



# Origin of Deep Femoral Artery and its Anatomical Variations

**Dhamne V.M.** Cheif Resident (M.D.), Department of Anatomy, MGM Medical College, Kamothe, Navi Mumbai, (Mah) India

**Sabnis A.S** Professor and Head of the Department, Department of Anatomy, MGM Medical College, Kamothe, Navi Mumbai, (Mah) India

**ABSTRACT** Femoral artery is the best choice for arterial catheterisation for various therapeutic and diagnostic procedures in the lower limb. Deep Femoral artery [profunda femoris artery (PFA)] is the largest branch of Femoral artery; its ramification is usually seen 30-35 mm below the mid-point of inguinal ligament. Its orientation is important to minimise iatrogenic complications. Dissections of 30 femoral triangles in 15 embalmed human cadavers revealed interesting data in the origin and course of the PFA femoris artery. The site of origin of the PFA was most commonly located midway between the inguinal ligament and the apex of the femoral triangle. In 03 cases (unilateral-2, bilateral-1) high origin of PFA, just below the inguinal ligament was found. Femoral vein was seen posterior to the femoral artery in those cases.

**KEYWORDS** Deep femoral artery, profunda femoris artery, inguinal ligament, femoral artery, femoral vein

**Introduction -**

In the present modern era of interventional radiology, the Femoral artery (FA) is often used for catheterization in a large number of investigations including angiographies. It is also used in several plastic and reconstructive procedures. With its wider caliber, length, accessibility and restricted mobility of lower limb in bed ridden patients; as an advantage over other vessels, it is commonly catheterized (arterial line) in intensive care units for chronically ill patients in whom continuous arterial pressure monitoring, arterial blood gas analysis, etc. are advised by the intensivists. The profunda femoris artery (PFA), branch of FA is used for arteriography, ultrasound and doppler imaging, digital subtraction angiography and magnetic resonance imaging (1).

At present in modern medical science, proper knowledge of the origin and branches of the FA are important for anatomists, clinicians and surgeons in various procedures. The external iliac artery continues as the FA behind the midpoint of inguinal ligament. In the thigh, the FA branches as superficial epigastric, superficial circumflex iliac, superficial external pudendal, deep external pudendal, profunda femoris and muscular branches in the femoral triangle; it also bifurcates as descending genicular and muscular branches in the adductor canal (2). The femoral catheterisation is performed in this location (3).

Clinicians call FA as a common FA above the origin of PFA and superficial FA below the origin of PFA(4).The PFA is also called deep femoral artery (DFA). Normally, it arises postero-laterally from the FA (sometimes medial or rarely posterior) about 3.5 cm distal to the inguinal ligament and gives four perforated, muscular, lateral and medial circumflex femoral arteries<sup>2</sup>.Any variations in the origin of DFA can lead to irreparable iatrogenic complications. Hence we undertook this study to throw some more light on variations of origin of DFA.

**Materials and methods -**

30 femoral triangles in 15 (12males & 03females) embalmed cadavers were dissected as per the guidelines of Cunningham's dissector manual (5).The femoral sheath was identified and was dissected thus clearing the femoral artery and its major branches. The PFA was identified and cleanly dissected to mark its origin and course. The relation of the profunda femoris to the FA, at its origin was studied. The distance of the site of origin of the PFA from the midpoint of inguinal ligament.

was measured in millimetres with a scale and a calliper.

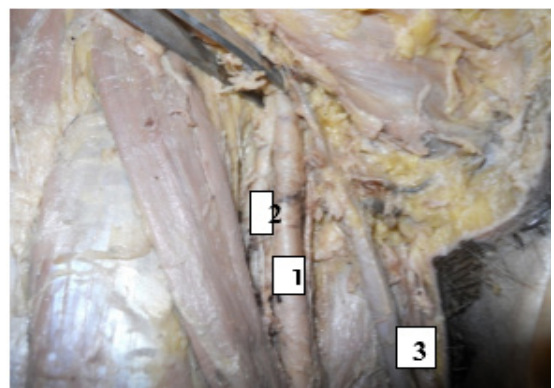
**Results -**

In all lower limbs PFA existed. Amongst 30 femoral triangles, the PFA originated from posterolateral aspect of FA in 23 cases i.e. 75.9% and from posterior aspect of FA in 04 cases i.e. 13.3%.The distance of origin of PFA from the midpoint of inguinal ligament varied from 20 mm to 75 mm (Table 1). In 03 cases [unilateral -2 (figure 1,2), bilateral -1(figure 3)] i.e. 10%, the PFA had a high origin, just below the inguinal ligament at the midpoint of inguinal ligament and lateral to FA. In cases with high origin of PFA, the femoral vein was positioned posterior to FA. The calibre of PFA with high origin was more (6mm) as compared to other cases (2-4mm).

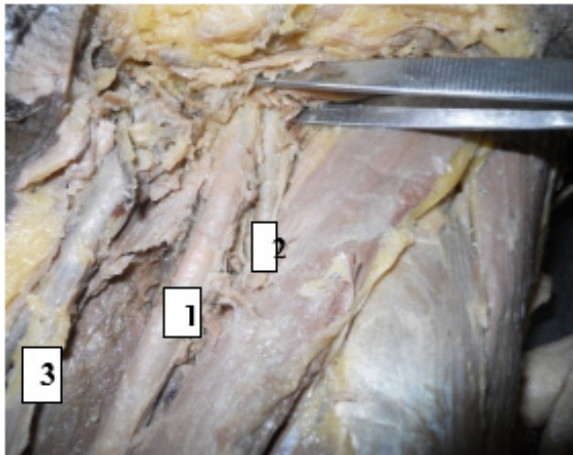
**Distance of origin of PFA from midpoint of inguinal ligament (n = 30)**

Distance	No. of cases on the Rt lower limb	No. of cases on the Lt lower limb
0-10 mm	2	2
10-20 mm	3	3
20-30 mm	10	9
30-40 mm	5	4
40-50 mm	9	11
>50 mm	1	1

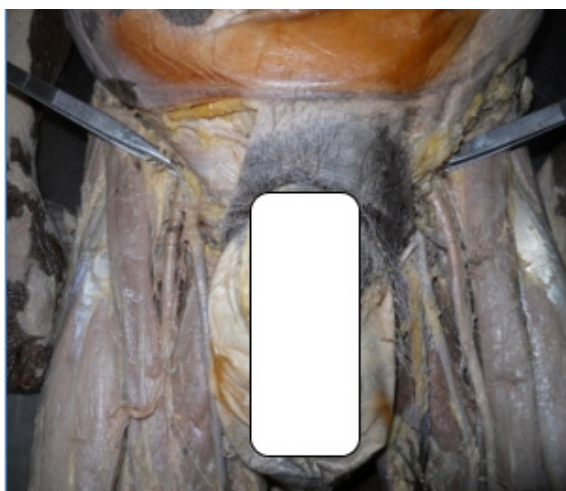
**TABLE 1 - Distance of origin of the PFA from the midpoint of inguinal ligament.**



**FIGURE 1 – Unilateral high origin of 2.PFA (Rt), 1.FA 3.GSV.**



**FIGURE 2 – Unilateral high origin of 2.PFA (Lt), 1.FA 3.GSV. GSV – Great Saphenous Vein.**



**FIGURE 3 – Bilateral high origin of PFA.**

**Discussion –**

Femoral artery (FA) in lower extremity and radial artery in upper extremity are preferred vessels for various surgical procedures. Femoral angiography is the main line for the investigations in the peripheral occlusive arterial disease and its diagnosis of suspected congenital anomalies. For the same FA is commonly used for these procedures (6). Interventional radiology opens new avenues for the study of variations of the courses of the PFA. The anatomical knowledge of the level of origin of PFA is important in avoiding iatrogenic femoral arterio-venous fistula formed during puncture of femoral artery (7). PFA is used for haemodialysis, vascular reconstructive procedures and various Radio Imaging techniques like Ultrasound Doppler Imaging and MRI (8).

Anatomical variations reported at the level of the division of the femoral artery can be explained as follows. In the lower animals, the PFA is a branch of the internal iliac artery. During course of evolution, the origin shifted distally from the femoral artery. Ontogeny recapitulates phylogeny. Hence, developmental arrest at different stages may lead to anatomical variations related to the division of the femoral artery (9).

In the present study conducted at the department of Anatomy, MGM medical college, Navi Mumbai, the average distance of origin of PFA from midpoint of inguinal ligament was 33.6 mm which was the lowest as compared to other authors (Table 2). The rare variation that we observed, were bilateral high origin of PFA in one case and the origin of PFA at distance of 75 mm in another case which was more than in any literature found.

The distance between midpoint of inguinal ligament and origin of PFA is clinically important. Too proximal or too distal origin of PFA may invite unwanted problems. Judkin technique is undertaken where femoral artery is approached by puncturing the vessel 1 to 3 cm below the inguinal ligament (6). Knowledge of the site of origin of PFA helps in avoiding iatrogenic femoral A-V fistulas or severe secondary haemorrhage when performing a femoral arterial puncture (10). Following table shows average distance of PFA from midpoint of inguinal ligament measured by various authors.

NAME OF THE AUTHORS	AVERAGE DISTANCE OF PFA FROM MID POINT OF INGUINAL LIGAMENT (mm)
Snell RS <sup>13</sup>	40
Grays <sup>2</sup>	35
Prakash et al. <sup>9</sup>	42
Samarawickrama et al. <sup>13</sup>	50
Dixit et al. <sup>1</sup>	47.5
Siddharth et al. <sup>14</sup>	44
Bannister et al. <sup>15</sup>	35
Present study	33.6

**TABLE 2 – Comparison of the variations related to the site of origin of PFA amongst various authors.**

In 30 femoral triangles, the average length of FA was 14.6 cm. The PFA in our study originated from posterolateral aspect of FA in 23 cases i.e. 75.9% and from posterior aspect of FA in 04 cases i.e. 13.3%. In 03 cases [unilateral -2 (figure 1,2), bilateral -1 (figure 3)] i.e. 10%, the PFA had a high origin, just below the inguinal ligament at the midpoint of inguinal ligament and lateral to FA. Literatures say that when the origin of PFA is high, it will emerge from the lateral side of the femoral artery (11). This was correlated in our study.

Another interesting finding was that in cases of high origin, the femoral vein was positioned posterior to the femoral artery which is worth noting. Such variation needs to be kept in mind while doing interventional procedures around FA to avoid through and through punctures leading to haematoma. Similar case was study by Chitra R(8).

The PFA in all cases did not further show any unusual ramification pattern.

**Conclusion –**

Awareness of the origin and distances of the profunda femoris artery will allow the surgeon and intensivists to define the vascular pattern of lower limb before performing any invasive procedure and to avoid unexpected iatrogenic injuries.

**References –**

- Dixit DP, Mehta LA, Kothari ML. Variations in the Origin and Course of Profunda Femoris. J Anat. Soc. India 50(1) 6-7 (2001).
- Standring S. Gray's anatomy, 39th edn. Philadelphia, PA: Elsevier Churchill Livingstone; 2005.pp.1450-2.).
- Chummy SS. Last's anatomy regional and applied, 10th edn. UK: Churchill Livingstone; 1999.pp.114-5.
- Hollinshead HW. Textbook of Anatomy. 3rd Ed., Hagerstown, Maryland, Harper & Row. 1974; 407.
- DJ Cunningham. Cunningham's manual of practical anatomy, vol. 1, 15th edi, pg. 242-245.
- M Baptist, F Sultana, T Hussain. The origin of profunda femoris artery, its branches and diameter of the femoral artery. Professional Med J. 2007;14:523-27.
- Prakash KJ, Kumar BA, Jose BA, Kumar Yadav S, Singh G. Variations in the origins of the profunda femoris and the medial and the lateral femoral circumflex arteries: a cadaver study in the Indian population. Rom J Morphol Embryol. 2010;51(1):167-70.
- Chitra R. A rare variational anatomy of the profunda femoris artery. Folia Morphol (Warsz). 2008;67(2):157-58.
- Prakash, Jyoti Kumari, Kumar Bharadwaj A, Betty Anna Jose, Kumar Yadav S, Sing G. Variations in the origins of the profunda femoris, medial and lateral femoral circumflex arteries: a cadaver study in the Indian

- population, RJME , 2010,51(1):161-170.
10. Mc Minn R.M.H. (1994) Last's Anatomy, 9th ed., London, Churchill Livingstone, 155-6.
  11. Mamatha H, Antony Sylvan D'souza, Jessica S, Suhani S. A Cadaveric Study On The Variations In The Origin, Course And Branching Pattern Of The Profunda Femoris Artery. IJCRR Vol 04 issue 19.
  12. Snell R.S. (1992) Clinical Anatomy of Medical Students, 4th ed., Little Brown and Co, Boston, 607.
  13. Samarawickrama M.B., Nanayakkara B.G., Wimalagunaratna K.W.R., Nishantha D.G., Walawage U.B. (2009) Galle Medical Journal, 14(1), 31-34.
  14. Siddharth P, Smith N.L., Mason R.A., Giron F. (1985) Anat. Rec., 212(2), 206-209.
  15. Bannister L.H., Berry M.M., Collins P. (1995) Gray's Anatomy, 38th ed., Churchill livingstone, Medical division of Longman Group, UK, 1566-8.