

STUDY OF PROFUNDA FEMORIS BRANCHING PATTERN IN HUMAN CADAVERS

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ABSTRACT

Background: The course and variations of the vessels of the lower limbs have long received attention from anatomists and surgeons. It is surprising to note the present lack of clarity of description of profunda femoris artery branches. Some effort has been put to reexamine the origin, course, and distribution of the branches of profunda femoris in human cadavers.

Results: The average mean distance of the Profunda femoris artery was 5.3 cm. In majority specimens, profunda femoris originated from posterolateral/ posterior of femoral artery (67.5%). In Posterolateral origin, distance is almost same on both sides (52 mm) and 1 mm more in females (54mm- males). In posteromedial/medial origin, distance is slightly more on right side and in males. (58.8mm-right, 54.7mm - left, 54.2mm- males and 52.5mm - females) Medial circumflex femoral artery originated maximally from the Profunda femoris (90 % extremities). Whereas in all specimens, Lateral circumflex femoral artery originated from the Profunda femoris only.

The average distance of the medial circumflex femoral artery from the origin of the Profunda femoris was 2mm more on left side (31mm- right). The internal diameter of Medial circumflex femoral artery is same on both sides- 3.4mm. In male Sex, diameter is slightly more (3.6mm – males, 2.8mm – females).

The distance of origin of the lateral circumflex femoral artery from the origin of the Profunda femoris was slightly more on left side (30.4mm - right and 35.2mm – left). The internal diameter is same on both sides and both sexes (44mm)

17.5% Variations were observed. Statistically, the values were significant.

Conclusion: Differences in measurement pertaining to sides and sexes were observed slightly with respect to MCFA (Medial circumflex femoral artery). Other findings were mimicking the previous studies. These findings and variations observed is of prime importance to the vascular surgeons and interventional radiologists to prevent inadvertent damage.

KEY WORDS: Profunda Femoris Artery, Medial Circumflex Femoral Artery, Lateral Circumflex Femoral Artery, Femoral artery.

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INTRODUCTION

The arterial variations of the lower limb, especially the Femoral artery (FA) and its

branches have gained popularity recently because of its close association with Femoral hernia repair and in coronary angiographies.

Profunda Femoris artery/ deep femoral artery (PF) is the largest branch of femoral artery; arises on lateral side of femoral artery, 3-5 cm below inguinal ligament; It passes on surface of pectineus & adductor brevis; then lying behind femoral artery & vein on medial side of femur, passing behind tendon of adductor longus; courses to lie directly on adductor magnus, perforating branches pass between edge of femur and tendinous insertion of adductor magnus. It gives Lateral circumflex femoral artery (LCFA) and Medial circumflex femoral artery (MCFA), muscular branches to adductor magnus, perforating branches [terminal branch (4th perforator)].

The LCFA and MCFA are largest branches of PFA, although they do not always arise from this vessel, either or both may arise from femoral artery above the origin of Profunda femoris artery [1].

LCFA usually arises from lateral side of deep femoral artery [2]; LCFA passes laterally in front of Psoas & between branches of Femoral Nerve; - passes deep to Sartorius & rectus femoris, and divides into anterior, transverse, and descending branches which supply the greater trochanter, hip joint and the anterolateral thigh.

MCFA arises from postero medial aspect of deep femoral artery. It may occasionally arise directly from the femoral artery [2]. It has an important role in supplying blood to the femoral head and neck, to fatty tissue in acetabular fossa and to the adductor muscles [3].

The MCFA typically gave origin to two major ventral muscular branches and a small trochanteric branch before passing from the adductor compartment into the flexor compartment of the thigh. Thereafter, the MCFA divided into an ascending branch to the hip and a descending branch to the hamstrings and sciatic nerve.

Knowledge of variations of the circumflex femoral arteries is important when undertaking clinical procedures within the femoral region and in hip joint replacement to minimize complications [4].

MATERIALS AND METHODS

Present study was undertaken on 40 lower limbs of human cadavers in South Indian population obtained from Department of Anatomy of BGS

Global Institute of Medical Sciences, Bangalore and Belagavi Institute of Medical Sciences, Belagavi. Data on age and sex of individual limbs were recorded.

Dissection was performed on 20 embalmed cadavers. The skin was incised and reflected, followed by the superficial fascia. The superficial vessels and superficial lymph nodes were identified and the fascia lata was incised thus exposing the femoral triangle. The femoral sheath was identified and its compartments were dissected thus clearing the femoral artery and its major branches. The PFA with its MCFA and LCFA were dissected and identified, their origin and course were studied. The relation of the PFA at its origin to the femoral artery was studied. The distance of the site of origin of the PFA from the midpoint of the inguinal ligament was measured in millimeters with a scale and a caliper. The site of origin of the MCFA and LCFAs were studied from the origin of PFA in millimeters.

Fig. 1: Femoral artery giving Profunda Femoral artery with numerous cluster of thickened branches of LCA.



Fig. 2: At the origin of Profunda Femoral artery another lateral branch is originating and giving three branches. No LCA is seen.

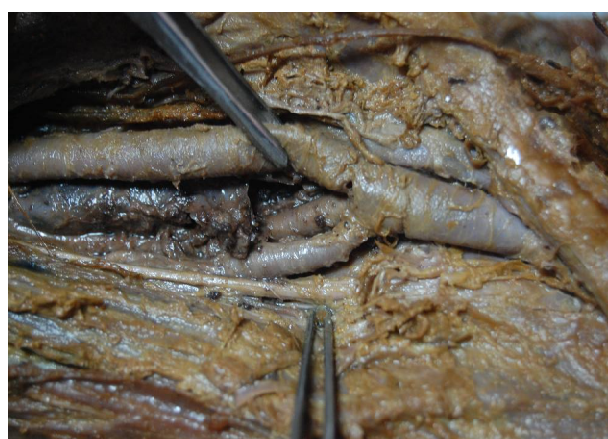


Fig. 3a & 3b: Two branches of LCA - directly coming from Profunda Femoral artery.

RESULTS

Table 1: Various measurements in mm.

* LCA instead of giving three branches it is having only two branches. i.e Upper and Lower branches, Upper branch once again is dividing into ascending and transverse branches.

** Two branches of LCA are directly coming from profunda femoral artery.

*** At the origin of profunda femoral artery another lateral branch is originating and giving three branches. No LCA is seen.

MCA arises directly from femoral artery 10 mm above the origin of profunda Femoris.

MCA arises directly from femoral artery 5 mm above the origin of profunda Femoris.

MCA arises directly from femoral artery 2 mm above the origin of profunda Femoris.

\$ 2 MCA arises from Profunda Femoris.

\$\$ MCA arises from the same level as that of Profunda Femoris.

**** 2 specimens having 4 branches of LCA .

***** 3 branches of LCA were given but wall of each branch was thick and hard measuring 7mm.

***** 5 branches of LCA were given but wall of each branch was thick and hard measuring 3mm.

Sl. No	Sex	Side	Int. dia of FA	Origin of PFA - posterolateral / lateral	Origin of PFA - posteromedial / medial	Origin of PFA	Int. dia of MCA	Distance of MCA from PFA origin	Int. dia of LCA	Distance of LCA from PFA	Variations
1	M	R	8	85		0	2	25	4	44	*
2	M	L	6	100		100	3.5	70	3	30	**
3	M	L	8		60	60	3.5	40	4	25	N
4	M	R	9		52	52	2.5	30	4.5	35	N
5	F	L	8.5	70		70	3	40	5	42	***
6	M	R	9		75	75	3.5	30	4	46	N
7	F	L	8	60		60	3	40	4.5	36	N
8	F	R	8	16		16	2	50	3.5	15	N
9	M	L	7		50	50	2	60	3	25	N
10	F	L	7	60		60	2	70	3	20	N
11	M	R	9		65	65	2.5	80	4	25	N
12	M	L	8		70	70	3	60	4	30	N
13	F	R	8		80	80	2.5	70	3	25	N
14	M	L	9		70	70	2.4	60	3.5	45	N
15	M	R	8	65		65	2	80	3	35	N
16	F	L	7	55		55	3.5	60	4	35	N
17	M	R	8.5	80		80	1.5	40	3.5	40	N
18	M	R	9		35	35	2.5	20	3	40	N
19	M	L	6		32	32	2	22	3	38	N
20	M	R	9	30		30	4	#	4	20	N
21	M	L	7	35		35	4	15	5	40	N
22	M	R	12	55		55	3	10	5	30	N
23	M	L	7	55		55	3	##	4	24	N
24	M	R	12	50		50	3	8	5	20	N
25	M	L	13	57		57	4	3	4	4	****
26	M	R	9	40		40	4	###	5	3	****
27	M	L	8	38		38	4	1	7	20	N
28	M	R	10	45		45	8	\$	8	25	v
29	M	L	10	45		45	7	\$\$	7	70	v
30	F	R	11	40		40	3	3	7	35	N
32	F	R	7	55		0	3	60	4	35	N
33	M	L	9	80		80	1	40	3	40	N
34	M	L	7		30	30	4	15	7	40	N
35	M	R	8		58	58	5	12	5	20	N
36	M	L	6	50		50	3	13	3	50	N
37	M	R	10	30		30	6	10	5	30	N
38	M	L	8	55		55	5	18	4	40	N
39	M	R	7	30		30	4	12	3	55	N
40	M	L	9	56		56	7	15	6	35	N

Table. 2: Sex difference of origin of Profunda femoris measured in mm.

Male		Female	
post.lat/lateral	post.medial / medial	post.lat/lateral	post.medial / medial
85	60	70	80
100	52	60	52.5
65	75	16	30
80	50	60	52.5
30	65		30
35	70	55	52.5
55	70	40	30
55	35	34	52.5
50	32	55	30
57	30		
40	58		
38			
5			
45			
80			
50			
30			
55			
30			
56			
Avg: 54.05	54.272723	55	52.5

Table 4: Sides differences of Lateral circumflex femoral artery measured in mm.

Right		Left	
Int. dia	Distance from PFA	Int. dia	Distance from PFA
4	44	3	30
4.5	35	4	25
4	46	5	42
3.5	15	4.5	36
4	25	3	25
3	25	3	20
3	35	4	30
3.5	40	3.5	45
3	40	4	35
4	20	3	38
5	30	5	40
5	20	4	24
5	3	4	4
8	25	7	20
7	35	7	70
4	35	6	50
5	20	3	40
5	30	7	40
3	55	3	50
		4	40
		6	35
Avg: 4.4	30.4	4.4	35.2

Table.3: Side differences of Medial circumflex femoral artery measured in mm.

Right		Left	
Int. dia	Distance from PFA origin	Int. dia	Distance from PFA origin
2	25	3.5	70
2.5	30	3.5	40
3.5	30	3	40
2	50	3	40
2.5	80	2	60
2.5	70	2	70
2	80	3	60
1.5	40	2.4	60
2.5	20	3.5	60
4	0	2	22
3	10	4	15
3	8	3	0
4	0	4	3
8	60	4	1
3	3	7	0
3	60	4	25
5	12	1	40
6	10	4	15
4	12	3	13
		5	18
		7	15
Avg: 3.4	31.6	3.3	33.4

The median distance of separation of the PFA from the femoral artery was 5.3 cm (Table 1) distal to the midpoint of the inguinal ligament

The PFA originated from the posterolateral/posterior from the midpoint of the inguinal ligament is 27 out of 40 cases i.e. 67.5%. On the right side was average 52 mm (Table 2), whereas on the left side it was average 51.2 mm and sex difference 54mm in males and 55mm in females (Table 2).

The PFA originated from the posteromedial/medial from the midpoint of the inguinal ligament is 12 out of 40 cases i.e. 30 %. On the right side distance was average 58.8 mm (Table 1), whereas on the left side it was average 54.7 mm and sex difference average 54.2mm in males and 52.5mm in females (Table 2).

The MFCA in 36 out of 40 (90 %) extremities originated from the PFA; whereas in 4 out of 40 (10 %) extremities it is originated from the FA. Where as in all specimens LFCA originated from

the PFA only. The distance of origin of the medial circumflex femoral from the origin of the PFA was average 31 mm on the right while on the left it was 33 mm (Table 3). The internal diameter of MCFA is 3.4 mm on right and 3.3 mm on left. Average Sex difference 3.6mm in males and 2.8 mm in females.

The distance of origin of the LCFA from the origin of the PFA was average 30.4mm on the right while on the left it was between average 35.2 mm (Table 4). The internal diameter of LCFA is 4.4 mm on both right and left. Average Sex difference is 4.4 in both.

Interestingly in 17.5% cases, variations were observed which was statistically, proved to be significant.

DISCUSSION

Normal study was observed in 33 extremities out of 40. The average internal diameter of the FA recorded in this study both on the left and the right side ranged between 8.5 mm which is in accordance to the findings obtained by contrast angiographic technique by Richard as 6 - 10 mm [5].

The PFA in our study originated (67.5%) mostly from the posterolateral side of the FA as is mentioned by Bannister et al., [6]. The average distance of origin of PFA from the midpoint of inguinal ligament was found to be 54 mm which was more than 35mm and 40mm mentioned by Bannister et al [6] and Snell [7]. In our study the distance was more on right side. The knowledge of the site of origin of the PFA helps in avoiding iatrogenic femoral arterio-venous fistula while performing femoral artery puncture.

Ronald A. Bergman [8] did not notice any side or sex differences for both circumflex arteries which was also observed in our study.

Various researchers found different percentages LCF artery origin from profunda femoris artery: 15% by Hollinshead [9], 81% by Massoud and Fletcher [10], 100% by W Henry [1], and 19% from femoral artery whereas in our study all lateral circumflex origin is from PFA. M Uzel et al [11] have studied 110 inguinal regions (55 cadavers). They have found that the LCFA arose from PFA artery in 85 cases (77.3%), from the FA in 21 cases (19.1%).

In our study we had seen cluster of arteries arising from LCF which has also been noted in 72% cases by Auburtin [12] and 75% cases by Lipchutz [13].

The MCFA commonly arises from PFA in 90% of cases and in 10% of cases from the femoral. This is comparable to findings by eminent scientists as: 59% and 36% by Lipshutz [13], 53%, 27.5% by William Henry [1], 40% by Clarke and Colborn [14] and 79%, 15% by Tanyeli [15]. The average internal diameter of MCFA is more on right side Vazquez et al [4] expressed almost equal measurements in right- left side and approximately equal in both sexes. In our study we have noticed slight difference with respect to MCF when compared to either sides and sexes.

William [16] described six major patterns of branching and three subtypes, based on varying origins of two circumflex femoral arteries. He quoted Embryological basis for variation; explained by the fact that during developmental processes some of the arterial channels regress whereas other channels enlarge and form definitive arterial pattern.

CONCLUSION

In our study, measurement differences pertaining to sides and sexes were observed slightly with respect to MCFA. Other findings were mimicking the previous ones. The variations were also observed in our cases. This knowledge is of prime importance to the vascular surgeons and interventional radiologists to prevent inadvertent damage.

ABBREVIATIONS

PFA - Profunda Femoris Artery

MCFA - Medial Circumflex femoral Artery

LCFA - Lateral Circumflex Femoral Artery

FA - Femoral Artery

Conflicts of Interests: None

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