## Case Report

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# Aberrant configuration of femoral vessels as cause of arterial occlusive disease

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#### **ABSTRACT**

Variations in the branching pattern of femoral and profunda femoris arteries have clinical implications while performing various diagnostic imaging procedures as well as during surgeries that are performed in the femoral triangle. Awareness about these variations aid surgeons during preoperative clinical evaluation for surgical and interventional revascularization of the ileo-femoral and femoro-popliteal segments, in open canulation of femoral artery for cardiopulmonary bypass, in radiological interventions for A-V malformations, and in salvage operations for traumatic limb ischemia. Here we report an aberrant configuration of profunda femoris artery which presented as a case of arterial occlusive disease of lower limb. On surgical exploration, Profunda femoris artery was found originating on the medial aspect of left common femoral artery high up in the inguinal region as compared to its usual lower and lateral origin. There was atheromatous occlusion of superficial femoral artery from its origin upto distal femoral metaphysis. In case of occlusion of the superficial femoral artery, the profunda femoris artery forms an effective collateral bed between the ileo-femoral segment and the popliteal artery and its branches. The clinical implications associated with these variations in therapeutic and diagnostic interventions is been discussed along with relevant literature review. Further study is necessary to identify aberrant configuration of femoral vessels as a cause of arterial occlusive disease in the lower limbs.

Keywords: Arterial occlusive disease, Medial origin, Profunda femoris artery, Revascularization

#### INTRODUCTION

The femoral artery is second in choice for arterial catheterization after the radial artery. Its superficial position below the inguinal ligament makes it easily accessible. Therefore it is used for various radiological investigations of the arterial system and for clinical procedures like coronary angioplasty.1 In addition to this, the femoral artery at the femoral triangle is directly opened at the origin of the profunda femoris artery for femoral embolectomy in lower limb arterial thromboembolism.<sup>2</sup> Profunda femoris artery (PFA) is the largest deep branch of FA. Normally it arises on the

posterolateral aspect of femoral artery about 3.5 cm distal to inguinal ligament in the femoral triangle, then it spirals posterior to the artery and femoral vein (FV) to reach medial side of femur. It provides the principal supply to the extensors, adductors and flexors muscles of thigh. The medial and lateral circumflex femoral arteries normally arise from the profunda femoris artery near its origin.3 PFA is used for haemodialysis, vascular reconstructive procedures and various Radio Imaging techniques such as arteriography, ultrasound and Doppler imaging, digital subtraction angiography and magnetic resonance imaging etc.<sup>4</sup> The anatomical knowledge of the PFA and the circumflex arteries is important to prevent inadvertent damage to these during various clinical and diagnostic procedures. Many variations have been observed regarding the site of origin of profunda femoris artery from femoral artery. A rare variant configuration of PFA was observed in this case and is reported for the clinical implications associated with this variation along with relevant review of literature.

#### **CASE REPORT**

A 58 year old male patient presented with complaints of progressively worsening pain in left lower limb for last 6 months. There was history of claudication pain in left leg which has progressed to continuous dull aching rest pain in the left foot over the last 2 months.

He had a history of trivial trauma in his left great toe about 2 months ago. Following this trauma he noticed gradual black discoloration on the undersurface of great toe associated with constant aching pain at the local site. Patient had history of similar complaints in the right lower limb 9 yrs ago for which he underwent below knee amputation.



Figure 1: Left great toe showing dry gangrenous patch.

There was no history of chest pain, breathlessness or transient ischemic attacks (TIA) suggestive of involvement of other arteries. There was no history of any co-morbidity. Patient was a chronic smoker since last 35 yrs. The general survey of the patient was essentially within normal limits. He was afebrile with a heart rate of 84 beats/min and blood pressure 136/74 mmHg. On examination, the patient had right lower limb amputated below knee with healed operated site and adequate knee joint mobility.

On the left lower limb, there was a clearly demarcated dry gangrenous patch of 2\*2cm on the plantar aspect of great toe about 3cm from the tip of the toe, associated with tenderness and loss of sensations over the affected

part. Signs of ischemia were evident on the left limb up to the calf region. Femoral pulsation was palpable at the level of inguinal ligament while rest of the distal pulsations was absent. The adjacent joint movements in the left lower limb were normal and there was no neurological deficit.



Figure 2: Signs of ischemia evident on left foot.

Blood analysis showed normal hematology panel and urinalysis was normal. CT Angiography revealed complete atheromatous occlusion of right common femoral artery, superficial femoral artery, popliteal artery and trifurcation with multiple collateral channels arising from branches of internal iliac artery. In the left lower limb, common femoral and profunda femoral artery appeared normal.

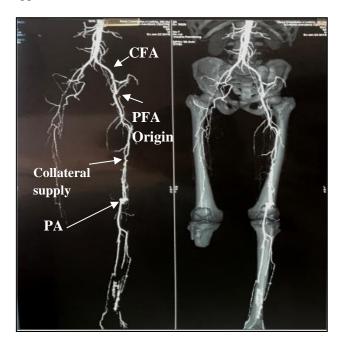


Figure 3: CT Angiogram of the patient, CFA-Common Femoral Artery, PFA- Profunda Femoral Artery, PA- Popliteal artery of Left lower limb

There was complete atheromatous occlusion of superficial femoral artery from its origin upto distal femoral metaphysis at junction with popliteal artery. Multiple collateral venous channels were seen within intermuscular plane of left thigh arising from left Profunda Femoris and popliteal artery. Rest of popliteal artery and trifurcation appeared normal. The patient was taken for left femoral endarterectomy under spinal anesthesia.

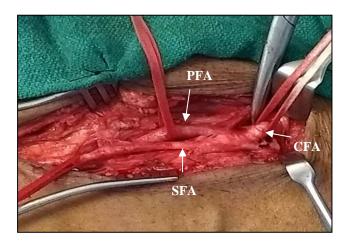


Figure 4: High and medial side origin of Left PFA, CFA- Common Femoral Artery, PFA- Profunda Femoris Artery, SFA- Superficial Femoral Artery.

A vertical incision was given at the mid-inguinal point, from a few centimeters above the inguinal ligament and extending distally over the course of femoral artery. Femoral artery was dissected and double looped. The size of FA was found to be half of its usual caliber. Profunda femoris could not be located so skin incision was extended further upwards.

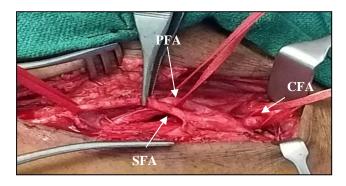


Figure 5: PFA passing deep to FA into the posterior compartment of Left thigh. CFA- Common Femoral Artery, PFA- Profunda Femoris Artery, SFA- Superficial Femoral Artery.

A dominant Profunda femoris, 1.5 times the normal size, was found originating on the medial aspect of common femoral artery high up in the inguinal region <10mm from the inguinal ligament as compared to its usual lower and lateral origin. PFA ran for a short distance on medial side of FA superficial to FV and then passed deep to FA. Profunda femoris was identified as it dips down in the posterior compartment of the thigh and was carrying the blood supply to the distal limb in this case.



Figure 6: Endarterectomy segment evacuated from superficial femoral artery

A longitudinal arteriotomy about 10 mm was given on common femoral artery overlying the profunda femoris origin. An endarterectomy segment measuring about 15 cm in length was evacuated from superficial femoral artery which was extending up to PFA origin. Good backbleeding was achieved in the superficial femoral artery at the distal end. Multiple runs of 5F Fogarty catheter were made to remove any residual plaques/thrombus. Arterioplasty was done using venous patch from great saphenous vein. Clamps were released, and gel foam was placed for adequate hemostasis.



Figure 7: Venous patch arterioplasty in Left thigh

Wound was closed in layers and compressive dressing was done. In the post-operative period 3 doses of Heparin 25000 IU (1000IU/hour) were given as infusion. Low dose aspirin 150 mg and Warfarin 5mg were started from 2nd post op day. Rest of the post op period was uneventful. On follow up peripheral pulsations were present suggestive of adequate vascular supply in the left lower limb.

#### **DISCUSSION**

Knowledge of variations in the branching pattern of FA and PFA are essential for carrying out various surgical procedures in and around femoral triangle, for diagnosis and interpretations of radiographs coupled with new

variations for anatomical interest.<sup>5</sup> Anatomical variations reported at the level of the division of the femoral artery can be explained on the basis of divergence in the mode and proximo distal level of branching or aberrant vessels that connect with the principal vessels, arcades or plexuses during the development of the blood vessels.1 In the lower animals, the profunda femoris artery was a branch of the internal iliac artery. During course of evolution, the origin shifted distally from the femoral artery. Hence, developmental arrest at different stages may lead to anatomical variations related to the division of the femoral artery.<sup>6</sup>

The profunda femoral artery has a compensatory role for the collateral blood flow in the atherosclerotic occlusive disease through collateral pathways in the lower pelvis, starting from the internal iliac arteries. This collateral pathway is more important if aortoiliac lesions are associated with femoro-popliteal lesions. In this case the profunda femoris artery represents a "bridge" between the lower pelvis circulation and the infrapopliteal circulation, through collateral pathways such as genicular arteries. Vaas F reported that for this function PFA should have a larger caliber. The PFA is useful in lower limb revascularization procedures done for non-healing ulcers and/or gangrene, to relieve the claudication pain. 9

The site of origin of PFA is important as it helps in avoiding iatrogenic injury to the vessels and femoral arteriovenous fistula while performing FA puncture. It enables to identify the correct incision site for surgical exposure of the FA and PFA junction. The direction of the origin of PFA is also important in catheter application, in making flaps with pedicles, in reconstructive surgery and bypass procedures made to supply the lower extremity. Shahin et al. opined that, before the catheterization of femoral vessels and operations in the femoral triangle, high-resolution ultrasonic imaging can provide anatomic and functional information about the femoral vessels and would be of assistance in planning catheterization as well as marking of incision site. Shahin et al. Opined that,

Differing patterns of the origin of the PFA and its branches have been described on a racial basis as well as variations being noted between the two legs of the same individual. In the present case, Profunda femoris artery was found originating on the medial aspect of left common femoral artery high up in the inguinal region. In a cadaveric study, Rajani et.al. reported 21.2% incidence of high origin of PFA (<10mm from the inguinal ligament). In the same study incidence of medial side origin of PFA was 3.1%. 13

Shankar and Roopa reported that high origin of PFA can cause problem in procedures like femoral arterial and venous puncture and femoral nerve blocks, because of close relationship of vessels and nerve in femoral triangle. <sup>14</sup> Pseudo aneurysms can occur when the puncture site is the PFA or FA distal to the origin of the

PFA.<sup>15-16</sup> Medial side origin of PFA is rare. Such type of variation carries a risk of damage to the large and unexpected arterial channel while collecting blood in infants from femoral vein and during exposure of saphenous vein for ligation at its junction with the femoral vein.<sup>17-18</sup> Such aberrant configuration of femoral vessels could be a cause of arterial occlusive disease in the lower limbs as found in our case. To the best of our knowledge such correlation has not been reported so far in the literature.

#### **CONCLUSION**

The sound knowledge about the anatomical variations of femoral vessels and their branches is important for the successful outcome of therapeutic and diagnostic procedures performed in the femoral triangle. Awareness of the original sites and distances of the profunda femoris artery and its circumflex femoral branches allows the surgeon to define the vascular pattern before performing any invasive procedure. It also helps to reduce chances of associated intra-operative secondary haemorrhage and post-operative complications. Further study is necessary to identify aberrant configuration of femoral vessels as a cause of arterial occlusive disease in the lower limbs.

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