

Study of Anatomical Variations of Profunda Femoris Artery in the Indian Population

A Maniombi Devi¹, Sushil Kumar², Debasis Bandopadhyay³

Abstract

Introduction: The femoral artery is commonly used for angiographic procedures. The Profunda femoris artery (PFA) is the largest branch of femoral artery. The knowledge of anatomical variation of PFA is clinically significant in view of most angiographic diagnostic procedures being performed in this region. A high origin of PFA is closely related with femoral nerve and its branches posing immense challenge to re-vascular surgeon in this region. **Objective:** To study the variation of PFA with respect to its origin, distance of origin from mid inguinal point and the direction of origin. **Methods:** A total of 30 femoral triangles were dissected in 15 human cadavers. The PFA was identified and its source, site and direction was noted. **Results:** The PFA originated from the postero lateral aspect of the femoral artery in 53.33%, lateral aspect in 33.33%, posterior aspect in 10% and from the anterolateral aspect in 3.33% of the cases. The PFA was found to originate from external iliac artery in 10% cases (3 out of 30) out of which the variation was seen bilaterally in one cadaver. The mean distance of origin of PFA from the mid inguinal point is 23 mm. **Conclusion:** Knowledge in the anatomical variations of the PFA helps the clinician to avoid iatrogenic injury while performing various procedures like angiography, venous excess for femoral vein, femoral nerve block. Pseudo aneurysms can occur when the puncture site is the PFA or Femoral artery distal to the origin of the PFA.

Keywords: Femoral artery; Profunda femoris artery.

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Introduction

Profunda Femoris Artery (PFA) is the largest branch of femoral artery which arises from lateral side of femoral artery 3.5 cm distal to inguinal ligament. The PFA is the chief supply to the extensor, adductor and flexor muscles of the thigh, and it also anastomoses with the internal iliac artery above and with the popliteal artery

below. It gives lateral and medial circumflex femoral arteries from lateral and medial aspect respectively in the proximal part of the thigh and gives multiple muscular and perforating branches more distally. The direction of origin of the profunda femoris is variable, at times it arises medially or less commonly from the posterior aspect of femoral artery [1]. The femoral artery is used for multiple clinical procedures like arteriography, digital subtraction angiography, Doppler imaging, ultrasound, and magnetic resonance imaging [2]. In the vascular surgical literature, the femoral artery proximal to the origin of the profunda branch is referred as the common femoral artery, and the vessel distal to the branch is termed as the superficial femoral artery [3]. PFA displays variations with respect to the point of origin, course and branches. These variations have received attention of not only the anatomist

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but also surgeons, radiologists and cardiologists. Origin of PFA from femoral artery may be at a short distance distal to inguinal ligament or it may arise as a separate vessel behind the inguinal ligament. Higher the origin of PFA greater is the risk of iatrogenic injury during surgical procedures [4]. Any variation in PFA should be kept in mind to prevent unexpected and avoidable complications. So, PFA with respect to its origin, distance of origin from mid inguinal point and the direction of origin was studied in detail in this study.

Aim

To study the anatomical variations of Profunda Femoris Artery in Indian population.

Objective

1. To study the variation of PFA with respect to its origin, distance of origin from mid inguinal point and the direction of origin.
2. To compare the findings of our study with other studies done in various diverse population.

Material and Methods

We selected 30 formalin embalmed lower extremities of 15 adult human cadavers of Indian origin in an age range of 67-98 years. Sexual dimorphism was not part of the study. The bony landmarks anterior superior iliac spine (ASIS) and pubic symphysis (PS) were identified. The distance between ASIS and PS was measured with scale and the midpoint of this distance was taken as mid-inguinal point (MIP). Careful dissection of femoral

triangles was carried out to identify the profunda femoris and circumflex femoral arteries. Their source of origin, direction and distance were noted from mid-inguinal point (MIP) which was taken as reference point. All measurements were recorded by a single observer to minimize the observational errors. The measurements were done using calibrated scale and quantified in millimetres. The data was expressed as range, mean values and percentage.

Results

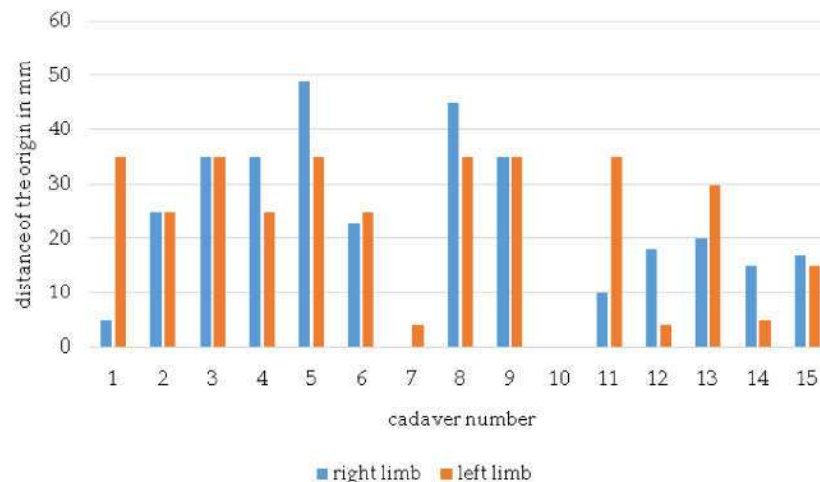
The PFA originated from the postero-lateral aspect of the femoral artery in 16 out of 30 cases (53.33%), lateral aspect in 10 out of 30 cases (33.33%), posterior aspect in 3 out of 30 cases (10%) and from antero-lateral aspect in 1 out of 30 cases (3.33%). The PFA was found to originate from external iliac artery in 3 cases emerging at inguinal ligament as two separate vessels. This variation was seen bilaterally in a 77 years old female cadaver. In one case the left circumflex femoral artery was found originating along with the PFA at the mid inguinal point (Fig 1). The mean distance of origin of PFA from the mid-inguinal point was 23 mm in this study with distance ranging from minimum 0 to a maximum of 49 mm. The mean distance was 22 mm in right side of the limb and 23 mm in the left side of the limb. The varying distances of origin of PFA from MIP has been depicted vide Graph 1. Symmetry in both sides of limb as per all three parameters (site of origin, distance from mid inguinal point and the direction of origin) was observed in 3 out of 15 cadavers. In one case the PFA originated in same distance from mid inguinal point on both sides but emerged in different directions. The direction of origin is shown in Table 1.

Table 1: Table showing the direction of origin of PFA from Femoral artery

S No	Direction of Origin	Frequency	Percentage
1	Posterolateral	16	53.33%
2	Lateral	10	33.33%
3	Posterior	3	10%
4	Anterolateral	1	3.33%

Table 2: Comparisons of origin of PFA in current study with the previous studies.

Studies	Distance between MIP and the origin of PFA
Dixit et al. (2001)	41-52 mm (Rt), 46-54 mm (Lt)
Prakash et al. (2010)	4.2 cm
T Manjapa et al. (2011)	3.56 cm
Daksha et al. (2011)	31-40 mm (Rt), 41-50 mm(Lt)
Sabnis et al. (2013)	3.2 cm
Ahire et al. (2014)	4.3±1.13 cm (Rt), 4.3±1.08 cm (Lt)
Present study	23 mm



Graph 1: Showing the distance of PFA origin from the mid inguinal point.

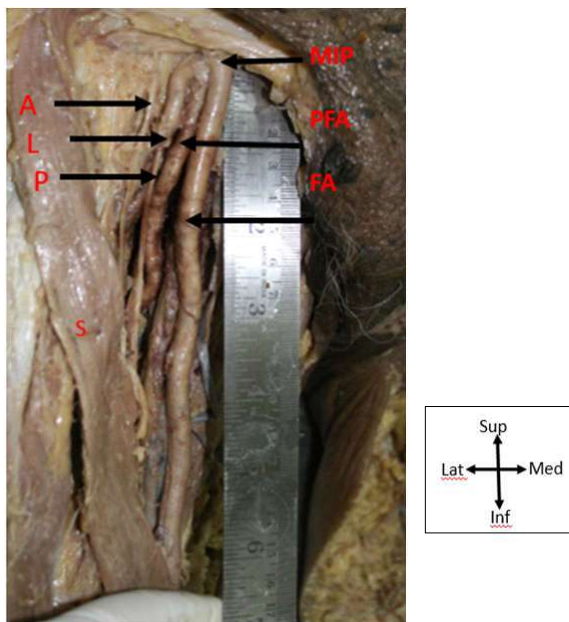


Fig 1: Photograph showing the origin of PFA along with left circumflex femoral artery at the mid inguinal point. MIP- Mid inguinal point, FA- Femoral artery, PFA- Profunda femoris artery L- lateral circumflex femoral artery, A- anterior division of femoral nerve, P - posterior division of femoral nerve, S- Sartorius.

Discussion

Femoral artery is a common site for angiographic procedures. Many previous studies found PFA arising commonly from postero-lateral aspect as noted by Dixit et al. in 2001 and other studies [3,5,6]. The profunda femoris artery in our study also originated commonly from the postero-lateral side of the femoral artery in 53.33%, lateral aspect in 33.33%, posterior aspect in 10% and anterolateral aspect in 3.33% cases. These findings were similar with the data available in literature.

The average distance of origin of profunda femoris artery from the mid inguinal point in our study was 23 mm as compared to 35 mm mentioned in Gray's Anatomy by Susan Standring and other studies (Table 2). This difference in mean distance might be because of the high origin of PFA noted in 3 cases where the PFA was found to originate from external iliac artery emerging as two separate vessels behind the inguinal ligament. This finding was seen bilaterally symmetrical in a cadaver.

The high origin of PFA was also noted in previous study by Daksha et al. in 2011 [5] and other studies [4,7,8,9,10]. In one cadaver the PFA originate at the MIP along with the LCFA. Similar findings have been noted by Daksha et al. in 2011 [5]. Since our study had a lower sample size the mean distance calculated could have been less when compared to data of previous studies.

Developmentally the axis artery of the lower limb is derived from the fifth lumbar segmental artery which runs in the dorsal aspect of the limb. The femoral artery is a new vessel formed in the ventral aspect which fuses with the external iliac proximally and the popliteal artery distally [12]. The presence of variations of the lower limb vessels can most often be explained as an abnormal development of the arterial network of the lower limb in the embryo.

Conclusion

Knowledge about the possibility of the anatomical variations of the PFA will help the clinician to avoid unwanted and preventable iatrogenic injuries while performing various procedures like angiography, venous access for femoral vein and femoral nerve block. Pseudo aneurysms can occur

if PFA or femoral artery distal to the origin of the PFA is punctured. The knowledge of variations in high origin of PFA and its branches and distribution is of immense importance to prevent flap necrosis of tensor fascia latae which is commonly used in plastic and reconstructive surgery. Anatomical variations should be considered before planning different diagnostic and therapeutic interventions on femoral artery and its branches as the vessels and the nerve are closely related in the femoral triangle.

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