

## A STUDY ON THE PATTERNS OF CIRCUMFLEX FEMORAL ARTERIES

R. Chitra \*<sup>1</sup>, K.S.N.Prasad <sup>2</sup>.

\*<sup>1</sup> Associate professor of anatomy, Siddhartha Medical College, Vijayawada, Andhra Pradesh, India.

<sup>2</sup> Professor and Head, Department of anatomy, Siddhartha Medical College, Vijayawada, Andhra Pradesh, India.

### ABSTRACT

**Context:** Many different patterns have been described to classify the origins of circumflex femoral arteries by many authors since from 1860. The aim of the present study was to classify the circumflex femoral arteries in 100 lower limbs of adult cadavers of both sexes following the recent classification and to compare with the previous studies.

**Materials and Methods:** A total of 100 lower limbs of 50 embalmed human adult cadavers (Male: 37, Female: 13) were dissected and observed for the origins of circumflex femoral arteries in femoral triangle in routine educational dissection in the period of 2005-2009

**Results:** The medial and lateral circumflex femoral arteries have been classified into three different patterns based on the levels of their origin. Pattern I: Both arteries arose from the profunda femoris artery (56%). Type Ia, medial circumflex femoral artery origin was proximal to the lateral circumflex femoral artery origin (69%); Type Ib, lateral circumflex femoral artery origin was proximal to medial circumflex femoral artery origin (16%); Type Ic, both arteries arose from a common trunk or at same level (14%). Pattern II: One of the arteries arose from the femoral artery and the other from the profunda femoris artery (36%). Type IIa, the medial circumflex femoral artery arose from the femoral artery (75%) and Type IIb, the lateral circumflex femoral artery arose from the femoral artery (25%). Pattern III: Both arteries arose from the femoral artery (7%). The medial circumflex femoral artery was absent in a female cadaver on right side.

**Conclusion:** In every pattern or type, there was significantly unilateral higher occurrence than bilateral occurrence. A precise knowledge of the circumflex femoral arteries in relation to the profunda femoris artery is important in surgical interventions of the hip region

**KEY WORDS:** Medial circumflex femoral artery, Lateral circumflex femoral artery, Profunda femoris artery, Vascular variations.

**Address for Correspondence:** Dr. R. Chitra. M.D., DNB (Anatomy), Associate Professor of Anatomy, Siddhartha Medical College, Vijayawada-8, Krishna district, Andhra Pradesh, India. Phone: (R) 0866-2576319 Mobile: +91-944-0508509 **E-Mail:** [vjwchitra@yahoo.co.in](mailto:vjwchitra@yahoo.co.in)

### Access this Article online

#### Quick Response code



DOI: 10.16965/ijar.2015.182

**Web site:** International Journal of Anatomy and Research  
ISSN 2321-4287  
[www.ijmhr.org/ijar.htm](http://www.ijmhr.org/ijar.htm)

Received: 18 May 2015      Accepted: 15 Jun 2015  
Peer Review: 18 May 2015      Published (O): 30 Sep 2015  
Revised: None      Published (P): 30 Sep 2015

### INTRODUCTION

The main aim of the present study was to classify the patterns of circumflex femoral arteries following the recent classification of Vasquez. et al. 2007 [1]. This classification is based on the different origins of circumflex femoral arteries in relation to the profunda

femoris artery which is the important landmark in vascular surgeries. The profunda femoris artery is the largest branch that arises from posterolateral aspect of femoral artery at a distance of 3.75 cm from midpoint of inguinal ligament. The profunda femoris artery gives off the muscular, perforating branches and also the

medial and lateral circumflex femoral arteries [2]. The profunda femoris artery is useful for the doppler imaging, ultrasound, arteriography, and angiography and also magnetic resonance imaging. The knowledge of origin of profunda femoris artery and circumflex femoral branches is necessary in surgical and interventional procedures that include the femoral artery [3,4,5]. The descending branch of lateral circumflex femoral artery has found recent use as a new arterial graft for coronary artery bypass grafting[6]. The circumflex femoral arteries are the most important branches of the profunda femoris artery but may arise from other arterial trunks in variant frequencies [7,8].

### MATERIALS AND METHODS

The present study was done in the departments of Anatomy at NRI medical college and at Siddhartha medical college during educational dissection for five years from 2005 to 2009. A total of 50 embalmed human adult cadavers (Male: 37, Female: 13) were dissected for the origins of circumflex femoral arteries in femoral triangle following the standard dissection procedures [2]. The free lower limbs which also were dissected in these years of which the gender is unknown were excluded from the study. The origins of both medial and lateral circumflex femoral arteries were observed and the distances of their origins in relation to profunda femoris artery were measured with vernier calipers. The origins of circumflex femoral arteries were classified following the classification of Vasquez et al and the literature of earlier classifications were also reviewed carefully [1].

### RESULTS

The circumflex femoral arteries are classified into three different patterns and in each pattern subdivided into types according to Vasquez. et al. 2007 [1]. The results of the present study of the branching of circumflex femoral arteries following the above classification have been tabulated in table 1.

**Pattern I:** It includes the specimens in which both circumflex femoral arteries arising from profunda femoris artery. This pattern was found in 56 limbs (R: 28, L: 28), in 18 cases bilaterally and in 20 limbs unilaterally(R: 13, L: 7)

**Table 1:** Patterns and types of circumflex femoral arteries in 100 sides.

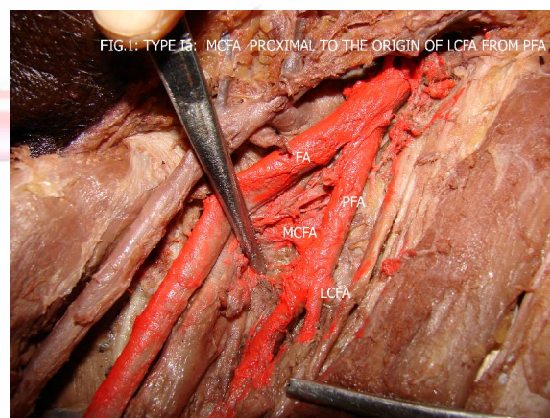
Type	R-N	L-N	Circumflex distance range	Mean distance of MCF	Mean distance of LCF
Pattern I	28	28	0.2 - 7 cm from the origin of PFA	1 cm	3 cm
Type Ia	20	19			
Type Ib	3	6			
Type Ic	5	3			
Pattern II	20	16			
Type IIa	14	13			
Type IIb	6	3			
Pattern III	1	6			

(R-Right side, L-Left side, N-numbers, PFA-Profunda femoris artery, MCF-Medial circumflex femoral artery, LCF-Lateral circumflex femoral artery)

**Three different types in this pattern are described:**

**Type Ia:** The origin of medial circumflex femoral artery is proximal to the origin of lateral circumflex femoral artery. This type (Fig. 1) was observed in 39 limbs (R: 20, L: 19), in 10 specimens bilaterally and in 19 limbs unilaterally(R: 10, L: 9).

**Fig. 1:** Type Ia: The origin of medial circumflex femoral artery is proximal to the origin of lateral circumflex femoral artery.



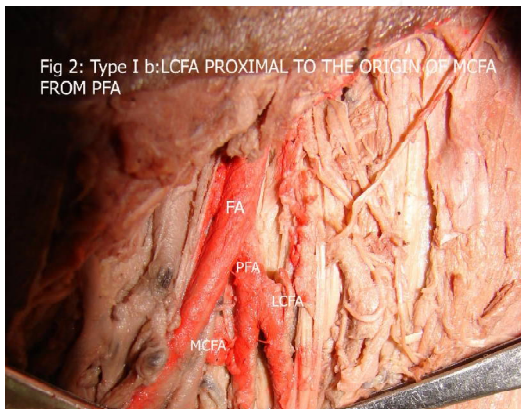
**Type Ib:** The origin of lateral circumflex femoral artery is proximal to the origin of medial circumflex femoral artery. This type (Fig. 2) was found in 9 limbs (R: 3, L: 6), in 1 case bilaterally and in 7 limbs unilaterally (R: 3, L: 4)

**Type Ic:** Both circumflex femoral arteries arising at same level or by common trunk from profunda femoris artery. This type (Fig. 3) was found in 8 limbs (R: 5, L: 3), all unilaterally.

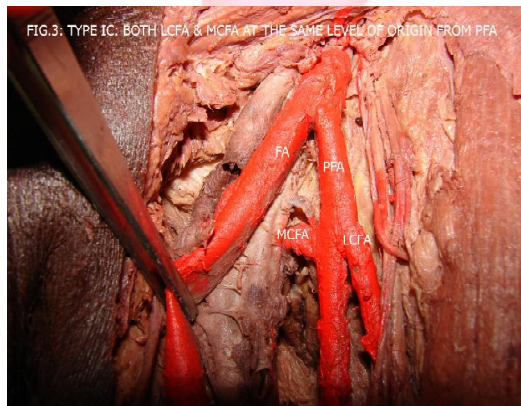
**Pattern II:** In this pattern, one of the circumflex femoral arteries arises from profunda femoris artery and the other from femoral artery. This pattern was found in 36 limbs (R: 20, L: 16), in 8

specimens bilaterally and in 20 limbs unilaterally (R: 12, L: 8). This pattern is divided into two subtypes.

**Fig. 2:** Type Ib: The origin of lateral circumflex femoral artery is proximal to the origin of medial circumflex femoral artery.

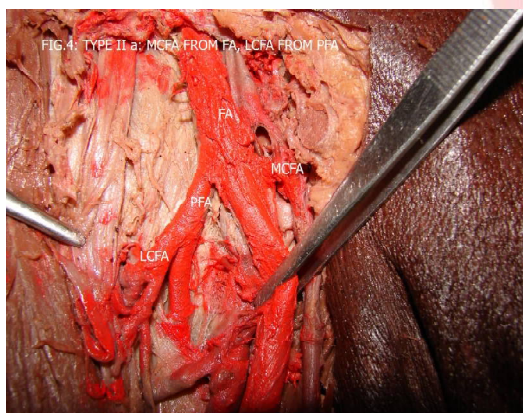


**Fig. 3:** Type Ic: Both circumflex femoral arteries arising at same level or by common trunk from profunda femoris artery.



**Type IIa:** The medial circumflex femoral artery arises from femoral artery and the lateral circumflex femoral artery arises from profunda femoris artery. This type (Fig. 4) was noted in 27 limbs, in 6 cases bilaterally and in 15 limbs unilaterally (R: 9, L: 6)

**Fig. 4:** Type IIa: The medial circumflex femoral artery arises from femoral artery and the lateral circumflex femoral artery arises from profunda femoris artery.



**Type IIb:** The lateral circumflex femoral artery arises from femoral artery and the medial circumflex femoral artery arises from profunda femoris artery. This type was observed in 9 limbs (R: 6, L: 3), all unilaterally.

**Pattern III:** In this pattern, both circumflex femoral arteries arise from femoral artery. This pattern was observed in 7 limbs (R: 1, L: 6), in a specimen bilaterally and in 4 limbs unilaterally on the left side.

The medial circumflex femoral artery was absent in a female cadaver on the right side and its branches directly arose from femoral artery.

## DISCUSSION

The variations in the origins of circumflex femoral arteries have been considered as due to variability in the selection of the capillary channels during the development of the arterial system of lower limb [9]. The oldest classification described four arrangements of the circumflex femoral arteries: (1) both arteries arose from the profunda femoris artery (2) medial circumflex femoral artery arose from the femoral artery and the lateral circumflex femoral artery from the profunda femoris artery (3) lateral circumflex femoral artery arose from the femoral artery and medial circumflex femoral artery from the profunda femoris artery and (4) both arteries arose from the femoral artery [10]. Williams. et al in 1930 introduced the new parameter in the classification, the descending branch of lateral circumflex femoral artery which may arise from profunda femoris artery or from femoral artery [11]. Later, numerous classifications of circumflex femoral arteries have been proposed by many authors [12-20.] Vazquez. et al in 2007 has simplified the classification of circumflex femoral arteries in the study of 221 human cadavers [1] The results of the present study is compared with the results of previous studies and tabulated in Table 2.

Pattern I is most frequently reported in all the studies except in the two where the pattern II is most commonly encountered [21,22]. The occurrence of pattern I range from 40% to 83%, pattern II from 14% to 51% and the pattern III from 1% to 13% in the studies of circumflex femoral arteries. The percentage occurrence of

**Table 2:** Patterns of circumflex femoral arteries in the previous studies compared with present study.

Author, year	Number of limbs	Pattern I (%)	Pattern II (%)	Pattern III (%)
Srb, 1860 [10]	200	62	33	4.5
Auburtin, 1905 [23]	100	55	40	5
Lipshutz, 1916 [21]	99	40	44	11
Charles et al, 1930 [12]	165	67.9	24.2	7.9
Baird & Cope, 1933 [13]	303	58.5	32.3	3.6
Williams et al, 1930 [11]	481	59	35.5	4.6
Ming Tzu, 1937 [14]	150	66.7	29.3	4
Chand & Singh, 1951 [15]	100	64	23	13
Keen, 1961 [22]	280	42	51	7
Videu et al, 1964 [16]	70	60	38.6	1.5
Leborgne, 1974 [17]	41	41	41	13
Marcade et al, 1978 [18]	100	66	14	20
Guillot et al, 1979 [19]	90	63.3	33.3	1.1
Lengua et al, 1980 [20]	100	66	-	-
Siddharth et al, 1985 [25]	100	70	-	-
Massoud & Fletcher, 1997 [24]	188	83.8	9.2	6.6
Vazquez et al, 2007 [1]	439	78.8	20.5	0.5
Present study, 2010	100	56	36	7

the patterns of circumflex femoral arteries in the present study mostly coincided with that of Auburtin, Baird & Cope and Williams et al [23,13,11]. The absence of circumflex femoral was 1% in this study which is comparable to that of Lengua. et al [20]. It was reported to be of 3% by Lipshutz and Massoud & Fletcher [21,24]. The incidence of absence of medial circumflex femoral artery was 0.5% in the study of Vasquez et al [1].

The study of statistical difference in the patterns of circumflex femoral arteries have been analysed by three authors [1,11,14] Williams et al and Ming –Tzu revealed the racial differences in the patterns of circumflex femoral arteries [11,14]. Vazquez et al 2007 studied the differences in the sexes of specimens and the sides of the lower limbs [1] He observed statistically except that the pattern I was more common in females but no differences were observed in the sexes in the patterns II & III and also in the sides of the limbs regarding the three patterns.

## CONCLUSION

The relevance of the arterial patterns is practically important in surgical procedures and in angiographic procedures [25,5,19,24]. Awareness of the variations of the circumflex femoral arteries and defining the vascular patterns is important in any invasive procedures to avoid unnecessary arterial injuries.

## ABBREVIATIONS:

FA- Femoral artery

PFA- Profunda femoris artery

MCFA- Medial circumflex femoral artery

LCFA- Lateral circumflex femoral artery

**Conflicts of Interests: None**

## REFERENCES

- [1]. Vazques MT, Murillo J, Maranillo E, Parkin I, Sanudo J. Patterns of circumflex femoral arteries revisited. *Clinical Anatomy* 2007;20:180–85.
- [2]. Standring S (Gray's Anatomy) In: Cardiovascular system. 38th Edn.; Churchill Livingstone, Medical Division of Longman Group, UK Ltd.2008; pp.1566-68.
- [3]. Moris GC Jr, Edwards E, Cooley DA, Crawford ES, De Bakey ME. Surgical importance of profunda femoris artery. *Arch Surg*1961;82:32-37.
- [4]. Billig DM, Callow AD, Deterling RA. Surgical considerations in the management of lesions of the profunda femoris artery. *Am J Surg* 1970;119:392-96.
- [5]. Gautier E, Ganz K, Kru'gel N, Gill T, Ganz R. Anatomy of the medial femoral circumflex artery and its surgical implications. *J Bone Joint Surg* 2000;82B:679–83.
- [6]. Fabbrocini M, Fattouch K, Camporini G, DeMicheli G, Bertucci C, Cioffi P, Mercogliano D. The descending branch of lateral femoral circumflex artery in arterial CABG: early and midterm results. *Ann Thoracic Surg* 2003;75:1836-41.
- [7]. Lippert H, Pabst R. Arterial variations in man: classification and frequency. JF Bergman Verlag, München 1985;61.
- [8]. Bergman, RA, Thompson, SA, Afifi, AK and Saadeh FA. *Compendium of Human Anatomic Variation: Catalog, Atlas and World Literature*. Urban & Schwarzenberg, Baltimore and Munich. 1988.
- [9]. Senior HD. The description of the larger direct or indirect muscular branches of the human femoral artery. A morphogenetic study. *Am J Anat* 1924;33:243–65.
- [10]. Srb J. Ueber das Verhalten der Arteria profunda femoris. *Oesterreichische Zeitschr. für praktische Heilkunde*. 1860;6 :1-6.
- [11]. Williams GD, Sindelar RJ, Perat JC, Martin NA, McIntire LR, Martin CH. Origin of the deep and circumflex femoral group of arteries. *Anat Rec* 1930;46:2273–79.
- [12]. Charles CM, Finley TL, Baird RD, Cope JS. On the termination of the circumflex veins of the thigh. *Anat Rec*1930;46:125–32.
- [13]. Baird RD, Cope JS. On the terminations of the circumflex veins of the thigh and their relations to the origins of the circumflex arteries. *Anat Rec* 1933;57:325–37.

- [14]. Ming-Tzu P. Origin of deep and circumflex femoral group of arteries in the Chinese. *Am J Phys Anthropol*1937;22:417–42.
- [15]. Chand I, Singh B. Arteria profunda femoris and its variations. *Indian Med Gazette*1951;86:248–51.
- [16]. Videau J, Rideau Y, Bonjean P, Kamina P. A propos du niveau d'origine de la femorale profonde en fonction de points de repères osseux du bassin. *CR. Ass Anat*1964;49:1831–43.
- [17]. Leborgne J, Pannier M, Visset J, Barbin JY. Considerations sur l'étude des rapports vasculaires du trou obturateur. *Bull Assoc. Anat* 1974;58:885–98.
- [18]. Marcade E, Leguerrier A, Scarabin JM, Rioux C, Logeais Y, Lanchou G. L'artère femorale profonde et étude anatomo-radiologique. *Bull Assoc Anat* 1978;62:453–59.
- [19]. Guillot M, Vanneuville G, Escande G, Chazal J, Tanguy A. Étude anatomique et systématisation des veines du pied. *Bull Assoc Anat*1979,63:425–433.
- [20]. Lengua F, Pajot A, Fernandez R, Kunlin J. Plaidoyer pour une meilleure terminologie de la chirurgie de l'artère femorale profonde. *J Chir*1980;117:37–42.
- [21]. Lipchut, BB. Studies on the blood vascular tree. 1. A composite study of the femoral artery. *Anatomical Record*1916;10:361-70.
- [22]. Keen JA. A study of the arterial variations in the limbs, with special reference to symmetry of vascular patterns. *Am J Anat*1961;108:245–61.
- [23]. Auburtin G. Die beiden Arteriae circumflexe femoris des Menschen. *Anat Anz* 1905;27:247–69.
- [24]. Massoud. TF, Fletcher EW. Anatomical variants of the profunda femoris artery-an angiographic study. *Surg Radiol Anat* 1997;19(2):99-103.
- [25]. Siddharth P, Smith NL, Mason RA, Giron F. Variational anatomy of the deep femoral artery. *Anat Rec* 1985;212: 206–09.

**How to cite this article:**

R. Chitra, K.S.N.Prasad. A STUDY ON THE PATTERNS OF CIRCUMFLEX FEMORAL ARTERIES. *Int J Anat Res* 2015;3(3):1326-1330. **DOI:** 10.16965/ijar.2015.182