



STUDY OF VARIATIONS IN ORIGIN OF MEDIAL CIRCUMFLEX FEMORAL ARTERY IN HUMAN CADAVERS

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ABSTRACT **Introduction:** Medial circumflex femoral artery is a branch of profunda femoris artery. It arises from the posteromedial aspect of the profunda femoris artery in the femoral triangle. It is an important artery in supplying blood to the head and neck of the femur, to the adductor muscles and to fatty tissue in the acetabular fossa. Because of its close relationship with this area there is a high risk of severing the artery after trauma or during operations such as total hip arthroplasty. Accurate knowledge of anatomical variations regarding origin of medial circumflex femoral artery is important for clinicians in the present modern era of interventional radiology. The expanding scope of interventional radiology has prompted this study.

Material and Methods: The study was done by dissection method. In the present study, hundred limbs of formaldehyde embalmed cadavers irrespective of their sex, without malformations were dissected and site and distance of origin of the medial circumflex femoral artery from the profunda femoris artery studied by dissection method. When the artery originated from the femoral artery proximal or distal separation of medial circumflex femoral artery from profunda femoris artery was measured.

Results : The most common site of origin of Medial Circumflex Femoral Artery observed to be from Profunda Femoris Artery, on right side 76% and on left side 80%. It originated directly from femoral artery in 16% on right side and 12% on left side and as common trunk from profunda femoris artery in 8% of cadavers on both sides. Distance of origin of Medial Circumflex Femoral Artery from origin of Profunda Femoris Artery was recorded most commonly between 0-2cm on both sides.

Conclusion : These variations of the origins of Medial circumflex femoral artery needs to be taken into account and considered in all the surgical and interventional procedures. It was found that the origin of medial circumflex femoral artery directly from the femoral artery was associated with more distal separation of profunda femoris artery from the femoral artery.

KEYWORDS : Medial Circumflex Femoral Artery, Profunda Femoris Artery, interventional radiology.

Introduction:

In Homo sapiens, the main stem artery supplying arterial branches to deep structures of the proximal thigh and hip joint is the profunda femoris artery (deep femoral artery). The deep artery of the thigh has lateral and medial circumflex femoral branches and three perforating branches. Medial circumflex femoral artery arises from the posteromedial aspect of the profunda femoris artery, and winds around the medial side of the femur, passing first between the pectineus and iliopsoas muscles, and then between the obturator externus and the adductor brevis muscles. It may occasionally arise directly from the femoral artery.² The principal sources of blood flow to the femoral head are the lateral epiphyseal vessels which are the branches of the posterior superior retinacular vessels of the medial circumflex femoral artery. It also gives postero-inferior arteries to the femoral head and neck and posterior arteries to the neck of femur. The medial circumflex femoral artery, therefore, is the chief source of blood supply to head and neck of femur.³ It also supplies to the fatty tissue in the acetabular fossa and to the adductor muscles.⁴ Selective arteriography of medial circumflex femoral artery in the patients of idiopathic ischaemic necrosis of the femoral head is done to determine the arterial supply of the femoral head. The precise knowledge of the anatomy of medial circumflex femoral artery is essential when performing both trochanteric and inter-trochanteric osteotomies and is also helpful to avoid iatrogenic vascular necrosis of the head of femur in reconstructive surgery of the hip and fixation of acetabular fractures through the posterior approach.⁵ The medial circumflex femoral artery is used for arteriography, ultrasound and dopplerimaging, digital subtraction angiography and magnetic resonance imaging. The expanding scope of interventional radiology has prompted this study.

Aim:

- To determine the site of origin of the Medial Circumflex Femoral Artery.
- To determine the distance of origin of the Medial Circumflex Femoral Artery from origin of Profunda Femoris Artery.
- When the artery originated from the femoral artery proximal or

distal separation of medial circumflex femoral artery from profunda femoris artery is measured.

- To compare the obtained results with those of other studies.

Source of data:

The present study was carried out on fifty (50) formalin embalmed cadavers allotted to the undergraduate students for dissection in the Department of Anatomy, at Government medical colleges. Among these there were thirty (30) males and twenty (20) females.

Inclusion criteria:

- The cadavers belonging to different age groups and both sexes have been included.

Exclusion criteria:

- Any injuries in the femoral region of the thigh which can injure the profunda femoris artery and its branches were excluded.
- Diseased specimens like anomalous tortuosities, dilatations or aneurysms, infections in that region are not included.

Material used :-

- Scalpel with blade
- Toothed forcep
- Plain forcep
- Digital camera
- Digital vernier calliper

Dissection method

A series of 100 femoral triangles in 50 human cadavers were dissected. A curved incision is given from anterior superior iliac spine to pubic tubercle, again a curved incision given around the scrotum towards upper medial side of thigh and extended it vertically downwards till medial condyle of tibia. The skin was incised and reflected, followed by the superficial fascia. The superficial inguinal lymph nodes along with the superficial vessels 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 site of origin of the medial circumflex femoral artery noted. Its distance of origin from the origin of profunda femoris artery was measured in millimeters by digital vernier calliper. When the artery originated from the femoral artery proximal or distal separation of medial circumflex femoral artery from profunda femoris artery is measured.

Study design	-	Observational study.
Study setting	-	Dissection hall, Department of Anatomy.
Study duration	-	January 2012 to December 2013.
Study sample size	-	100 femoral triangles.
Study subjects	-	Human cadavers

Data Analysis:-

- 1) Data entry:- It was done using Microsoft excel 2007.
- 2) Statistical Analysis:
 - a. Descriptive statistics (Percentage, Mean, Median and Standard deviation) was used to summarize baseline characteristics of the study subjects.
 - b. Various data obtained from dissection of human cadavers and variations were noted.
 - c. Data was analysed using STATA VERSION-10 statistical software.
 - d. Chi square test, Unpaired t-test used to analyse data.

Fig. no. 1 Measurement of distance of origin of Medial circumflex femoral artery from origin of Profunda femoris artery.

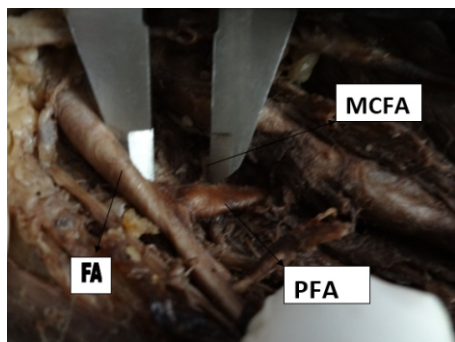


Fig. no. 2. Showing normal pattern of origin Medial circumflex femoral artery from Profunda femoris artery

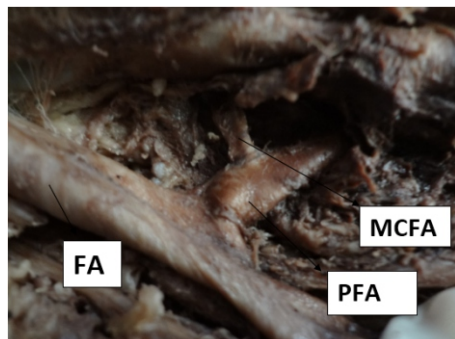


Fig no. 3 Showing medial circumflex femoral artery arising as a common stem with Profunda femoris artery

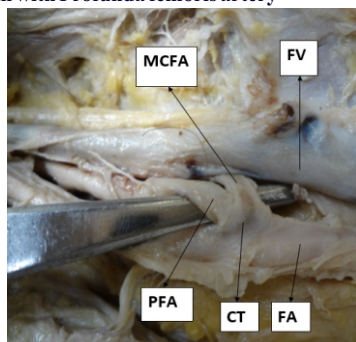
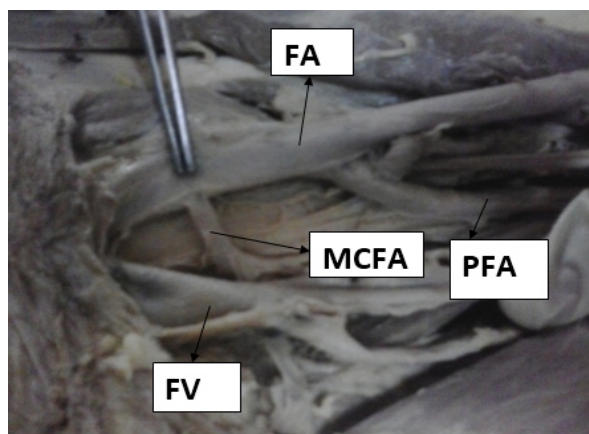


Fig no. 4 Medial circumflex femoral artery arising from femoral artery proximal to origin of Profunda femoris artery



Observations and Results

“Study of variations in the origin of Medial circumflex femoral artery in human cadavers.” was an observational study in which 100 femoral triangles of 50 human cadavers (30 males and 20 females) were dissected in the medical colleges.

Medial circumflex femoral artery was studied with respect to its site of origin and distance of separation from Profunda femoris artery.

The Data was tabulated and statistically analyzed for various parameters described subsequently.

Table No. 1 Distribution of site of origin of Medial Circumflex Femoral Artery

	CT	FA	PFA	P-VALUE	Chi. Sq.
RIGHT	4 (8%)	8(16%)	38(76%)	0.844 NS	0.3370 df=2
LEFT	4(8%)	6(12%)	40(80%)		

The most common site of origin of Medial Circumflex Femoral Artery observed to be from Profunda Femoris Artery on right side 76% and on left side 80%

The site of origin of Medial Circumflex Femoral Artery between the right and left sides showed statistically non significant difference by chi square test.

Table No. 2 Distribution of site of origin of Medial Circumflex Femoral Artery separately among males and females

	MALE(30)		FEMALE(20)	
	RIGHT	LEFT	RIGHT	LEFT
CT	2 (6.67%)	2 (6.67%)	2 (10%)	2 (10%)
FA	5 (16.67%)	4 (13.33%)	3 (15%)	2 (10%)
PFA	23 (76.67%)	24 (80%)	15 (75%)	16 (80%)
P-VALUE	0.935, NS		0.890,NS	
Chi square	0.1324 df=2		0.2323 df=2	

The most common site of origin of Medial Circumflex Femoral Artery on both sides was observed to be profunda femoris artery. In males 76.67% on right side and 80% on left side. The right and left sides in males showed statistically non significant difference by chi square test..

In females also the most common site of origin of Medial Circumflex Femoral Artery was observed to be profunda femoris artery 75% on right side and 80% on left side. The right and left sides in females showed statistically non significant difference by chi square test.

Table No. 3 Distribution of distance of origin of Medial Circumflex Femoral Artery from origin of Profunda Femoris Artery

DISTANCE(cm)	RIGHT	%	LEFT	%
0-1.0	18	36	16	32
1.1-2.0	14	28	15	30
2.1-3.0	11	22	9	18
3.1-4.0	5	10	8	16
4.1-5.0	2	4	2	4

TOTAL	50	100	50	100
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Distance of origin of Medial Circumflex Femoral Artery from origin of Profunda Femoris Artery was recorded most commonly between 0-2cm on both sides.

Table No.4 Comparison of distance of origin of Medial Circumflex Femoral Artery from origin of Profunda Femoris Artery on Right and Left side

	RIGHT	LEFT
MEAN	1.90	1.96
SD	1.15	1.19
MEDIAN	1.8	1.95
SEM	0.1632	0.1696
RANGE	0-4.6	0-4.8
T-VALUE	0.2464 df= 98	
P-VALUE	0.8059, NS	

The mean distance of origin of Medial Circumflex Femoral Artery from origin of Profunda Femoris Artery on right side was observed to be 1.90cm whereas on left side 1.96cm

The comparison of mean value of distance of origin of Medial Circumflex Femoral Artery from origin of Profunda Femoris Artery showed statistically non significant difference between right and left side by unpaired t-test.

Table No.5 Comparison of distance of origin of Medial Circumflex Femoral Artery from origin of Profunda Femoris Artery separately among males and females

	MALE		FEMALE	
	RIGHT	LEFT	RIGHT	LEFT
MEAN	1.90	1.93	1.90	2.0
SD	1.12	1.15	1.22	1.29
MEDIAN	1.8	1.95	1.90	1.85
SEM	0.2053	0.2111	0.2742	0.2885
T-VALUE	0.1132 df=58		0.2387 df= 38	
P-VALUE	0.9103, NS		0.8126, NS	

The mean distance of origin of Medial Circumflex Femoral Artery from origin of Profunda Femoris Artery on right side was observed to be 1.90cm whereas on left side 1.93cm in males whereas in females 1.90cm on right side and 2.0cm on left side

The comparison of mean value of distance of origin of Medial Circumflex Femoral Artery from origin of Profunda Femoris Artery separately for males and females showed statistically non significant difference between right and left side by unpaired t-test.

Discussion

Variations in the arterial patterns may be due to⁶

1. Divergence in the mode and proximodistal level of branching.
2. Presence of unusual compound arterial segments.
3. Aberrant vessels that connect with principal vessels, arcades or plexuses.
4. Vessels that occupy exceptional tissue planes (e.g. superficial fascia instead of sub fascia).
5. Have unsuspected neural myological or osteoligamentous relationships based on the aforementioned comparative anatomy.

Many workers have reported variability in the origin and branching pattern of medial circumflex femoral artery still, study on the anatomical variations of the origins of the medial circumflex femoral artery is rare in literature. Hence, present work was undertaken on cadavers to study.

Site of origin of Medial Circumflex Femoral Artery:

Siddharth P⁷ et al 1985, observed that the medial circumflex artery originated from the deep femoral in 63% of the specimens. It arose separately from the common femoral and more proximally in 26% of the specimens.

Gautier E⁸, et al 2000, studied in 12 cadavers i.e. 24femoral triangles. In 20 (i.e. 83.33%) specimens the MFCA originated from the profunda femoris artery and in four from the common femoral artery.

Tanyeli E⁹ et al 2006, performed an anatomical study of the origins of the medial circumflex femoral artery in the Turkish population In this study 100 inguinal regions of 50 cadavers were investigated. In 79 extremities (79%) MCFA branched from DFA, while in 15 (15%) it branched from FA. In one case they found a common trunk of DFA and MCFA.

Vazquez MT¹⁰ et al 2007, observed that both arteries i.e. MCFA arose from the deep femoral artery (346 cases, 78.8%). Rest of the MCFA derived from the femoral artery.

Samarawickrama MB¹¹ et al 2009, observed that on the right side the medial circumflex femoral artery arose from the profunda in 8 out of 13 cases (62%), from the femoral in 4 out of 13 cases (31%) and from the profunda femoris common stem in one case (8%). A similar pattern was observed in the left side as well having similar number of medial circumflex arteries originated from the profunda femoris and the femoral artery. Similarly one medial circumflex artery originated from the common profunda femoris stump. When the artery was originated from the femoral artery it was above the origin of the profunda femoris in all the cases and it was within 5mm to 30mm above the origin of the profunda femoris artery.

Prakash¹² et al 2010, observed that medial circumflex femoral artery in 43 out of 64 (67.2%) extremities originated from the profunda femoris artery; whereas in 21 out of 64 (32.8%) extremities it originated from the femoral artery.

Kent SS¹³ et al 2010, observed a common arterial trunk for the circumflex femoral arteries in one limb of a single specimen (0.5 percent of cadavers), which is lower than that reported in the literature This limb had a medial circumflex femoral artery that arose from the femoral artery superior to the origin of the profunda femoris.

Puspha MS¹⁴ et al 2011, reported a case in which the medial circumflex femoral artery on left side is arising directly from femoral artery proximal to the origin of profunda femoris artery.

Anwer D¹⁵ et al 2013, The medial circumflex artery on an average arose in 73.33% of specimens from the profunda femoris artery and originated from the common femoral artery in 21.67%.

Lalovic N¹⁶ et al 2013, observed that commonly in 25 (59.5%) limbs MCFA originated from the deep femoral artery. In 14 (33.3%) limbs MCFA arose from the femoral artery (FA), in one case (2.4%) a common source of deep femoral artery (DFA) and MCFA was identified.

Shiny Vinila B H¹⁷ et al 2013, observed that in 6 extremities (15%) medial circumflex femoral artery was originated directly from femoral artery. Normal study was observed in 27 extremities (67.5%).

In the present study, on right side side the Medial Circumflex Femoral Artery originated from the Profunda Femoris Artery in 76% cases, from the femoral artery in 16% cases and as a common trunk with Profunda Femoris in 8% cases.

On left side the Medial Circumflex Femoral Artery arose from the Profunda Femoris Artery in 80% cases, from the femoral artery in 12% cases and as a common trunk with Profunda Femoris in 8% cases.

So the most common site of origin of Medial Circumflex Femoral Artery observed to be from Profunda Femoris Artery on both sides. On right side 76% and on left side 80%.

The site of origin of Medial Circumflex Femoral Artery between the right and left sides of males and females also showed statistically non significant difference.

Results of present study ie origin of Medial Circumflex Femoral Artery are similar to the findings by Gautier (83.3%), Tanyeli (79%), Prakash (76.2%), Danish (73.33%) and Vazquez MT et al (78.8%). Shiny V et al found it to originate from profunda femoris artery in (67.5%) , Siddharth(63%), Dixit et al(62.5%) where also most common site of origin was Profunda Femoris Artery and nearer to the findings of the present study.

The proportion of medial circumflex femoral artery originated from

the common femoral artery in present study is 16% on right side and 12% on left side which is comparable to the findings of Vazquez MT et al (22.2%), Danish A et al (21.67%) and Tanyeli (15%).

When the artery originated from the femoral artery it was above the origin of the profunda femoris in all the cases and it was within 5mm to 30mm above the origin of the profunda femoris artery which is comparable with the study by MB Samarawickrama et al.

The proportion of medial circumflex femoral artery originated from the common trunk is 8% on both sides which is similar to MB Samarawickrama et al (8%), and in between Lalovic N et al (2.4%) and Shiny V et al 17.5%. This may be due to different ethnic origins of study group.

Distance of origin of Medial Circumflex Femoral Artery from the origin of Profunda Femoris Artery:

Dixit DP¹⁸ et al 2001, observed that the distance of origin of the medial circumflex femoral from the origin of the profunda was between 21 and 30mm on the right while on the left it was between 11 and 30mm.

Baptist M¹⁹ et al 2007, observed that the distance of origin of medial circumflex artery was 20-40 mm in 60% cases on both sides. On the left side in 10% cases the distance was measured as high as 0-10 mm and as low as 60 mm in one case.

Samarawickrama MB¹¹ et al 2009, observed that the distance of origin of the medial circumflex femoral from profunda artery was between 01 and 30mm on the right while on the left it was between 11 and 40mm.

Prakash¹² et al 2010, observed that the medial femoral circumflex artery in 43 out of 64 (67.2%) extremities separated at an average distance of 2 cm distal to the origin of the profunda femoris artery. On the other hand, the medial femoral circumflex artery in 21 out of 64 (32.8%) extremities originated from femoral artery, its average distance of branching was 2.3 cm proximal to the origin of the profunda femoris artery.

Dixit D²⁰ et al 2011, observed that the distance of origin of medial circumflex femoral artery from the origin of profunda femoris artery was between 0-10 mm on both the sides.

Anwer D¹⁵ et al 2013, observed that the average distance of the origin of medial circumflex artery from the profunda femoris artery was found to be 24.38mm.

In the present study the medial circumflex femoral artery originated commonly from a distance of 0-2 cm. from the origin of Profunda Femoris Artery. The average distance on right side was found to be 1.90 cm whereas on left side 1.96 cm. The comparison of mean value of distance of origin of medial circumflex femoral artery from the origin of Profunda Femoris Artery on Right And Left side showed statistically non significant difference .

Findings of present study are comparable with findings of the above studies however Marina Baptist et al got distance of origin between 2-4 commonly and Dixit et al 2001 between 21 and 30mm on right side which is slightly higher than the present study. This difference may be due to different ethnic origin. However this study shows that the origin of medial circumflex femoral artery is placed close to the root of the profunda femoris artery.⁵³

Conclusion

The most common site of origin of Medial Circumflex Femoral Artery was observed to be Profunda Femoris Artery on both sides. On right side 76% and on left side 80% of the study group.

The site of origin of Medial Circumflex Femoral Artery between the right and left sides showed statistically non significant difference.

In males the most common site of origin of Medial Circumflex Femoral Artery on both sides was observed to be profunda femoris artery, 76.67% on right side and 80% on left side. The right and left sides in males showed statistically non significant difference.

In females also the most common site of origin of Medial Circumflex Femoral Artery was observed to be profunda femoris artery, 75% on

right side and 80% on left side. The right and left sides in females showed statistically non significant difference.

Distance of origin of Medial Circumflex Femoral Artery from origin of Profunda Femoris Artery was recorded most commonly between 0-2cm on both sides.

The mean distance of origin of Medial Circumflex Femoral Artery from origin of Profunda Femoris Artery on right side was observed to be 1.90cm whereas on left side 1.96cm

The comparison of mean value of distance of origin of Medial Circumflex Femoral Artery from origin of Profunda Femoris Artery showed statistically non significant difference between right and left side.

In males the mean distance of origin of Medial Circumflex Femoral Artery from origin of Profunda Femoris Artery on right side was observed to be 1.90cm whereas on left side 1.93cm in males whereas in females 1.90cm on right side and 2.0cm on left side.

The comparison of mean value of distance of origin of Medial Circumflex Femoral Artery from origin of Profunda Femoris Artery separately for males and females showed statistically non significant difference between right and left side.

When the artery was originated from the femoral artery it was above the origin of the profunda femoris in all the cases and it was within 5mm to 30mm above the origin of the profunda femoris artery.

It was found that the origin of medial circumflex femoral artery directly from the femoral artery was associated with more distal separation of profunda femoris artery from the femoral artery.

The results of the present study may be used as reference guide for future studies about femoral artery and its branches as well as for surgical, clinical and radiological interventions.

Abbreviations

M -	Male
F -	Female
R -	Right
L -	Left
PFA -	Profunda Femoris Artery
LCFA -	Lateral Circumflex Femoral Artery
MCFA -	Medial Circumflex Femoral Artery
NS -	Non Significant
S -	Significant
SD -	Standard Deviation
SEM -	Standard Error of Mean
df -	degree of free
Fig. no. -	Figure number
DB -	descending branch
Π -	pie
Chi sq -	chi square
CT -	Common trunk. (when PFA originates with MCFA from a common site).

References

- Davidson CJ, O Bonon R. Cardiac Catheterization. Edited by Zipes, Liby et al. Braunwald's. Heart Diseases A Textbook of Cardiovascular Medicine. 7th Ed. Vol. I. Pennsylvania, USA. Elsevier Saunders; 2005. p. 402-3.
- Susan Standring, Pelvic girdle, Gluteal region and Hip joint, Gray's Anatomy, 39th edition, Elsevier, Churchill Livingstone, Spain, 2005; pp. 1450-1452.
- Hollinshead WJ. Anatomy for surgeon's. The Back and Limbs, vol.3. Newyork: Medical book department of harper and brothers 1958; p.705-42.
- Moore KL , Lower limb, Clinically oriented anatomy, 6th edition, Lippincott Williams and Wilkins, Baltimore,2010; pp. 555-556.
- Gautier E, Ganz K, Krügel N, Gill T, Ganz R. Anatomy of the medial femoral circumflex artery and its surgical implications. The journal of bone and joint surgery (Br) 2000; 82: p.679-683.
- Standring S. Gray's Anatomy; The anatomical basis of clinical practice, 40 ed. Elsevier Churchill Livingstone; 2005. p.1480.
- Siddharth P, Smith NL, Mason RA, Giron F. Variational anatomy of the deep femoral artery. Anat Rec; 1985. 212(2): p. 206-9.
- Gautier E, Ganz K, Krügel N, GILL T, GANZ R. Anatomy of the medial femoral circumflex artery and its surgical implications. J Bone Joint Surg Br; 2000. 82(5): p. 679-83.
- Tanyeli E, Uzel M, Yildirim M, Celik HH. An anatomical study of the origins of the medial circumflex femoral artery in the Turkish population. Folia Morphol (warsz); 2006. 65(3): p.209-12.
- Vazquez MT Murrillo J, Maranillo E, Parkin I, Sanudo J. Patterns of the Circumflex Femoral Arteries revisited. Clin Anat; 2007. 20: p. 108-185.
- Samarawickrama MB, Nanayakkara BG, Wimalagunaratna KWR, Nishantha DG , Walawag UB. Branching pattern of the femoral artery at the femoral triangle: a cadaver

- study. Galle Medical Journal; 14(1) 2009. p. 31-4.
12. Prakash, Kumari J, Bharadwaj AK, Jose BA, Yadav SK, 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): p. 161-70.
 13. Kent SS, Kirby LJ, and Stewart C. A rare variant of a common arterial trunk for the circumflex femoral arteries. *Proc. Okla. Acad. Sci*; 2010. 90: p.133-6.
 14. Puspha MS, Kulkarni R. Anomalous origin of medial circumflex femoral artery - case report. *Anatomica Karnataka*; 2011. 5(1) p. 33-5.
 15. Anwer D, Karmalkar AS, Humbarwadi RS. A study of variation in origin of profunda femoris artery and its branches. *IJBAR*; 2013. 04 (06): p. 366-8.
 16. Lalovic N, Malis M, Korica M, Cvijanovic R, Simatovic M, Ilic M. Origin of the medial circumflex femoral artery – a cadaver study. *Med Glas (Zenica)*; 2013. 10(2): p. 198-202.
 17. Shiny Vinila B H, Suseelamma D, Sridevi NS, Gayatri N, Sangeeta M. A study on the origins of medial circumflex femoral artery. *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*; 2013. 4(5): p. 28-31.
 18. Dixit DP, Mehta LA, Kothari ML. Variations in the origin and course of profunda femoris. *J Anat Soc India*; 2001. 50(1): p. 6-7.
 19. Baptist M, Sultana F, Hussain T. Anatomical variations: The origin of profundafemoris artery, its branches and diameter of the femoral artery. *Professional Med J*; 2007. 14 (3): p. 523-7.
 20. Dixit D, Kubavat DM, Rathod SP, Pateld MM, Singel TC. A study of variations in the origin of profunda femoris artery and its circumflex branches. *Int J Biol Med Res*; 2011. 2(4): p. 1084-9.