Anatomical and radiological study of the variations of profound femoris artery and its branches

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Introduction
The femoral artery begins at the level of the midinguinal point as a continuation of the external iliac artery, and profound femoris artery (PFA) is the main branch of femoral artery that arises variably.
Aim
The aim of this study was to show the anatomical variations of PFA and its branches.
Patients and methods
(i) In the cadaveric study, femoral triangles of 20 lower limbs of 10 cadavers were dissected to study origin, course, and branches of PFA. The origin, course, and branches were noted. The distance of origin of PFA from midinguinal point was measured with the help of a scale. The width of femoral and PFA was measured with the help of a divider and a scale. (ii) In the radiological study, we retrospectively reviewed 49 patients (92 sides) undergoing femoral computed tomography angiography.
Results
Overall, 49.2% of them showed posterolateral origin of PFA on the right side and 62.7% on the left side followed by lateral origin in 33.9% on the right side and 23.7% on the left side, but the least percentage was to be posteromedial origin with no significant variations of other parameters ($P \geq 0.05$) except for medial circumflex femoral artery origin to lateral circumflex femoral artery origin site of origin between right and left sides ($P \leq 0.05$).
Conclusion
It could be concluded that variations of PFA and its branches are common, and it is most important to know variant origin of PFA and its branches, as they have an important role during preoperative clinical evaluation.

Keywords:
anatomical, profound femoris artery, radiological, variations

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Introduction

The femoral artery begins at the level of the midinguinal point (MI) as a continuation of the external iliac artery, passes anteromedially in the thigh and continues as the popliteal artery after passing through the adductor hiatus [1].

Bannister *et al.* [2] described the superficial branches of the femoral artery in the form of three superficial branches, namely, superficial epigastric artery, superficial external pudendal artery, and superficial circumflex iliac artery.

Moreover, Prakash *et al.* [3] reported the deep branches of the femoral artery in the form of the deep external pudendal artery, profound femoris artery (PFA), and the descending genicular artery.

Furthermore, Shiny *et al.* [4] added the branching of profound femoris into medial and lateral circumflex femoral arteries (MCFA and LCFA) and perforating arteries.

However, Standring [5] mentioned that PFA is the main branch of femoral artery that arises variably from lateral, medial, posterolateral, or posteromedial aspects of femoral artery, different distances distal to inguinal ligament in femoral triangle. Manjappa and Prasanna [6] confirmed these variations by studies done in adult cadavers.

So, Al-Talalwah [7] evaluated the importance of the proper knowledge of the course and ramification of femoral artery and its branches in femoral artery catheterization, which is commonly used while performing various intensive care procedures.

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Moreover, Nasr *et al.* [8] gave attention to the femoral region of thigh as an important region for various clinical procedures, particularly with respect to arterial cannulation. Gautier *et al.* [9] added that surgeons and anatomists have paid more interest to the accurate knowledge of anatomical variations regarding profound femoris. MCFA and LCFA are important for clinicians in the present era of various clinical procedures like arterial catheterization, arteriography, and femoral embolectomy, fracture reduction of acetabulum, and head of femur.

Massoud and Fletcher [10] warned that the anatomical variations in the origin of profunda femoris artery [PFA] and its branches are in concern during puncture by seldinger method for cathererization in interventional procedure. Further, Shakeri *et al.* [11] reported many minor and major complications such as arterial dissection, hematoma, arterio-thrombosis and pseudoaneurysm due to double side puncture technique or the tip of introducer invade the origin of PFA. However the vascular disease in this location is rare which only one case reported.

Patients and methods

Cadaveric study

Femoral triangles of 20 lower limbs of 10 embalmed cadavers obtained from Department of Anatomy, Cairo University, were dissected to study origin, course, and branches of PFA. After removing the skin and superficial fascia, femoral artery, vein, and nerve were identified. PFA was searched on the different aspects of femoral artery. The origin, course, and branches were noted. The distance of PFAO from the MI was measured with the help of a scale. The width of femoral and PFA was measured with the help of a divider and a scale.

Radiological study

We retrospectively reviewed 49 patients (98 sides) of femoral computed tomography angiography at Fayoum Hospital, Faculty of Medicine, Fayoum University, Egypt. Institutional Ethical Review Board approval was obtained.

Statistical analysis

We compared origins, sizes, distances of the origins from the midinguinal point (MI) of profuna femoris artery (PFA) and its branches; medial and lateral femoral circumflex (MFCA and LFCA), in both Femoral Artery CTA and dissected cadavers. The mean, percentage, and multivariate statistics were performed. Analyses were performed using the SPSS statistical software (version 15.0; SPSS Inc., Chicago, Illinois, USA). A *P* value of less than 0.05 was considered significant.

Results

Total specimens were 59 which of them 47.5% of study group were males and 35.6% of them were females and finally 16.9% were cadavers (Table 1 and Histogram 1). (Figs 1–5).

In all lower limbs, PFA was present. Overall, 49.2% of them showed posterolateral PFAO on the right side and 62.7% on the left side followed by lateral origin in 33.9% on right side and 23.7% on left side, but the least percentage was to be posteromedial origin (Table 2 and Histograms 2, 3).

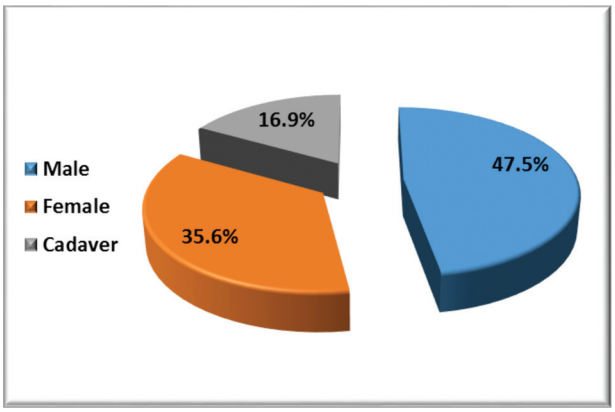
The mean PFAO-MI was 44.6±13.7 on the right side and was 44.5±13.9 on the left side. The mean profound femoris artery length (PFAL) was 96.6±35.4 on the right side and was 95.6±39.4 on the left side. The mean PFAO-MCFAO was 13.7±7.3 on the right side and was 12.3±6.1 on the left side. The mean PFAO-LCFAO was 18±9.3 on the right side and was 17.4 ±10.1 on the left side, and finally, the mean number of perforators was 3.7±0.67 on the right side and was 3.6 ±0.7 on the left side (Table 3).

MCFAO originated from common femoral artery and PFA, but on the right side, 54.5% originated from

Table 1 Description of study group

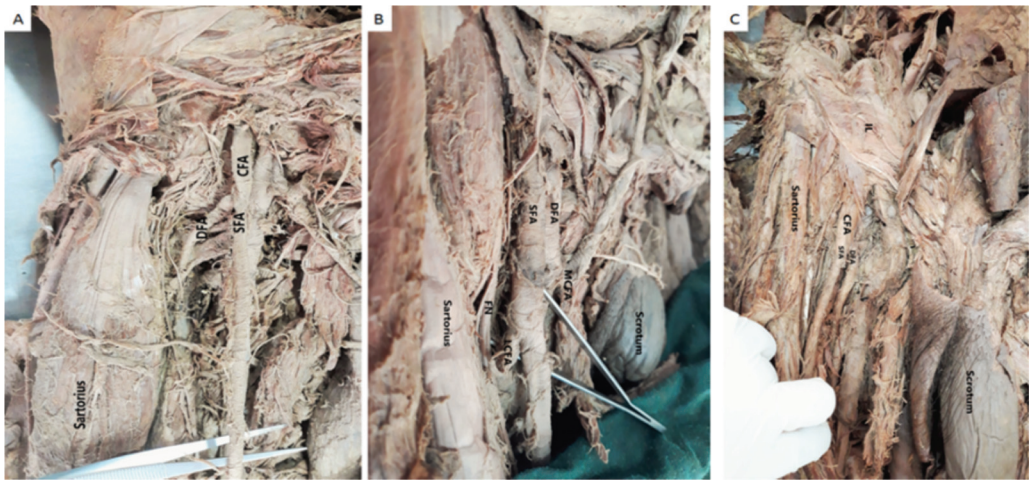
Sex	*N*=59 [*n* (%)]
Male	28 (47.5)
Female	21 (35.9)
Cadaver	10 (16.9)

Histogram 1



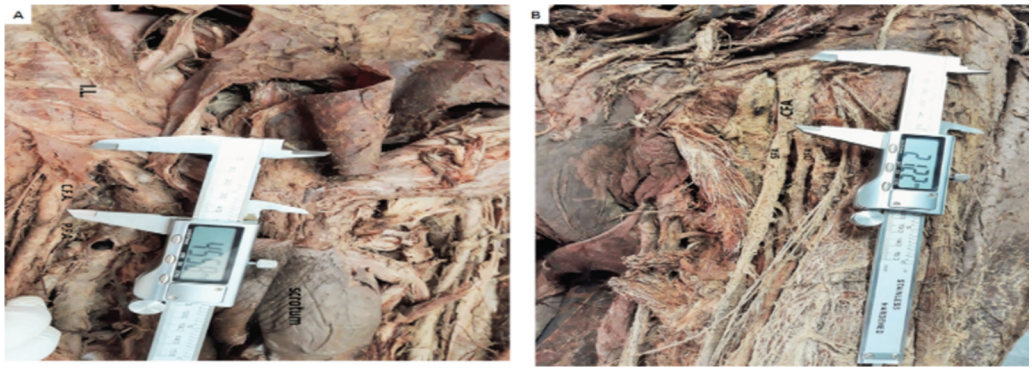
Description of the study group.

Figure 1



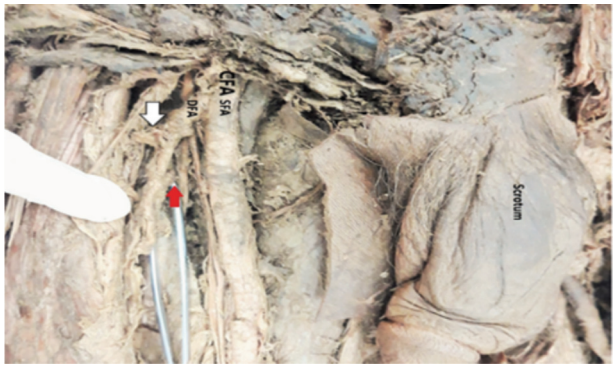
(a) Photograph of a right lower limb shows that deep femoral artery (DFA) originates from the posterolateral aspect of common femoral artery (CFA). (b) A right lower limb showing a high division of femoral artery into the DFA and superficial femoral artery (SFA), and the lateral circumflex femoral artery branch (LCFA) originates from the lateral side of the SFA. Femoral nerve (FN) lies lateral to SFA. (c) A right lower limb of a male, showing the DFA originates from the medial aspect of CFA. IL, inguinal ligament; MCFA, medial circumflex femoral artery.

Figure 2



(a) A right lower limb showing the deep femoral artery (DFA) originates from common femoral artery (CFA) 45.58 mm from midinguinal point. (b) A left lower limb showing the DFA originates from CFA 21.22 mm from the midinguinal point. IL, inguinal ligament.

Figure 3



A right lower limb showing the lateral circumflex femoral artery (white arrow) originates from the deep femoral artery (DFA) higher than medial circumflex femoral artery (red arrow). CFA, common femoral artery; SFA, superficial femoral artery.

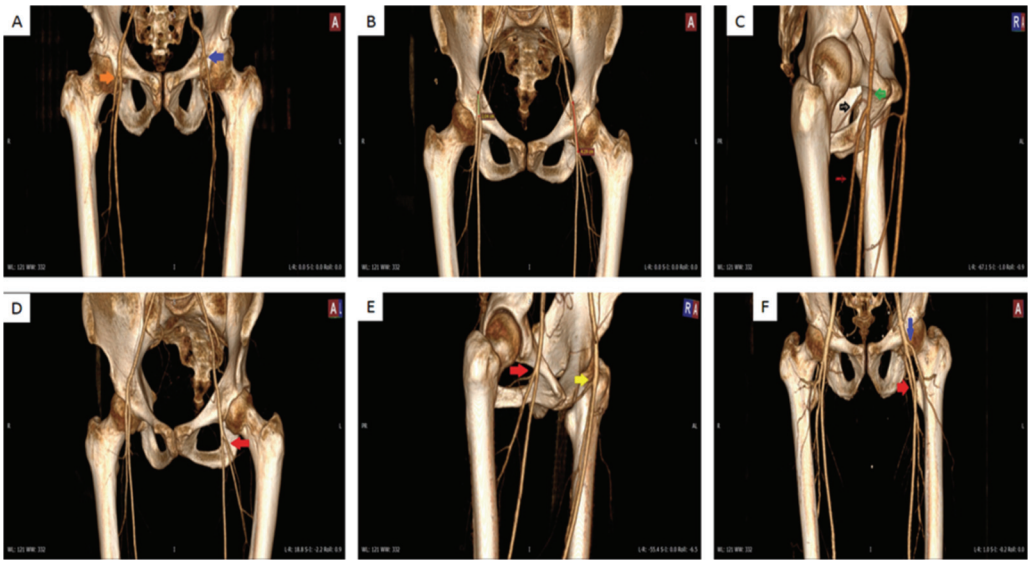
common femoral artery, and on the left side from PFA in 50.9% (Table 4 and Histograms 4, 5).

Site of LCFAO was from PFA in 69.1% on the right side and 67.9% on the left side (Table 5 and Histogram 6–9).

MCFAO was higher than LCFAO in 81.5% of cases on right side and 69.4% on left side followed by 13% on right side originated at same level versus 18.4% on left side (Table 6 and Histogram 8).

There was no statistical significance difference with *P*-value >0.05 in Profunda femoris artery origin on both right and left side between different genders, which indicated that no effect of gender on Profunda femoris artery origin (Table 7 and Histograms 9 and 10).

Figure 4



(a) Three-dimensional (3D) volume rendering image of a male patient showing right profound femoris artery (orange arrow) originates from the lateral aspect of common femoral artery, whereas left profound femoris artery (blue arrow) originates from the medial aspect of common femoral artery. (b) 3D volume rendering image of a female patient showing right profound femoris artery originates at high level (2.04 cm from midinguinal point) than left profound femoris artery (4.29 cm from midinguinal point). (c) 3D volume rendering image of a male patient showing right medial circumflex femoral artery (black arrow) originates from common femoral artery (green arrow) above origin of profound femoris artery (red arrow). (d) 3D volume rendering image of a female patient showing left lateral circumflex femoral artery (red arrow) originates in a common stem with profound femoris artery from common femoral artery. (e) 3D volume rendering image of a female patient showing bilateral medial circumflex femoral artery (arrows) originates in a common stem with profound femoris artery from common femoral artery. (f) 3D volume rendering image of a male patient showing left lateral circumflex femoral artery (blue arrow) originates directly from common femoral artery above origin of profound femoris artery (red arrow) and left profound femoris artery originates from medial aspect of common femoral artery.

Figure 5

(a) Three-dimensional (3D) volume rendering image of a male patient showing right medial (red arrow), lateral circumflex (blue arrow) and profound femoris artery (yellow arrow) originate from common trunk of femoral artery. (b) 3D volume rendering image of a male patient showing right lateral circumflex femoral artery(yellow arrow) originates from superficial femoral artery below origin of profound femoris artery (green arrow). (c) 3D volume rendering image (posterior view) of a male patient showing presence of three perforators (arrows) originates from profound femoris artery in bilateral lower limbs. (d) 3D volume rendering image (posterior view) of a male patient showing presence of five perforators (arrows) originates from right profound femoris artery.

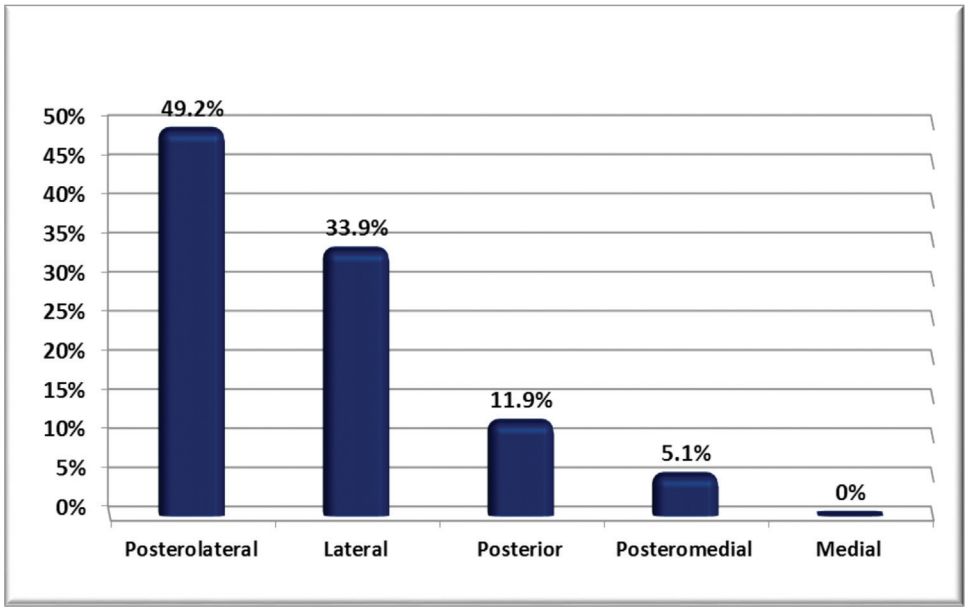
Table 2 Description of profound femoris artery origin among study group

Profunda femoris artery origin	*N*=59 [*n* (%)]
Right side	
Posterolateral	29 (49.2)
Lateral	20 (33.9)
Posterior	7 (11.9)
Posteromedial	3 (5.1)
Left side	
Posterolateral	37 (62.7)
Lateral	14 (23.7)
Posterior	5 (8.5)
Posteromedial	1 (1.7)
Medial	2 (3.4)

There was no statistically significant difference ($P>0.05$), in PFAO-MI, PFAO-MCFAO, PFAO-LCFAO, and number of perforators on both right and left side between different sexes (Table 8 and Histograms 10, 11).

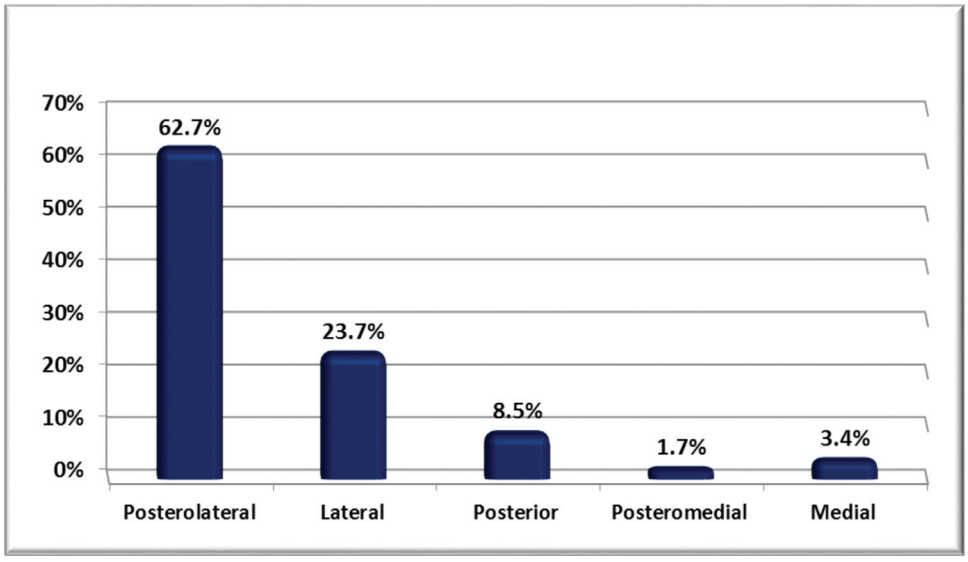
Moreover, there was no statistically significance difference ($P>0.05$), in PFAL on the left side; on the contrary, there was a statistically significance difference ($P<0.05$) in PFAL on the right side, with high length among males (Table 9 and Histogram 12).

Histogram 2



Profunda femoris artery site of origin on the right side.

Histogram 3



Profunda femoris artery site of origin on the left side.

Table 3 Description of different measures among study group

Variables	*N*	Minimum	Maximum	Mean	SD
Right side					
PFAO-MI	59	5	67	44.6	13.7
PFAL	48	21	173	96.6	35.4
PFAO-MCFAO	22	7	37	15.2	9.1
PFAO-LCFAO	33	3	40	17.4	9.6
Number of perforators	49	3	5	3.8	0.67
Left side					
PFAO-MI	59	7	80	44.5	13.9
PFAL	48	26	190	95.6	39.4
PFAO-MCFAO	16	6	25	10.1	5.1
PFAO-LCFAO	31	6	44	18.3	11.2
Number of perforators	49	2	5	3.61	0.70

PFAO-MI, distance between origin of profound femoris artery and midpoint of inguinal ligament; PFAL, profound femoris artery length; PFAO-MCFAO, distance between profound femoris artery origin and medial circumflex femoral artery origin; PFAO-LCFAO, distance between origin of profound femoris artery and lateral circumflex femoris artery.

Table 4 Description of MCFAO site among study group

MCFAO site	*n* (%)
Right side(*n*=55)	
Profunda femoris artery	23 (41.8)
Common femoral artery	30 (54.5)
Superficial femoral artery	1 (1.8)
Absent	1 (1.8)
Left side (*n*=53)	
Profunda femoris artery	27 (50.9)
Common femoral artery	25 (47.2)
Absent	1 (1.9)

MCFAO, medial circumflex femoral artery origin.

There was no statistically significance difference ($P>0.05$), in MCFAO on both right and left sides between different sexes, which indicated no effect of sex on MCFAO (Table 10 and Histogram 10).

There was no statistically significance difference ($P>0.05$), in LCFAO on both right and left sides between different sexes, which indicated no effect of sex on LCFAO (Table 11 and Histogram 11).

There was no statistical significance difference ($P>0.05$), in MCFAO to LCFAO on both right and left sides between different sexes, which indicated that no effect of sex on MCFAO to LCFAO (Table 12 and Histogram 12).

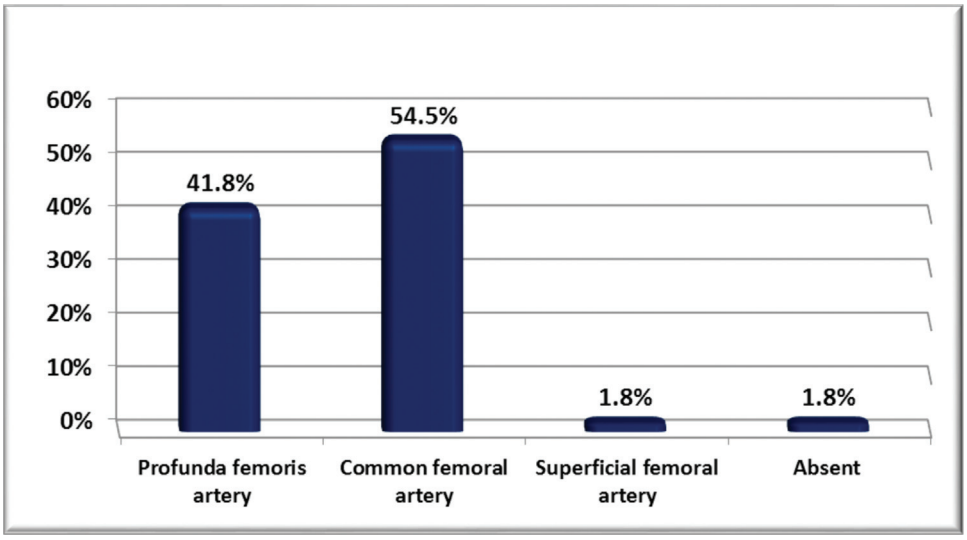
There was no statistical significance difference ($P>0.05$) in PFAO between right and left side among study group (Table 13).

There was no statistically significance difference ($P>0.05$), in PFAO-MI, PFAL, PFAO-LCFAO, and number of perforators between right and left sides among the study group. In contrast, there was a statistically significant difference ($P<0.05$), in PFAO-MCFAO, with higher mean on the right side (Table 14 and Histogram 13).

There was no statistically significant difference ($P>0.05$), in MCFAO site of origin between right and left side among study group (Table 15).

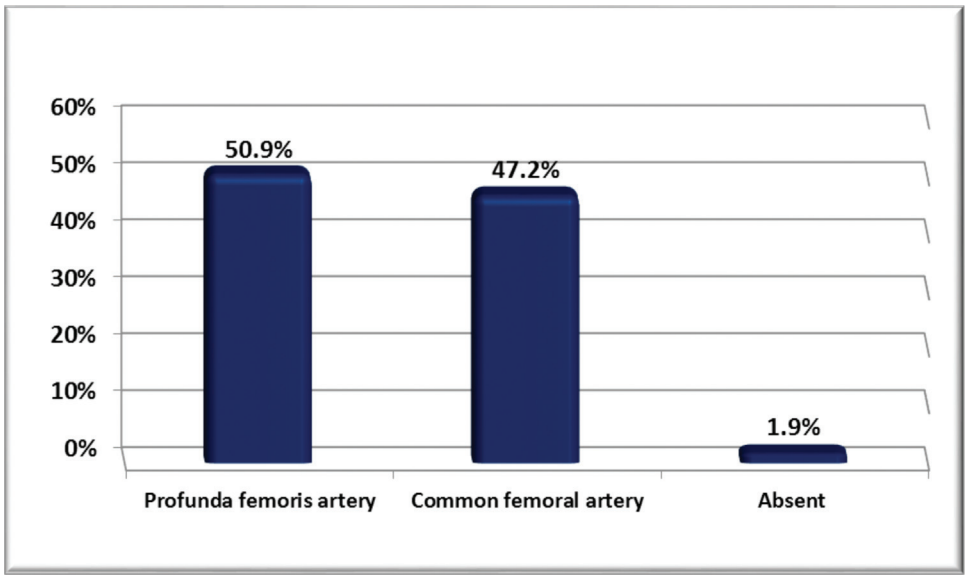
There was no statistical significance difference ($P>0.05$), in LCFAO site of origin between the right and left sides among the study group (Table 16).

Histogram 4



MCFAO site of origin on the right side.

Histogram 5

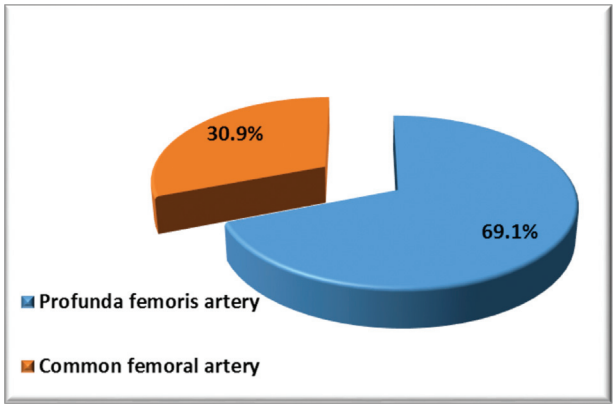


MCFAO site of origin on the left side.

Table 5 Description of LCFAO site of origin among study group

LCFAO site	Number	%
Right side (*n*=55)		
Profunda femoris artery	38	69.1%
Common femoral artery	17	30.9%
Left side (*n*=53)		
Profunda femoris artery	36	67.9%
Common femoral artery	17	32.1%

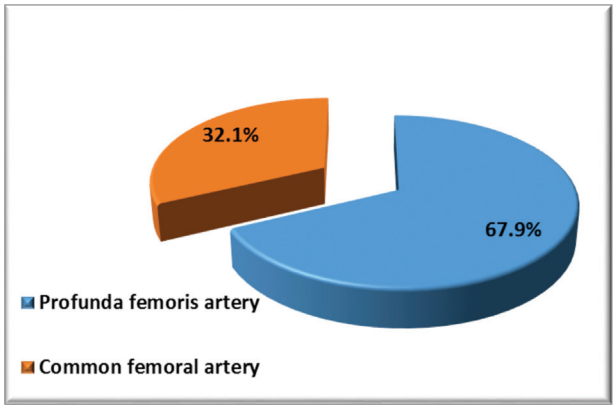
Histogram 6



LCFAO site of origin on the right side.

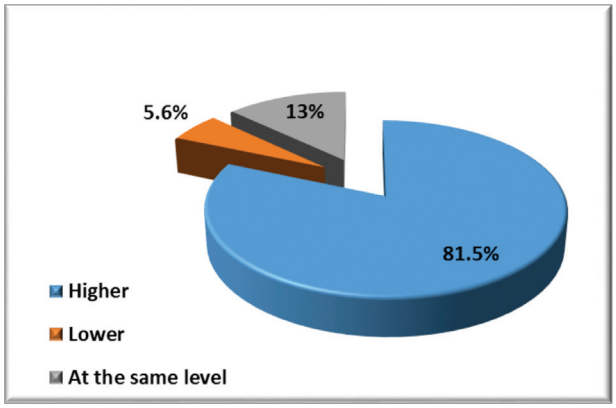
There was a statistically significant difference ($P<0.05$) in MCFAO to LCFAO site of origin between the right and left sides, with high percentage of MCFAO higher to LCFAO on the right side and high percentage of MCFAO lower to and at same site of LCFAO on the left side (Table 17 and Histogram 14).

Histogram 7



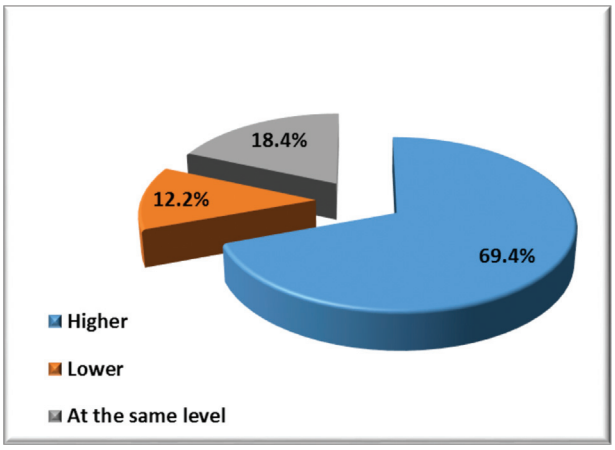
LCFAO site of origin on the left side.

Histogram 8



Origin of MCFAO to LCFAO on the right side.

Histogram 9



Origin of MCFAO to LCFAO on the left side.

Table 6 Description of LCFAO site among study group

LCFAO site	*n* (%)
Right side (*n*=55)	
Profunda femoris artery	38 (69.1)
Common femoral artery	17 (30.9)
Left side (*n*=53)	
Profunda femoris artery	36 (67.9)
Common femoral artery	17 (32.1)

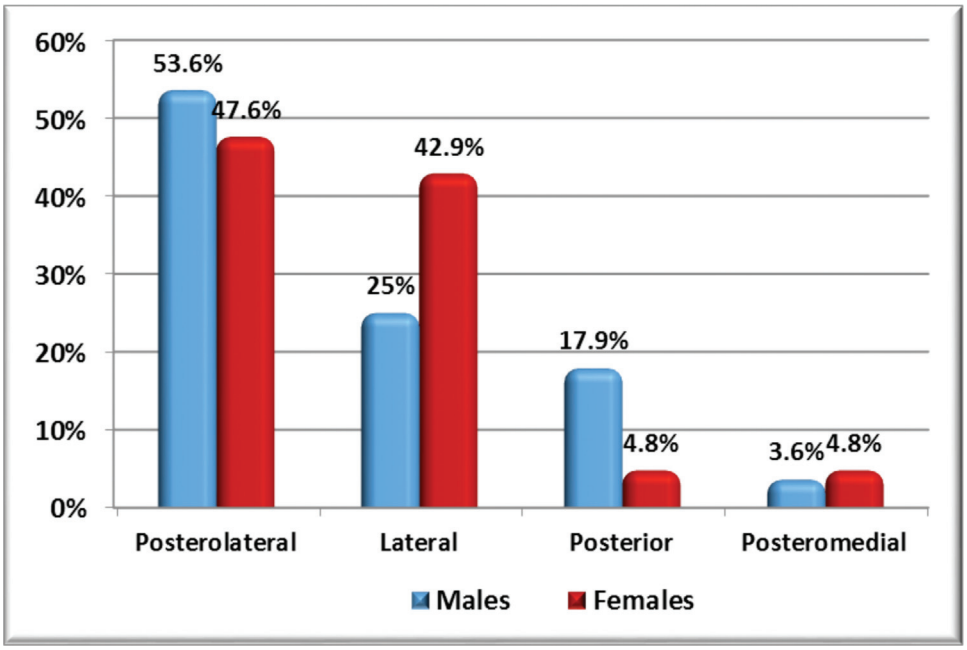
LCFAO, lateral circumflex femoral artery origin.

Table 7 Description of MCFAO to LCFAO among study group

MCFAO to LCFAO	*n* (%)
Right side(*n*=54)	
Higher	44 (81.5)
Lower	3 (5.6)
At the same level	7 (13)
Left side (*n*=49)	
Higher	34 (69.4)
Lower	6 (12.2)
At the same level	9 (18.4)

LCFAO, lateral circumflex femoral artery origin; MCFAO, medial circumflex femoral artery origin.

Histogram 10



Profunda femoris artery origin in different gender on the right side.

Discussion

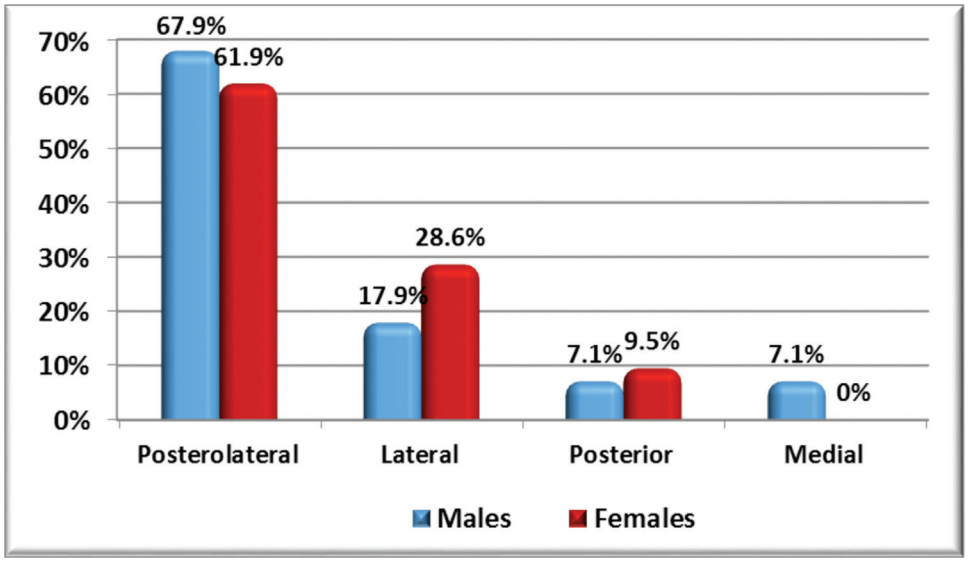
Not only the femoral artery but also PFA and its branches are of the commonest arteries in the human body which should be kept in mind among physicians when making interventions for therapeutic and diagnostic procedures. The surgeons use them in many operations like the anterolateral flap of thigh and plastic and reconstructive operations. Moreover, diagnostic procedures including catheterization, angiography, and Doppler imaging involve a precise knowledge of the anatomy of PFA along with the femoral artery [12].

A meta-analysis study of PFA recorded by Tomaszewski *et al.* [13] revealed that the most common origin of the PFA was from the posterior wall of the FA (38.8%). However, the prevalence of this

Table 8 Comparisons of profound femoris artery origin in different sexes

Profunda femoris artery origin	Males (*n*=28) [*n* (%)]	Females (*n*=21) [*n* (%)]	*P* value	Significance
Right side				
Posterolateral	15 (53.6)	10 (47.6)	0.4	NS
Lateral	7 (25)	9 (42.9)		
Posterior	5 (17.9)	1 (4.8)		
Posteromedial	1 (3.6)	1 (4.8)		
Left side				
Posterolateral	19 (67.9)	13 (61.9)	0.5	NS
Lateral	5 (17.9)	6 (28.6)		
Posterior	2 (7.1)	2 (9.5)		
Medial	2 (7.1)	0 (0)		

Histogram 11



Profunda femoris artery origin in different gender on the left side.

Table 9 Comparisons of different measures in different sexes

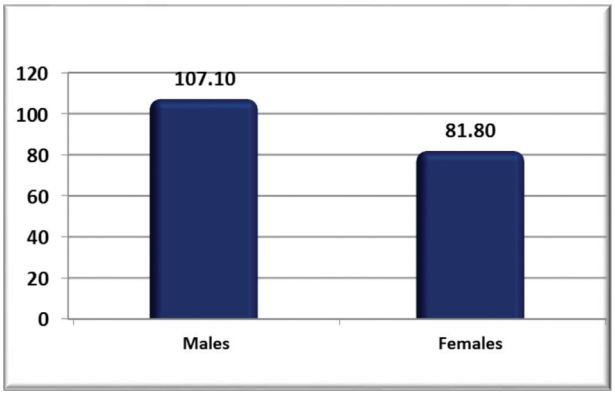
	Males (n=28)		Females (n=21)			
Variables	Mean	SD	Mean	SD	*P* value	Significance
Right side						
PFAO-MI	47.1	12.8	40.3	15.1	0.09	NS
PFAL	107.1	33.8	81.8	32.8	0.01	S
PFAO-MCFAO	12.5	5.4	14.1	10.4	0.6	NS
PFAO-LCFAO	16.9	7.4	18.5	11.8	0.6	NS
Number of perforators	3.7	0.66	3.8	0.70	0.8	NS
Left side						
PFAO-MI	44.7	14	43.6	16.9	0.8	NS
PFAL	103.5	37.8	84.6	39.8	0.1	NS
PFAO-MCFAO	11.8	6.1	12.8	6.4	0.8	NS
PFAO-LCFAO	18.8	10.5	16.1	9.8	0.4	NS
Number of perforators	3.6	0.73	3.6	0.67	0.7	NS

PFAO-MI, distance between origin of profound femoris artery and midpoint of inguinal ligament; PFAL, profound femoris artery length; PFAO-MCFAO, distance between profound femoris artery origin and medial circumflex femoral artery origin; PFAO-LCFAO, distance between origin of profound femoris artery and lateral circumflex femoris artery.

origin type varies among studies ranging from as low as 5.9% [10] to as high as 86.7% [14]. Such large differences emphasize the high variability of PFA origin but could also result in part from the different methods used in the included studies. The second most common type of origin of the PFA was posterolateral with pooled prevalence of 34.0%.

Many textbooks mention that the most common site of PFAO is from the lateral aspect of femoral artery. However, Dixit *et al.* [15] reported the PFAO arising from posterior aspect of femoral artery in 39% of cases, and Samarawickrama and Nanayakkara [16] reported that the most frequent variation of origin is from posterior aspect of the femoral artery in 46% of cases. Moreover, this study showed that 49.2% of them showed posterolateral PFAO on the right side and 62.7% on the left side followed by lateral origin in 33.9% on right side and 23.7% on left side, but the least percentage was to be posteromedial origin.

Histogram 12



PFAL length in different genders.

The puncture needle of the femoral artery cannulation pierces either PFA or femoral artery distal to the PFAO making the knowledge of the level of PFAO necessary [8]. Mamatha *et al.* [17] measured the mean distance of origin of the PFA from MI as 35 mm. In contrast, Bannister *et al.* [2] found that the average measure of PFAO from the MI to be 47.5 mm.

In this study, the mean PFAO-MI was 44.6±13.7 on the right side and was 44.5±13.9 on the left side. Moreover, in agreement with this study, Marina *et al.* [18] observed very distal PFAO reaching up to 60–70 mm. However, Nachikat and Roopa [19] found the very proximal PFAO to be less than 10 mm distal to the inguinal ligament.

Such knowledge of the distance of the PFAO from the MI noted in this study is very necessary for many surgical interventions such as revascularization procedures done for nonhealing ulcers and/or gangrene, to relieve the claudication pain and in preventing the necrosis of flap, when used in plastic and reconstructive surgery [11].

The mean PFAO-MI was 44.6±13.7 on the right side and was 44.5±13.9 on the left side. This indicates that

Table 10 Comparisons of MCFAO site in different sexes

MCFAO site	Males (*n*=28) [*n* (%)]	Females (*n*=21) [*n* (%)]	*P* value	Significance
Right side				
Profunda femoris artery	13 (46.4)	7 (33.3)	0.4	NS
Common femoral artery	15 (53.6)	12 (57.1)		
Superficial femoral artery	0 (0)	1 (4.8)		
Absent	0 (0)	1 (4.8)		
Left side				
Profunda femoris artery	12 (42.9)	12 (57.1)	0.3	NS
Common femoral artery	16 (57.1)	8 (38.1)		
Superficial femoral artery	0 (0)	1 (4.8)		

MCFAO, medial circumflex femoral artery origin.

Table 11 Comparisons of LCFAO site in different sexes

LCFAO site	Males (*n*=28) [*n* (%)]	Females (*n*=21) [*n* (%)]	*P* value	Significance
Right side				
Profunda femoris artery	19 (67.9)	14 (66.7)	0.9	NS
Common femoral artery	9 (32.1)	7 (33.3)		
Left side				
Profunda femoris artery	16 (57.1)	16 (76.2)	0.2	NS
Common femoral artery	12 (42.9)	5 (23.8)		

LCFAO, lateral circumflex femoral artery origin.

Table 12 Comparisons of MCFAO to LCFAO in different sexes

MCFAO to LCFAO	Males (*n*=28) [*n* (%)]	Females (*n*=21) [*n* (%)]	*P* value	Significance
Right side				
Higher	22 (78.6)	17 (81)	0.9	NS
Lower	2 (7.1)	1 (4.8)		
At the same level	4 (14.3)	3 (14.3)		
Left side				
Higher	17 (60.7)	17 (81)	0.1	NS
Lower	3 (10.7)	3 (14.3)		
At the same level	8 (28.6)	1 (4.8)		

LCFAO, lateral circumflex femoral artery origin; MCFAO, medial circumflex femoral artery origin.

Table 13 Comparisons of profound femoris artery origin in different sides

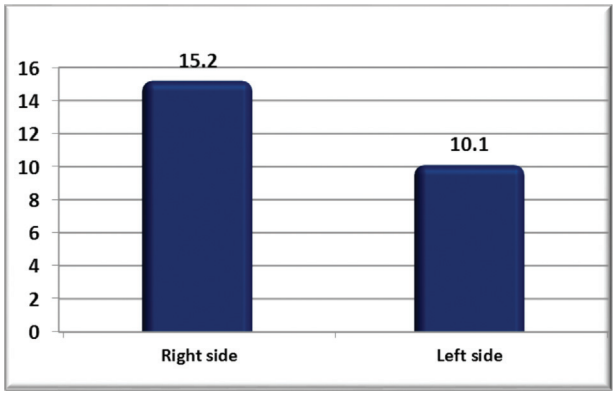
	Profunda femoris artery origin [*n* (%)]	Right side left side [*n* (%)]	*P* value	Significance
Posterolateral	29 (49.2)	37 (62.7)	0.4	NS
Lateral	20 (33.9)	14 (23.7)		
Posterior	7 (11.9)	5 (8.5)		
Posteromedial	3 (5.1)	1 (1.7)		
Medial	0 (0)	2 (3.4)		

Table 14 Comparisons of different measures in different sides

	Right side		Left side			
Variables	Mean	SD	Mean	SD	*P* value	Significance
PFAO-MI	44.6	13.3	44.5	13.9	0.9	NS
PFAL	96.6	35.4	95.6	39.4	0.7	NS
PFAO-MCFAO	15.2	9.1	10.1	5.1	0.01	S
PFAO-LCFAO	17.4	9.6	18.3	11.2	0.6	NS
Number of perforators	3.8	0.67	3.61	0.70	0.06	NS

PFAO-MI, distance between origin of profound femoris artery and midpoint of inguinal ligament; PFAL, profound femoris artery length; PFAO-MCFAO, distance between profound femoris artery origin and medial circumflex femoral artery origin; PFAO-LCFAO, distance between origin of profound femoris artery and lateral circumflex femoris artery.

Histogram 13



Mean PFAO-MCFAO in different sides.

the origin of the right profound is approximately at the same level of the origin of the left profound femoris, which is different from the study done by Bannister *et al.* [2] who reported the distal origin of the right PFA, and Siddharth *et al.* [20] who measured the right PFAO 4.4 cm distal to the left PFAO. Finally, Dixit *et al.* [15] mentioned that the right PFAO 4.75 cm distal to the left PFAO, and they added that the high PFAO can cause problems in procedures such as femoral arterial and venous puncture and femoral nerve injury.

Gautier *et al.* [9] supposed that learning the anatomy of MCFA by orthopedics is beneficial in performing both trochanteric and intertrochanteric osteotomies and is also helpful to avoid iatrogenic replacement of the head of the femur in reconstructive surgery of the hip and fixation of acetabular fractures through the posterior approach. At the same time, Prakash *et al.* [3] pointed to the LCFA as the most important branch through which collaterals develop across axial artery disease. Hence, its anatomy is very important for the plastic surgeons. Moreover, Uzel *et al.* [12] refer to the LCFA as a lateral branch of the PFA given off in the femoral triangle, and this artery further divides into ascending, transverse, and descending branches sharing in the anastomosis at the anterior superior iliac spine by its

Table 15 Comparisons of MCFAO site in different sides

MCFAO site	Right side [*n* (%)]	Left side [*n* (%)]	*P* value	Significance
Profunda femoris artery	23 (41.8)	27 (50.9)	0.4	NS
Common femoral artery	30 (54.5)	25 (47.2)		
Superficial femoral artery	1 (1.8)	0 (0)		
Absent	1 (1.8)	1 (1.9)		

LMCFAO, medial circumflex femoral artery origin.

Table 16 Comparisons of LCFAO site in different sides

LCFAO site	Right side [*n* (%)]	Left side [*n* (%)]	*P* value	Significance
Profunda femoris artery	38 (69.1)	36 (67.9)	0.9	NS
Common femoral artery	17 (30.9)	17 (32.1)		

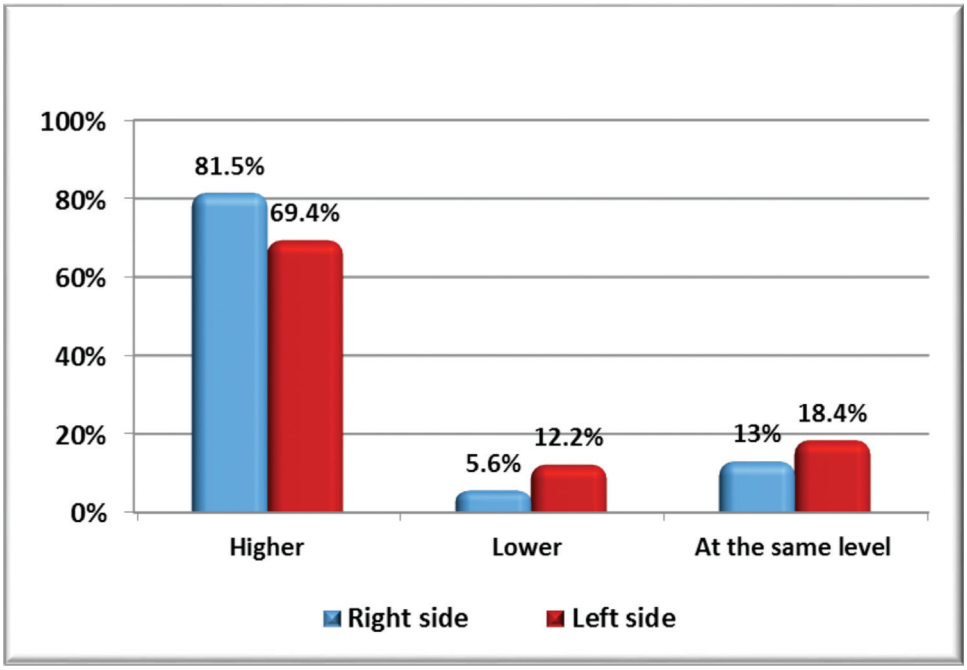
LCFAO, lateral circumflex femoral artery origin.

Table 17 Comparisons of site of origin of MCFAO to LCFAO in different sides

MCFAO to LCFAO	Right side [*n* (%)]	Left side [*n* (%)]	*P* value	Significance
Higher	44 (81.5)	34 (69.4)	0.002	NS
Lower	3 (5.6)	6 (12.2)		
At the same level	7 (13)	9 (18.4)		

LCFAO, lateral circumflex femoral artery origin; MCFAO, medial circumflex femoral artery origin.

Histogram 14



Site of origin of MCFAO to LCFAO in different sides.

ascending branch supplying the tensor fascia lata, and this is used as a myocutaneous flap for plastic and reconstructive surgery.

This study showed that site of LCFAO was from PFA in 69.1% on the right side and 67.9% on the left side, whereas MCFAO originated from common femoral artery and PFA, but on the right side 54.5% originated from common femoral artery, and on the left side, from PFA in 50.9%. Finally, MCFAO was higher than LCFAO in 81.5% of cases on the right side and 69.4% on the left side followed by 13% on the right side originated at same level versus 18.4% on left side. Other studies by Danish *et al.* [21] and Manjappa and Prasanna [6] also observed similar results, except for Dixit *et al.* [15] who described MCFA originating from FA as the most frequent variation.

The variation of the origin of LCFA and FA as a common trunk was noticeable by surgeons for flap

surgery as mentioned before. Other variations of the origin of LCFA as direct branch from FA or as a common trunk with PFA are also important as the diameter of LCFA is obviously larger as compared with it arising as a branch of PFA. Hence, with the spreading of large vascular diseases that involve aortoileofemoral segments, PFA frequently becomes the limb saver, owing to its rich collateralization [22].

The MCFA gains its importance as a branch of the PFA from being the prime supplier of blood to the head and neck of femur, the fatty tissue in the acetabular fossa, and the adductor compartment of the thigh. The most common origin of MCFA is from FA as observed by Al-Talalwah [7]. According to Al-Talalwah [7], MCFA most frequently arose from deep femoral artery in 57%, secondly from common femoral artery in 39.3%, and less frequently from superficial femoral artery (SFA) in 2.5%, LCFA in 0.6%, and it was absent in 0.6%.

Darji *et al.* [22] and Mamatha *et al.* [17], described other variations of the origin of MCFA being might also arise from LCFA or from the SFA after giving off the PFA. They added that when the artery arises from the FA, its origin is at higher level than when it arises from PFA/LCFA or SFA. Moreover, they emphasized that the level of origin of MCFA is dependent on the source of its origin, and this is also going to alter the direction and course of the artery before it reaches its destination.

Hence, the level and source of origin of MCFA is important especially to orthopedic surgeons as its damage during procedures may lead to avascular necrosis of the head of the femur.

Finally, in the radiological images of this study the mean number of perforating arteries of PFA was found 3.7±0.66 (range: 3–5) in male and female. Left to right variations in number of perforating vessels was not significant ($P>0.05$). Dissanayake *et al.* [23] had a mean number of perforating arteries of 3.86±1.77 (range: 2–7) on the left side specimens and the right side had 4.29±1.5 (range: 3–7) vessels of the 14 thigh specimens dissected.

It could be concluded that variations of PFA and its branches are common. So, it is most important to know variant PFAO and its branches as they have an important role during preoperative clinical evaluation for surgical and interventional revascularization of ileofemoral and femoropopliteal segments. Accordingly variations in the femoral region vasculature in relation to population, sex, and side should be taken in consideration during radiological and vascular interventions.

Conflicts of interest

There are no conflicts of interest.

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