

# Pseudoaneurysm in a High Takeoff Anterior Tibial Artery with Endovascular Repair

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## Abstract

**Purpose:** To report the first case of a pseudoaneurysm in a high takeoff anterior tibial artery after minor traumatic injury which was successfully excluded with endovascular stent deployment.

**Case report:** A 77-year-old male was found on ultrasound to have a pseudoaneurysm of the anterior tibial artery approximately one month after a fall from the standing position. Further investigation with computed tomographic angiography confirmed a pseudoaneurysm of a high takeoff anterior tibial artery. The pseudoaneurysm was successfully excluded with the endovascular deployment of two stents. Postoperative duplex at eight months indicated continued patency of both stents.

**Conclusions:** This case suggests that high takeoff anterior tibial arteries may have increased susceptibility to injury. However, pseudoaneurysm in this anatomical variant can be successfully repaired with endovascular stent deployment.

**Keywords:** Anterior tibial artery; Pseudoaneurysm; Endovascular repair; Vascular anomaly

## Introduction

Pseudoaneurysm of the anterior tibial artery is an uncommon phenomenon occurring most frequently after significant trauma or orthopedic surgical intervention to the lower extremity [1,2]. The anterior tibial artery typically originates as a branch from the popliteal artery below the knee joint at the inferior border of the popliteus muscle. However, anatomic studies have demonstrated variation in 1.2 - 4.5% of the population in which the anterior tibial artery originates from the popliteal artery superior to the knee joint (hereafter referred to as 'high takeoff' because of varying nomenclature in the literature) [3,4]. To our knowledge, a pseudoaneurysm in a high takeoff anterior tibial artery has not previously been described. The treatment for anterior tibial artery pseudoaneurysm has traditionally been an open surgical approach, though Joglar and colleagues recently reviewed four cases which were successfully treated by endovascular intervention [5,6]. We therefore present a novel case of a high takeoff anterior tibial artery pseudoaneurysm after minor blunt trauma with endovascular stent graft exclusion and continued patency at 8 months by duplex imaging.

## Case Report

A 77 year old Caucasian male presented to his primary care physician with persistent left lower extremity edema and pain approximately one month after a minor fall from the standing position. The patient did not recall any injury as a result of the fall. Out of concern for deep venous thrombosis, the patient received an ultrasound of the left lower extremity which showed a 5.6 cm x 3 cm pseudoaneurysm arising from the popliteal artery. The patient was thus transferred to our institution for further workup. Upon arrival at our institution the patient had 2+ pitting edema below the left knee with palpable dorsalis pedis and posterior tibial pulses. Computed tomographic angiography demonstrated an aneurysm near the origin of the left anterior tibial artery with a high takeoff from the popliteal artery.

The patient subsequently underwent conventional angiography of the left lower extremity. The left common femoral artery was accessed under fluoroscopic guidance via an antegrade puncture.

Selective catheter placement was achieved in the anterior tibial artery and exchanged for a 0.035 inch wire for planned intervention. The pseudoaneurysm of the anterior tibial artery was located 3 cm from its origin above the knee joint (Figure 1A). We initially placed a 5x22 mm iCAST™ covered stent (Atrium Medical Corporation, Hudson, New Hampshire) across the defect. Subsequent intravascular ultrasound established proximal compression of the stent so a 4 mm balloon angioplasty was performed. However, there was still significant stenosis of the proximal stent so we placed an additional 4x20 mm self-expanding Xpert biliary stent (Abbott Laboratories, Abbot Park, Illinois). The second stent was deployed 10 mm into the first stent and 10 mm proximally into the anterior tibial artery. The overlapping segment of stents provided a section with two layers of stent and therefore increased radial force. We again dilated the stent with a 4 mm balloon and had subsequent brisk filling of the anterior tibial artery. We reevaluated the stented segment with intravascular ultrasound and demonstrated less than 30% stenosis of the stented region. Angiography showed complete exclusion of the pseudoaneurysm with normal contrast opacification of the distal anterior tibial artery (Figure 1B).

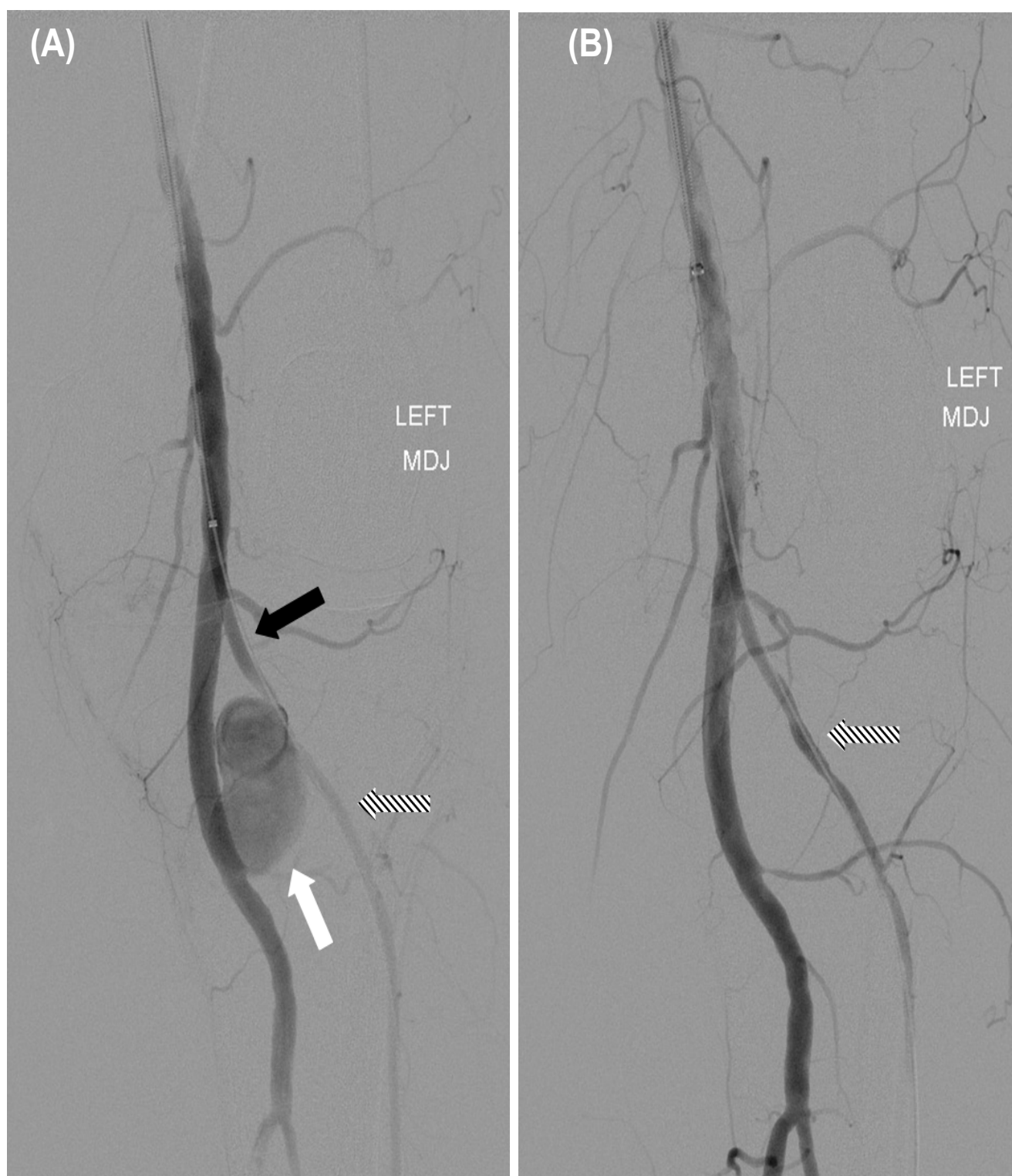
The patient was discharged the following morning with dual antiplatelet therapy consisting of clopidogrel 75 mg daily and aspirin 81 mg daily. Clopidogrel was discontinued after six months and aspirin was continued indefinitely. The patient was seen for follow-up Ankle Brachial Indexes (ABIs) and color duplex imaging of the stented vessel

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**Figure 1:** Pre- and post-intervention angiography of an anterior tibial artery pseudoaneurysm. A: Left lower extremity pre-intervention angiography demonstrating high takeoff of the anterior tibial artery (black arrow), a large pseudoaneurysm (white arrow), and decreased contrast opacification of the anterior tibial artery (striped arrow). B: Left lower extremity angiography after stenting shows exclusion of the pseudoaneurysm and improved contrast opacification of the anterior tibial artery (striped arrow).

at one and eight months postoperatively. At one month, his left ABI was 1.21 and consistent with patent stent. At eight months, his left ABI was 1.20 and again consistent with patent stents. The patient continues to do well today.

## Discussion

We present a novel case of a pseudoaneurysm in a high takeoff anterior tibial artery after minor trauma with successful endovascular repair. Our case differs from those previously described because the patient had a history of only very minor trauma and was found to have a high takeoff origin of the anterior tibial artery.

The anterior tibial artery most commonly originates as a branch of the popliteal artery at the inferior border of the popliteus muscle, although 1.2-4.5% of the population have an anomaly in which the anterior tibial artery branches off of the popliteal artery superior to the knee joint as in the present case [3,4]. Specifically, our patient demonstrated a popliteal branching pattern in which the anterior tibial artery branches from the popliteal artery above the level of the tibial plateau and then courses laterally. Anatomic studies have reported this variant is found in only 1.3-2.1% of the population and is thought to arise from the failed formation of a communicating branch between the embryologic superficial and deep popliteal arteries [7-9]. That our patient experienced a pseudoaneurysm near the anomalous division of the anterior tibial artery calls into question the possibility that these patients are at increased risk of vascular injury following minor trauma. This increased susceptibility to injury in anomalous anterior tibial arteries could be related to the artery's location within the knee joint. This location could expose the anterior tibial artery to bony structures of the knee including proximal tibia and distal femur. The proximity to bony structures combined with the repetitive movement of the knee could perhaps weaken this anomalously located artery. To our knowledge, however, the susceptibility to injury of high takeoff anterior tibial arteries has yet to be investigated but has been reported after orthopedic procedures secondary to the close proximity with the with the knee joint [3].

Options for the treatment of anterior tibial artery pseudoaneurysms include surgical ligation, endovascular coil embolization, ultrasound-guided compression therapy, direct thrombin injection or surgical bypass, though endovascular stent deployment continues to gain popularity [2,5,6,10-13]. Despite the variety of open and endovascular treatments for anterior tibial artery pseudoaneurysms, the role of each method in the repair of tibial artery aneurysms remains unclear other than open surgical revascularization which has proven durability in tibial artery occlusive disease [14].

Endovascular revascularization was chosen in our patient because he had no angiographic evidence or history of peripheral vascular disease. Most tibial arteries in healthy men have a luminal diameter of approximately 3.5 mm. However, one small study (n=152 limbs) found that patients with aortoiliac occlusive disease and the type of popliteal artery branching configuration found in our patient have an even smaller tibial artery luminal diameter of 2.1 mm [8]. In contrast to this data, our patient's anterior tibial artery measured 3.8 mm in its proximal portion thus allowing us to use a 5 mm balloon expandable stent. Unfortunately the proximal portion of the stent failed to remain expanded after deployment. A self-expanding nitinol stent was used to provide additional radial force in the proximal portion of the stent

graft with gratifying intraoperative and early postoperative duplex results at eight months. Therefore, it appears that endovascular stent exclusion provides a minimally invasive treatment option for anterior tibial artery aneurysms even in the presence of a high takeoff vascular anomaly.

## Conclusion

This is the first case of a pseudoaneurysm involving an anomalous high takeoff anterior tibial artery. This case leads us to hypothesize that high takeoff anterior tibial arteries may have increased susceptibility to vascular injury though these lesions may be successfully treated with endovascular stent therapy. Providers should thus remain cognizant that patients presenting with proximal anterior tibial artery pseudoaneurysms without a recent history of major trauma or orthopedic intervention could have anomalous anterior tibial artery anatomy although the endovascular treatment plan need not be grossly altered.

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