

Screening of the local vascular system by doppler ultrasound revealed a pseudoaneurysmal sac of size 6.3 x 3.2x 2.2 cm arising from the mid-aspect of left superficial femoral artery with surrounding intramuscular hematoma.

The pseudoaneurysm was found to be connected to the parent artery via a narrow neck and showed admixture of arterial and venous phase flow within the sac. On sampling the neck of the pseudoaneurysm, the typical 'to-&-fro' waveform pattern of systole and diastolic flow was noted. The forward flow into the pseudoaneurysmal sac was noted during the systole and the reverse flow away from the pseudoaneurysmal sac was noted during the diastolic phase of the cardiac cycle.



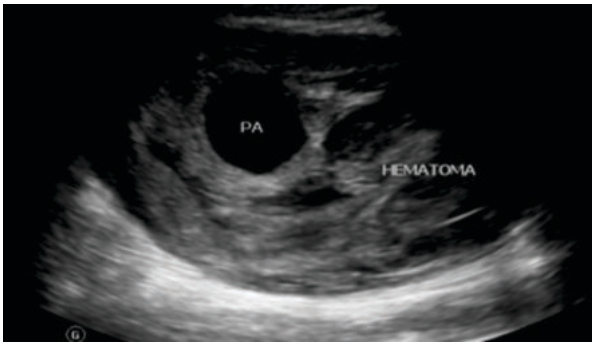


Figure 2-CASE 1: Pseudoaneurysm arising from the mid-aspect of left superficial femoral artery with surrounding intramuscular hematoma

CT angiography of the lower limbs was done which confirmed the presence of the pseudoaneurysm arising from the superficial femoral artery. It also showed the presence of intramuscular hematoma surrounding the pseudoaneurysm.

The pseudoaneurysm sac and hematoma was confirmed intraoperatively and removed.

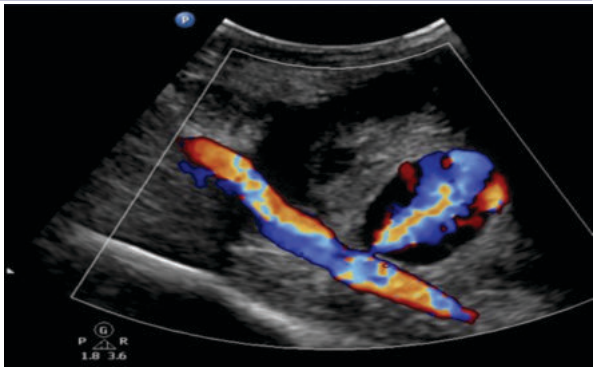


Figure 3-CASE 1: Admixture of arterial and venous phase flow within the pseudoaneurysm.

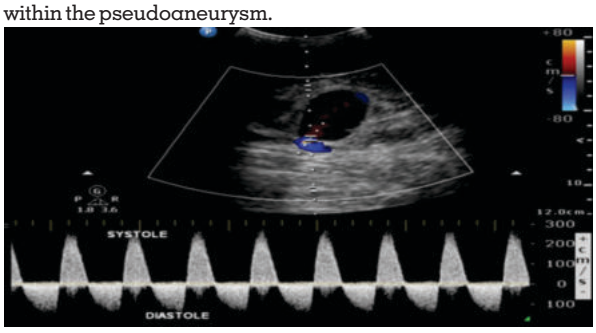


Figure 4-CASE 1: Typical 'to-&-fro' waveform pattern of pseudoaneurysm.

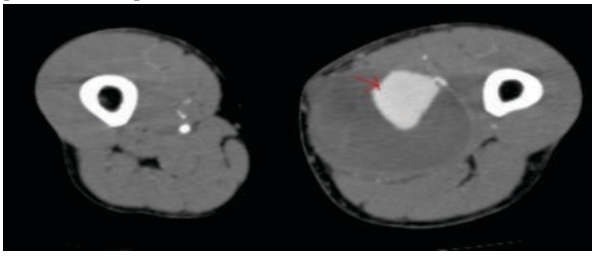


Figure 5-CASE 1: Axial CECT shows pseudoaneurysm arising from the superficial femoral artery with surrounding intramuscular hematoma.

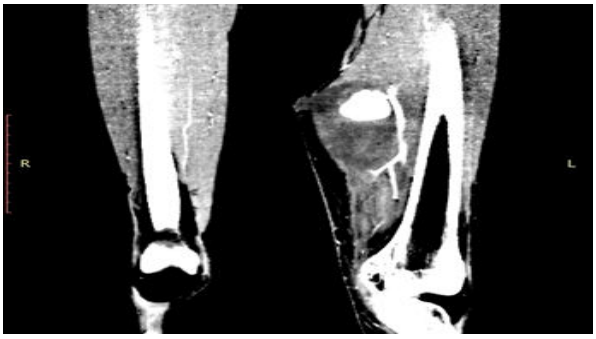


Figure 6-CASE 1: Coronal reformatted CECT shows pseudoaneurysm arising from the superficial femoral artery with surrounding intramuscular hematoma.

Figure 7-CASE 1: Intra-operative pictures showing pseudoaneurysm with surrounding intramuscular hematoma.

CASE 2

A 20-year-old male came with complaints of swelling around the left angle of mandible for 10 days. Patient had a history of penetrating stab injury to the same area due to a knife attack by a thief about 15 days back which was then treated at a local facility by simple suturing. Clinically patient had a pulsatile swelling in the area.

Doppler ultrasound showed the presence of a pseudoaneurysm of size 3 x 2.5 x 2.1 cm with eccentric thrombus within the sac. The sac was seen to arise from a parent artery that was traced to arise from a branch of the left external carotid artery.

CT angiography confirmed the presence of the pseudoaneurysm which was revealed to arise from the facial branch of the superficial temporal artery of the left external carotid artery.

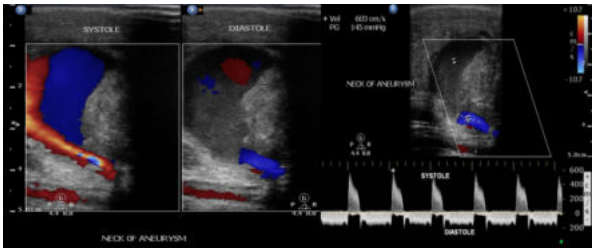


Figure 8-CASE 2: Ultrasound shows pseudoaneurysm from a branch of the left external carotid artery.

Figure 9-CASE 2: Axial CECT shows pseudoaneurysm from superficial temporal artery.

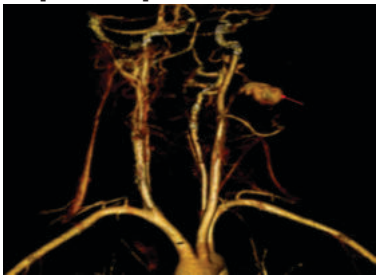


Figure 10-CASE 2: Volume rendered CTimage showspseudoaneurysm from superficial temporal artery.

Excision of the pseudoaneurysm was done and post-operative period was uneventful.

CASE 3

A 26-year-old male patient came with the complaints of increasing swelling and pain over the lower abdomen and right thigh for 15 days. Patient had a history of workplace injury with wooden door falling over the body about 3 weeks back.

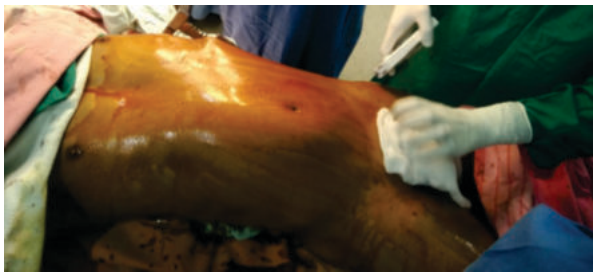


Figure 11-CASE 3: Clinical photograph of patient with complaints of swelling and increasing girth of the abdomen and proximal right thigh for 15 days with history of blunt injury 3 weeks back.

CT angiography showed the presence of post-traumatic pseudoaneurysms of bilateral external iliac arteries, larger one in the right and a smaller one in the left, with rupture of the right external iliac pseudoaneurysm causing a large retroperitoneal hematoma displacing the right kidney superiorly.

Figure 12-CASE 3: Axial CECT shows bilateral external iliac pseudoaneurysms, with rupture of the right side.

Figure 13-CASE 3: Coronal reformatted CECT shows bilateral external iliac pseudoaneurysms, with rupture of the right side.

Figure 14-CASE 3: Volume rendered image shows bilateral external iliac pseudoaneurysms.

The pseudoaneurysms were confirmed during surgery with a large rent of about 4cm found in the right external iliac artery. About 1.5 litres of organized clot was evacuated from the retroperitoneum in the right side. Despite having a large rent and a huge hematoma, patient was able to survive the surgery and post-operative period was uneventful.

Figure 15-CASE 3: Intraoperative and post-operative pictures of patient with bilateral external iliac pseudoaneurysms. Large rents in the parent arteries were noted with large pseudoaneurysms with surrounding hematomas. Excision and evacuation was done and post-operative period was uneventful.

CASE 4

A 40-year-old male patient came with the complaints of pulsatile swelling over the anterior chest wall for 2 months. There was a history of open cardiac surgery in the form of double mitral and aortic valve replacement for rheumatic disease about 6 months back.

Figure 16-CASE 4: Clinical picture showing swelling over the anterior chest wall which was pulsatile in nature.

Figure 17-CASE 4: CT scannogram showing double (aortic and mitral) valve replacement status.

Doppler ultrasound showed the presence of a pseudoaneurysm arising from the ascending aorta with eccentric thrombus with a communication defect of diameter 3mm.

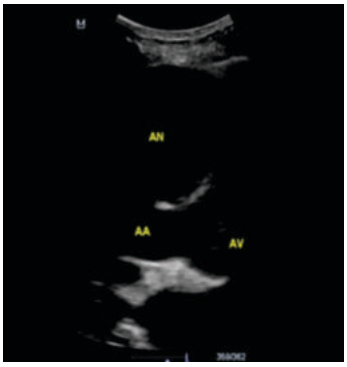


Figure 18-CASE 4: B mode ultrasound shows pseudoaneurysm with narrow neck noted arising from ascending aorta just distal to the aortic root.

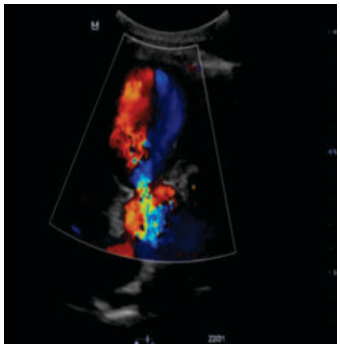


Figure 19-CASE 4: Colour doppler ultrasound shows the presence of admixture of systolic and diastolic blood in the aortic pseudoaneurysm.

CT angiography showed the pseudoaneurysm to be present in the pre-vascular space, arising from the ascending aorta just above the aortic root, protruding out of the post-operative sternal defect. Since the sac was in close relation to the aortic root and valve, it was a high-risk surgery to begin with, and despite best efforts the patient could not be saved and died on table.

Figure 20-CASE 4: Axial CECT shows pseudoaneurysm in the pre-vascular space, arising from the ascending aorta just above the aortic root.

DISCUSSION

The pathogenesis of pseudoaneurysm is manifold but follows a common natural history in most, especially in post-traumatic or iatrogenic cases [4, 9, 14]. It is commonly encountered because of iatrogenic causes due to angiographic procedures where femoral arterial catheterization is involved [16]. The increase in incidence of minimally invasive and endoluminal procedures has in turn increased the occurrence of pseudoaneurysms [4].These procedures may result in local vascular injury either due to direct trauma or secondary infection. Apart from femoral catheterization in angiography, pseudoaneurysms can occur post-trauma, percutaneous biopsy, liver or kidney transplantation, obstetric procedures like dilatation and curettage and inflammatory conditions like pancreatitis. Pseudoaneurysms may rupture causing haemorrhage, may cause mass effect and compression on surrounding structures or may undergo spontaneous thrombosis [1, 2].

Imaging findings are very typical and characteristic in most cases. B mode ultrasound shows a hypoechoic or anechoic cystic structure that is attached to the parent artery. It may be unilobed or multilobed with septations. It may have echogenic thrombus within the sac in an eccentric location or be surrounded by hematoma [16].

Doppler ultrasound usually helps in making a firm diagnosis of pseudoaneurysm by demonstrating the flow of systolic and diastolic blood into and out of the pseudoaneurysmal sac giving the appearance of a 'yin-&-yang' sign. Spectral doppler further adds to the diagnostic confidence by demonstrating a to-&-fro waveform pattern at the neck of the pseudoaneurysm. Ultrasound works best as a screening modality since it is non-invasive and does not involve ionizing radiation and can be used to refer patients with positive findings for angiography [16].

CT angiography is the main workhorse to evaluate and outline the treatment determinants of pseudoaneurysm apart from confirming the diagnosis. It is used to assess the exact morphology of the pseudoaneurysm namely the location, size of the sac, diameter of the neck, status of the parent artery, presence or risk of rupture, intra-aneurysmal thrombosis and compression of other structures surrounding the pseudoaneurysm. Unenhanced CT scan may show the pseudoaneurysm to be a low-density structure arising from a vessel. CT angiography reveals the sac to be completely or partially contrast filled depending on the degree of thrombosis and reveals the margins of the sac to be regular in case of unruptured aneurysm and irregular with surrounding hematoma in case of ruptured pseudoaneurysm. CT also offers additional advantages in terms of visualization of the entire vasculature surrounding the pseudoaneurysm and it also allows evaluation of other findings related to the underlying aetiology, like trauma related findings or inflammatory aetiologies like pancreatitis. Thus, a complete preoperative imaging workup is possible with the help of CT angiography [1, 2].

Invasive conventional angiography or digital subtraction angiography is considered as the gold standard imaging method to confirm the diagnosis of pseudoaneurysm. It is not routinely recommended except in very doubtful cases or when endovascular management is planned. The main utility of angiography lies in its ability to not just accurately diagnose pseudoaneurysm but also to delineate the surrounding vascular anatomy and find out the expendability of the vessels involved, which is important for endoluminal approach [1-4].
Treatment options consist of traditional approaches like open surgical management, or alternative or newer approaches like ultrasound guided probe compression, intra-aneurysmal thrombin injection and endovascular options like embolization and stent-graft placement [1, 3, 4, 6-7, 9-10, 12-15].

The choice of treatment and nature of approach depends on the clinical setting, the morphological characteristics of the pseudoaneurysm, the nature of the parent vessel, the expendability of the vessels involved, the surrounding vasculature, the etiological factor, and the presence of complications [2, 7, 9, 13].

CONCLUSION

The four cases that were reviewed were trauma related or iatrogenic pseudoaneurysms with different kinds of presentation in each case with different outcomes. This points to the fact that there is a factor of heterogeneity in the way pseudoaneurysms present and their prognosis, for those with a common or similar aetiology. Thus, this highlights the need for analysing, judging, reporting, and reviewing each case by its own unique merits and demerits. It also emphasizes the need for proper selection of the optimal imaging modality and appropriate treatment strategy in each case based on its unique imaging parameters. Further clinical trials and large-scalestudies with bigger cohorts are warranted tocombine the old and newlyavailable information with regards to imaging and management of pseudoaneurysms of different aetiologies. This will help to assimilate the newly available evidence with the existing protocols to modify, formulate and refine more optimal protocols for the detailed reporting and interventional management of pseudoaneurysms.

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