Original Article

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# Popliteal Artery Pseudoaneurysm: Imaging Features

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## Abstract

**Background:** The purpose of this article is to review the imaging features of popliteal artery pseudo-aneurysm. **Case Report:** We report a 42-year-old male patient with a history of previous blunt injury to left knee presenting with intense pain and edema, with hyperemia and localized temperature increase. Doppler ultrasonography revealed a voluminous pseudo-aneurysm of the popliteal artery with a contained rupture, and hematoma involving the popliteal fossa causing compression of the popliteal vein. Multidetector computed tomography (MDCT) angiography verified the pseudo-aneurysm. Popliteal artery pseudo-aneurysms lead to many dreadful conditions if left untreated. Endovascular repair was accomplished with covered stents and the rupture was verified during the procedure. The aneurysm was barred and the signs and symptoms it had caused resolved fully. **Conclusion:** Doppler ultrasonography, CT angiography and MR angiography may all be precious in the imaging workup of popliteal pseudo-aneurysms. Prompt diagnosis and treatment of popliteal pseudo-aneurysms are necessary to avoid the morbidity and mortality associated with hemorrhage and rupture. Treatment can involve surgical, medical, and endovascular methods.

**Keywords:** Popliteal artery pseudo-aneurysm, Peripheral pseudo-aneurysm.

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## Introduction

Popliteal artery pseudo-aneurysms are not uncommon. They may result from penetrating or blunt trauma, arterial reconstructive surgery, invasive diagnostic or surgical orthopedic procedures and neoplasia. Because pseudo-aneurysms do not necessarily present with pulse deficits and may not be pulsatile, they may be clinically confused with mass lesions. Popliteal artery pseudo-aneurysms can be life-threatening due to rupture and bleeding and are considered an emergency disease which need to be diagnosed accurately and quickly. Also, prompt treatment using surgical, medical, and endovascular techniques is essential. It is important to know the imaging findings of popliteal pseudo-aneurysms. The terms "pseudo-aneurysm," "false aneurysm," "pulsatile hematoma," and "communicating hematoma" are synonymous and may be used interchangeably. A pseudo-aneurysm is defined as a pulsating, encapsulated hematoma in communication with the lumen of a ruptured vessel. [1]

In this article, we discuss and show Doppler ultrasound & MDCT angiogram imaging features of popliteal pseudo-aneurysm in a 42-year-old male patient, who presented with pain & pulsatile swelling of left knee following blunt trauma.

## Case Report

A 42-year-old man was admitted to our institution with left knee pain of one month following blunt trauma aggravated by walking and oedema. There was no prior history of claudication. He had previously been seen by an orthopaedic surgeon for his symptoms. Analgesic treatment and a simple knee brace were recommended. However, the patient's symptoms persistent for another month and he was then referred to our hospital. On physical examination, pulsatile swelling, localised increased temperature, discrete hyperaemia, audible bruit and overlying oedema of posterior knee was noted. Routine blood & urine examination was unremarkable.

Doppler ultrasonography of the left lower limb revealed a voluminous pseudo-aneurysm of the popliteal artery with internal hematoma with images compatible with a contained rupture causing compression of the popliteal vein. The

pseudo-aneurysm measured about 5 x 3.2 centimetres. MDCT angiography confirmed the pseudo-aneurysm Endovascular repair was accomplished with covered stents and the rupture was confirmed during the procedure. The patient's signs and symptoms resolved completely after the procedure, and the postoperative period was uneventful.

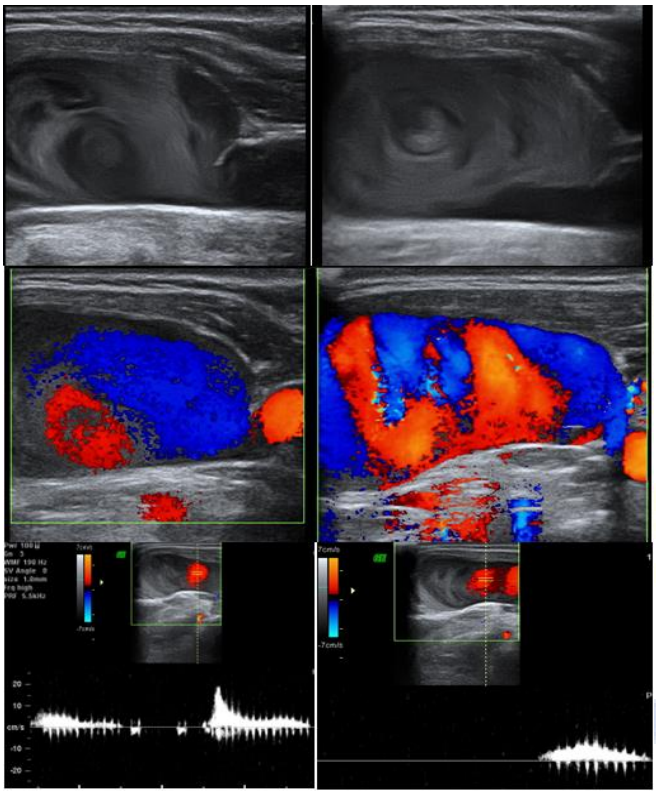

**Figure 1: (A-F). Realtime grey scale ultrasound images (A,B), Colour doppler images (C,D) and Duplex doppler images ( E,F) show bidirectional ("to-and-fro") turbulent blood flow within the lumen of popliteal saccular pseudo-aneurysm (Ying-Yang sign).**

**Figure 2: MDCT angiogram (A-C) of Lower limbs, Maximum intensity projection (MIP) (A) and 3D volume rendered (B, C) reveal lobulated saccular Pseudo-aneurysm of left popliteal artery.**

## Discussion

A pseudo-aneurysm is defined as an arterial wall deficiency, which leads to accumulation of oxygenated blood in the nearby extra-luminal region. Therefore arterial blood spread out of the vessel, forming a sac surrounding by soft tissue and compressed thrombus.[2] Pathologically, the wall of arterial pseudo-aneurysm has been breached, and the external wall of the aneurysmal sac consists of external arterial layers, perivascular tissue, blood clot, or layer of reactive fibrosis.[3] Pseudo-aneurysms are generally progressive and have complications, including thrombosis, embolization, and rupture.[4] The introductory difference of arterial aneurysm and pseudo-aneurysm is that the three-layers of the arterial wall don't bind the later one.[5]

The reported incidence of post catheterization pseudo-aneurysm varies widely from 0.05% to 14%. Iatrogenic pseudo-aneurysms are most generally produced by catheterization, accounting for 70–80% of the incidence. [1] Pseudo-aneurysms which are the most common in the femoral and radial arteries, frequently noticed in the groin and forearm after cardiac catheterization. Likewise, it may also be observed after arterial punctures for blood gas analysis, after the placement of indwelling catheter or after direct arterial trauma.[5,6,7] Also popliteal artery is the most frequent region for pseudo-aneurysm incidence because this artery is not supported by muscular tissue to shield it from dilatation and bending, compared to superficial and deep femoral arteries.[8]

Utmost pseudo-aneurysms that result from piercing or blunt traumas are caused by gunshot injuries, stabbing wounds, and motor vehicle crashes. [9]

Both benign and malignant tumors can cause pseudo-aneurysm due to vessel erosion.[10] Pseudo-aneurysms that are caused by osteochondroma are fairly common. In patients with neurofibromatosis, pseudo-aneurysms are caused by degenerative changes of the vessel wall or secondary erosion by adjacent tumor.[10] The incidence of pseudo-aneurysm caused by malignant tumor is uncertain, but choriocarcinoma has been reported to account for approximately one quarter of neoplastic aneurysms.[11] Leukemic cells or lymphomas damage the arterial wall and cause the formation of a pseudo-aneurysm.[12]

Infection can cause both true aneurysms and pseudo-aneurysms. However, pseudo-aneurysms may be more frequent because infection can easily disrupt the arterial wall. The most common position of an infected aneurysm is the femoral artery, followed by the abdominal aorta. [13]

Pseudo-aneurysms caused by primary vasculitis are fairly rare. Primary vasculitis can be seen in systemic vasculitis, similar as Behçet's syndrome, Polyarteritis nodosa, Systemic lupus erythematosus, Giant cell arteritis, Takayasu's arteritis, and so on. The frequency of vascular involvement in Behçet's syndrome is estimated to range from 2% to 46%. The aorta is the most constantly affected site of pseudo-aneurysm, followed by pulmonary, femoral, subclavian, and popliteal arteries.[14]

Ultrasonography (US) is a valuable tool for diagnosis of pseudo-aneurysms and has been extensively employed as a non-invasive imaging modality for investigation of vascular disease. It has been reported that US has 94% and 97% of Sensitivity and Specificity, respectively in the diagnosis of post catheterization pseudo-aneurysms, but this sensitivity is not enough to diagnose the pseudo-aneurysms of the deep visceral arteries.[15,16] The major limitation of US it is an

operator dependent imaging technique, has low sensitivity in the evaluation of deep visceral artery pseudo-aneurysm, and evaluation of vessels in trauma patient accompanied with hematoma or fracture.[17] Grayscale US can be used to evaluate many pseudo-aneurysmal findings such as the size, the number of pseudo-aneurysm, and its relation to the artery.[18]

Doppler US can be used to confirm the diagnosis of blood flow in a cystic structure distinguished by swirling motion pattern "yin-yang sign" (FIG.1). Also, this type of flow can be detected in saccular aneurysm. The cornerstone of pseudo-aneurysm diagnosis is dependent upon the appearance of the communicating neck between the arterial vessel and pseudo-aneurysmal sac with "to-and-fro" waveform at duplex Doppler ultrasonography [Figure 1]. The "to" represents the arterial blood going into the pseudo-aneurysmal sac in systolic cycle, while "fro" illustrate blood exiting the sac in diastolic cycle.[19]

MDCT angiography had a sensitivity of 95.1% and a specificity of 98.7% in the detection of vascular lesions, including pseudo-aneurysms, of the proximal parts of the extremities.[17] Large pseudo-aneurysms can be detected easily on contrast-enhanced CT [Figure 2], whereas small lesions can be overlooked easily. In such cases, angiography is required.[20] Utmost pseudo-aneurysms are saccular in shape. Angiography allows confirmation of the site of the pseudo-aneurysm and assessment of its suitability for immediate treatment with an interventional technique if demanded.

Magnetic resonance imaging (MRI) has not been as useful as CT angiography or sonography in the diagnosis of pseudo-aneurysm because its use is limited by the poor clinical condition of patients. [20] Treatment can involve surgical, medical, and endovascular methods.

## Conclusion

Doppler ultrasonography, CT angiography and MR angiography may all be valuable in the imaging workup of popliteal pseudo-aneurysms. Prompt diagnosis and treatment of popliteal pseudo-aneurysms are necessary to avoid the morbidity and mortality associated with hemorrhage and rupture. Treatment can involve surgical, medical, and endovascular methods.

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