

Original Article-Anatomy

ANATOMICAL VARIATIONS OF ORIGIN OF DEEP FEMORAL ARTERY IN INDIAN POPULATION

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Abstract:

The variations of the profunda and its branches are numerous, and to a considerable extent, largely associated with one another. In 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 Deep Femoral artery [profunda femoris artery (PFA)] is the largest branch of the Femoral artery; its ramification is usually seen 30-35 mm below the mid-point of the inguinal ligament. Its orientation is important to minimize 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. 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.

Keywords: Artery. Deep femoral artery. Profunda femoris artery. Variations, femoral vein.

1. Introduction:

In the vascular surgical literature, the femoral artery above the origin of the profunda branch (deep femoral artery) is termed the common femoral artery, and the vessel below the branch is the superficial femoral artery [1]. The profunda femoral artery has an important 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 (or the mesenteric arteries if the internal iliac arteries are also affected). This collateral pathway is more important if aortoiliac lesions are associated with femoropopliteal lesions [2]. 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.

The DFA is the biggest branch of the lateral or posterior aspect of the common femoral artery (CFA) in the femoral triangle, located 2 - 6 cm below the inguinal ligament [2]. It is the main vessel for the blood supply of the adductors, flexors, and extensors thigh muscles, as well as of the hip joint

and the femur [3-4]. Moreover, it plays a crucial role in the collateral blood flow between the lower pelvis and the infrapopliteal circulation [5]. The major branches of the DFA are the lateral circumflex femoral artery (LCFA) from its lateral aspect and the medial circumflex femoral artery (MCFA) from its medial wall [6]. The varying vascular anatomy of these vessels is of the utmost importance due to their involvement in vascular, orthopedic, plastic, and reconstructive surgery [7-10].

Clinicians call FA as a common FA above the origin of PFA and superficial FA below the origin of PFA [11]. The PFA is also called the deep femoral artery (DFA). Normally, it arises posterolaterally 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. 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 the origin of DFA.

2. Materials and methods -

30 femoral triangles in 15 (12males & 03females) embalmed cadavers were dissected as per the guidelines of Cunningham's dissector manual [12]. 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. It was measured in millimetres with a scale and a calliper.

3. Results:

Table.1: Distance of origin of the PFA from the midpoint of the inguinal ligament (n=30).

Distance	No. of Cases on the RT Lower Limb	No. of Cases on the Lt Lower Limb
0-10 mm	02	02
10-20 mm	03	03
20-30 mm	10	09
30-40 mm	05	04
40-50 mm	08	12
> 50 mm	01	01

Table.2: Comparison of the variations related to the site of origin of PFA amongst various authors.

Name of the Authors	Average Distance of PFA From MID Point of Inguinal Ligament (mm)
Snell RS ¹³	40
Grays ²	35
Prakash etal ⁹	42
Samarawickrama etal ¹³	50
Dixit etal ¹	47.5
Siddharth etal ¹⁴	44

Bannister et al ¹⁵	35
Present Study	33.9

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



4. Discussion:

The point of origin of profunda from the femoral artery is usually stated to be about 4 cm distant from the inguinal ligament [13], but the figure must be taken as an average from which there may be wide departure. Bozarić et al. also point out that variances in the height of profunda origin influence the distribution of their lateral branches. If PFA is separated in the lower part of the femoral triangle, the circumflex arteries are separated as the lateral branches of the femoral artery and also PFA calibre decreases [14]. This calibre and distribution of PFA lateral branches have a significant impact on the quality of vascularization of the musculocutaneous flap they are nourishing. High origin of PFA can cause problems in procedures such as femoral arterial and venous puncture and femoral nerve blocks because of the close relationship between vessels and nerves in the femoral triangle. Pseudoaneurysms can occur when the puncture site is the PFA or FA distal to the origin of the PFA. The knowledge of the site of origin of the profunda helps to enable us to identify the correct site of making incision for surgical exposure of the common femoral and profunda femoris junction. „Occasionally, both circumflexes arise independently from the femoral artery, the profunda in such cases usually having a low origin, and one of the perforating arteries may arise from the circumflexes [13].

A cadaveric study in the South Indian population by Manjappa et al. performed on 40 embalmed human extremities demonstrated that the DFA arose from the CFA in more than 90% of cases and from the CFA by a common trunk with the MCFA in 10% of the cases [15]. Another cadaveric study conducted on 42 thighs in Serbia by Lalović et al. illustrated that the MCFA originated from the DFA in 59.5% of cases, at a mean distance of 57.9 ± 19.5 mm from the MIP [16]. It arose from the FA in 33.3% of cases, being at a distance of 44.2 ± 13.5 mm from the MIP. The least usual type of origin was by a common trunk with the DFA (2.4%). It was absent in 4.8% of specimens. There was no statistically significant difference between the right and left limbs or males and females.

In the present study conducted at the department of Anatomy, Santhiram Medical College, Nandyal the average distance of origin of PFA from midpoint of inguinal ligament was 33.9 mm which was the lowest as compared to other authors [17]. 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 [18]. 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 [19]. Following table shows average distance of PFA from midpoint of inguinal ligament measured by various authors. In 30 femoral triangles, the average length of FA was 14.5 cm. The PFA in our study originated from posterolateral aspect of FA in 24 cases i.e. 76.1% and from posterior aspect of FA in 04 cases i.e. 13.3%. In 03 cases [unilateral -2, bilateral -1 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 [20]. This was correlated in our study. The PFA in all cases did not further show any unusual ramification pattern.

Conclusion:

High punctures, above the inguinal ligament, may result in retroperitoneal hematoma, as the artery is difficult to compress without the support of the femoral head. Low punctures may result in pseudo-aneurysms formation. Very rarely, femoral artery punctures result in femoral nerve damage or neural compression by a large hematoma. It is important to bear in mind the proximity of the femoral nerve, which lies just lateral to the artery. Our study was to collect and analyse all available information correlated to the anatomical characteristics of the DFA and its branches in order to ameliorate the current clinically pertinent knowledge. This information is vital for surgeons, interventional radiologists, and other medical professionals performing procedures in the femoral region. Furthermore, the use of ALT flaps has become an optimal option, especially for head and neck reconstruction. It is a multipurpose soft tissue flap that can be harvested as a fasciocutaneous or myocutaneous flap, whereas donor morbidity is strikingly minimal in spite of the availability of plenty of amounts of tissue. 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.

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Conflicts Of Interest

The authors declare no conflict of interest.

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