

ORIGINAL PAPER

Variations in the origins of the profunda femoris, medial and lateral femoral circumflex arteries: a cadaver study in the Indian population

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Abstract

Femoral artery is frequently accessed by radiologists and surgeons. Anatomical knowledge of the variations of femoral artery and its branches including profunda femoris, medial and lateral femoral circumflex arteries is required to minimize complications and hence it is suggested for the clinicians planning surgery and intervention around the aforementioned vessels. Present study was undertaken on Indian population and dissection was performed on 64 extremities of 32 embalmed cadavers. The level of origin of the profunda femoris artery was studied in relation to the midpoint of the inguinal ligament. Prevalence of the mode and configurations of origins of the medial and lateral femoral circumflex arteries was observed. The median distance of separation of the profunda femoris artery from the femoral artery was 4.2 cm distal to the midpoint of the inguinal ligament. The medial femoral circumflex 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. On the other hand, the lateral femoral circumflex artery in 52 out of 64 (81.25%) extremities originated from the profunda femoris artery; whereas in 12 out of 64 (18.75%) extremities it originated from the femoral artery. We further suggest that origins of the medial and lateral femoral circumflex arteries directly from the femoral artery is associated with lower level of separation of the profunda femoral artery from the femoral artery.

Keywords: anatomy, cadaver, artery, femoral, profunda femoris.

Introduction

The femoral artery is preferred and it is easily accessible to catheterization in a large number of investigations including angiographies. Accurate knowledge of anatomical variations regarding origins of the profunda femoris, medial and lateral femoral circumflex arteries are important for clinicians in the present modern era of interventional radiology. The profunda femoris artery is frequently incorporated in vascular reconstructive procedures in the proximal leg [1]. The knowledge of variations in height origin of profunda femoris artery and its branches distribution is of great significance for preventing flap necrosis, particularly tensor fascia latae, when used in plastic and reconstructive surgery [2]. Gautier E *et al.* [3] opined that precise knowledge of the anatomy of medial femoral circumflex artery is essential when performing both trochanteric and intertrochanteric 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. Anatomy of the vessels of the lower limb has long received attention from various authors, time and again [1–23]. On the other hand, combined study on the anatomical variations of the origins of the profunda femoris, medial and lateral femoral circumflex arteries is rare in literature. Hence, present work was undertaken on cadavers to study the prevalence of origins of the aforementioned arteries in the Indian population.

Material and Methods

Thirty-two properly embalmed and formalin fixed cadavers were selected for the present study. There were 20 male and 12 female cadavers with age range between 20 to 70 years. Dissection started with skin incision followed by superficial fascia and fascia lata. The distance from the midpoint of the inguinal ligament to the apex of the femoral triangle was divided into three equal parts: proximal one-third (A), middle one third (B), and distal third (C). The site and the mode of the origin of the profunda femoris artery were studied in relation to the aforementioned criteria. Configurations

of the femoral origins of the medial femoral circumflex artery and lateral femoral circumflex artery and their prevalence were studied.

Results

Following observations were recorded. The median distance of separation of the profunda femoris artery from the femoral artery was 4.2 cm distal to the midpoint of the inguinal ligament.

In 29 out of 64 (45.3%) extremities, the profunda femoris artery originated in the proximal third (A); whereas in 25 out of 64 (39.4%) extremities it originated in the middle third (B) and in 10 out of 64 (15.1%) specimens origin was observed in the distal third (C) of the distance from the midpoint of the inguinal ligament to the apex of the femoral triangle.

In 32 out of 64 (50%) extremities, the profunda femoris artery originated from the postero-lateral aspect of the femoral artery; whereas it originated from the posterior aspect in 30 out of 64 (46.9%) specimens. On the

other hand, in two out of 64 (3.1%) extremities, the profunda femoris artery separated from the medial side of the femoral artery.

The medial femoral circumflex artery in 43 out of 64 (67.2%) extremities originated from the profunda femoris artery and it 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 the femoral artery and its average distance of branching was 2.3 cm proximal to the origin of the profunda femoris artery. The lateral femoral circumflex artery in 52 out of 64 (81.25%) extremities originated from the profunda femoris artery and its separation was observed at an average distance of 2.5 cm distal to the origin of the profunda femoris artery. Whereas the lateral femoral circumflex artery in 12 out of 64 (18.75%) extremities originated from the femoral artery (Figures 1 and 2) and its average distance of origin was 2.1 cm proximal to the separation of the profunda femoris artery.

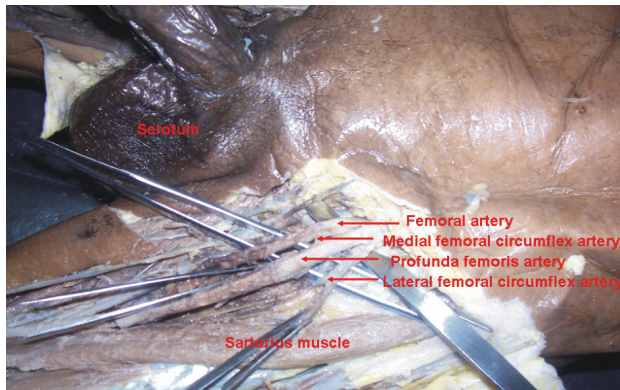


Figure 1 – Origins of medial and lateral circumflex arteries directly from the femoral artery.

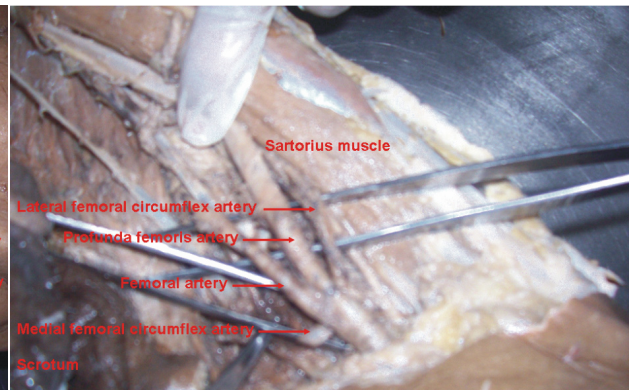


Figure 2 – Origins of medial and lateral circumflex arteries directly from the femoral artery and more distal separation of profunda femoris artery from the femoral artery.

Discussion

Anatomical variations reported at the level of the division of the femoral artery can be explained as follows. In the lower animals, the profunda femoris artery is a branch of the internal iliac artery. During course of evolution, the origin shifted distally from the femoral artery. Ontogeny repeats phylogeny. Hence, developmental arrest at different stages may lead to anatomical variations related to the division of the femoral artery. Vaas F [6] reported that the profunda femoris artery acts as a collateral vessel in the occlusion of the femoral artery and for this important function, it has to have a large caliber, which can be explained based on the aforementioned comparative anatomy.

The anatomical knowledge of the level of origin is important in avoiding iatrogenic femoral arteriovenous fistula formed during puncture of femoral artery [17].

Table 1 compares the variations related to the site of origin of profunda femoris artery in different studies [1, 2, 17]. Studies on the prevalence of anatomical variations related to the origin of medial and lateral femoral circumflex arteries by various authors [1, 3, 4, 9, 15–17, 22] has been discussed in Table 2.

We observed that origins of the medial and lateral femoral circumflex arteries directly from the femoral artery were associated with distal shift of the level of separation of the profunda femoris artery from the femoral artery.

Table 1 – Comparison of the variations related to the origin of profunda femoris artery in different studies

S.N.	Authors	Year of study	Specimens studied	Median distance of separation of the profunda femoris artery from the femoral artery measured from the midpoint of the inguinal ligament [cm]	Most common site of origin of profunda femoris artery in the femoral triangle
1.	Siddharth P <i>et al.</i> [1]	1985	cadavers	4.4	proximal half
2.	Dixit DP <i>et al.</i> [17]	2001	cadavers	4.75	midway
3.	Bannister LH <i>et al.</i> [20]	1995	cadavers	3.5	proximal half

S.N.	Authors	Year of study	Specimens studied	Median distance of separation of the profunda femoris artery from the femoral artery measured from the midpoint of the inguinal ligament [cm]	Most common site of origin of profunda femoris artery in the femoral triangle
4.	Snell RS [21]	1992	cadavers	4	proximal half
5.	Vuksanović-Božarić A et al. [2]	2007	fetal cadavers	3.75	proximal one fourth
6.	Present study	2009	cadavers	4.2	proximal one third

Table 2 – Comparison of the variations related to the origin of medial and lateral femoral circumflex arteries in different studies

S.N.	Authors	Year of study	Specimens studied	Prevalence of origin of medial femoral circumflex artery from profunda femoris artery [%]	Prevalence of origin of medial femoral circumflex artery from femoral artery (including common stem) [%]	Prevalence of origin of lateral femoral circumflex artery from profunda femoris artery [%]	Prevalence of origin of lateral femoral circumflex artery from femoral artery (including common stem) [%]
1.	Tanyeli E et al. [4]	2006	cadavers	79	21		
2.	Uzel M et al. [9]	2008	cadavers			77.3	22.7
3.	Siddharth P et al. [1]	1985	cadavers	63	37		
4.	Fukuda H et al. [15]	2005	angiographs			78.6	21.4
5.	Dixit DP et al. [17]	2001	cadavers	62.5	37.5	83.34	16.66
6.	Gautier E et al. [3]	2000	cadavers	83.3	16.7		
7.	Choi SW et al. [16]	2007	cadavers			86.8	13.2
8.	Clarke SM and Colborn GL [19]	1993	cadavers	53	47		
9.	Tansatit T et al. [22]	2008	cadavers			56.67	43.33
10.	Present study	2009	cadavers	67.2	32.8	81.25	18.75

☒ Conclusions

Ontogeny repeats phylogeny. Hence, origins of medial and lateral circumflex arteries directly from the femoral artery are associated with more distal separation of profunda femoral artery from the femoral artery. Aforementioned anatomical facts should be considered before planning different diagnostic and therapeutic interventions on the femoral artery and its branches.

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