

# Anatomical variations in the origin of profunda femoris artery

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## Abstract

The profunda femoris artery (PFA) generally arises from the lateral aspect of femoral artery (FA) in the thigh, 3.5 cm distal to the inguinal ligament. Variations with respect to its point of origin, relation and branching pattern have been widely reported. Dissection of 21 lower limbs in the department of Anatomy at North Delhi Municipal Corporation Medical College and Hindu Rao Hospital, Delhi, demonstrated variations in the origin of PFA from the femoral artery. The PFAs were examined in detail for their origin, branches and relations. The distance of origin of PFA keeping midpoint of inguinal ligament as a reference point, were noted. PFA was found to originate from the femoral artery in 95.24% cases (20 out of 21 lower limbs) at a mean distance of 3.16cm on the right side and 3.07cm on the left side. In one rare case the PFA was found to originate 1.5cm above the midpoint of inguinal ligament from the lateral aspect of external iliac artery at the pelvic brim. Knowledge of this high origin of PFA has clinical implications for revascularizing by-pass surgeries such as aorto-common femoral artery bypass and profundoplasty, performed to relieve limb ischemia in atherosclerotic occlusive disease of aorto-iliac segment and superficial femoral artery, as well as in true aneurysms of common iliac artery and PFA.

## Key Word:

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origin, relation and branching pattern have been widely reported.

## MATERIALS AND METHODS

Dissection of 21 lower limbs in the department of Anatomy at North Delhi Municipal Corporation Medical College and Hindu Rao Hospital, Delhi, demonstrated variations in the origin of PFA from the femoral artery. The PFAs were examined in detail for their origin and relations. The distance of origin of PFA keeping midpoint of inguinal ligament as a reference point, were noted. Appropriate photographs were taken and relevant measurements recorded with reference to the midpoint of inguinal ligament.

## RESULTS

In the present study, it was found that PFA commonly (95.24%) arises from femoral artery (FA), except in one case (4.76%) where PFA was found to arise from external iliac artery, which is a rare variant. This study also shows that PFA mostly arises independently (71.42%) from FA. Only in 23.8% cases did PFA arise along with lateral

## INTRODUCTION

The profunda femoris artery (PFA) generally arises from the lateral aspect of femoral artery (FA) in the thigh. However, there are reports of its origin from medial or posterior side of femoral artery. Its origin is commonly 3.5 cm distal to the inguinal ligament. It mainly supplies flexors, adductors and extensors of thigh. PFA forms anastomosing networks above with the branches of internal and external iliac arteries and below with popliteal artery. Variations with respect to its point of

circumflex femoral artery (LCFA) or medial circumflex femoral artery (MCFA) or with both by a common trunk. PFA originates independently from FA in 70% of the right lower limbs and in 72.72% of the left lower limbs. For 30% of the right lower limbs and 18.8% of the left lower limbs, PFA originated from FA as a common trunk with LCFA and/or MCFA. However, PFA originated from external iliac artery in one case (9.09%) of left lower limb. No case was reported from the right lower limb. This finding is the major contribution of the study. The PFA originates from lateral (14.29%), posterior (47.62%) or posterolateral (38.1%) aspect of the right and left FA. The PFA originated from the lateral side of FA in 20% of right lower limbs and 9.09% of left lower limbs. Similarly PFA arises more commonly from the posterior aspect in the left lower limb (54.54%) than the right lower limb (40%). But the origin of PFA from the posterolateral aspect is more common on the right side (40%) than the left side (36.36%). None of the limbs showed a medial or posteromedial origin of PFA from the FA. The probability of finding PFA originating from posterior or posterolateral aspect of FA to be same (40% each) in the right lower limb; while the probability of PFA originating from posterior is higher (54.54%) than posterolateral (36.36%) aspects of FA in left lower limbs. These findings are reported in a tabular form in table 1. The mean distance of origin of PFA from midpoint of inguinal ligament was calculated from table 2 as 3.16cm for the right lower limbs and 3.07cm for the left lower limbs. A major contribution of this study is the reporting of one PFA originating from external iliac artery as shown in figure 1. Moreover, this was found to originate 1.5cm above the midpoint of inguinal ligament from the lateral aspect of external iliac artery at the pelvic brim (figure 1) and it was located medial to psoas tendon, lateral to femoral artery and anterior to the pecten muscle. The inferior epigastric and deep circumflex iliac arteries were observed to arise high up from the external iliac artery near the mid-pelvic brim, 4cm proximal to the inguinal ligament (figure 1). The lateral and medial circumflex branches of left side originated in the thigh, 1.5 and 2.5cms distal to the inguinal ligament, respectively (figure 2). The left LCFA was coursing deep to femoral nerve, located on its lateral aspect (figure 2). The left FA

crossed the femoral vein anteriorly, near the base of the femoral triangle. This crossing was also 7 cm distal to the midpoint of inguinal ligament (figure 2).



Figure 1

Photograph shows:

1. High origin of the PFA from the external iliac artery in the pelvis on the left side, 1.5cm proximal to the midpoint of inguinal ligament.
2. High origin of inferior epigastric and deep circumflex iliac arteries from the left external iliac artery at the mid-pelvic brim, 4cm proximal to the inguinal ligament



Figure 2

Photograph shows the high origin of the LCFA and MCFA arteries from PFA, in the left thigh. Note the:

- i) LCFA passes deep to both the divisions of femoral nerve and
- ii) FA crosses the femoral vein closer to the inguinal ligament (7cm).

Table 1: Site and Source of origin of PFA and its mean distance.

	Right lower limbs (10 in number)			Left lower limbs (11 in number)		
Site of origin of PFA	Lateral	2	20%	Lateral	1	9.09%
	Posterior	4	40%	Posterior	6	54.54%
	Posterolateral	4	40%	Posterolateral	4	36.36%
	Total Lateral origin			3		
	Total Posterior origin			10		
	Total Posterolateral origin			8		
Source of origin of	Independent origin of PFA	7	70%	Independent origin of PFA	8	72.72%

PFA	from FA			from FA		
Common trunk origin of PFA from FA with LCFA and/or MCFA	3	30%		Common trunk origin of PFA from FA with LCFA and/or MCFA	2	18.18%
External iliac artery	0	0		External iliac artery	1	9.09%
Origin of PFA from FA (right and left sides)				Origin of PFA from FA (right and left sides)	20	95.24%
Independent origin of PFA from FA (right and left sides)				Independent origin of PFA from FA (right and left sides)	15	71.42%
Common trunk origin of PFA from FA (right and left sides)				Common trunk origin of PFA from FA (right and left sides)	5	23.8%
Origin of PFA from External iliac artery				Origin of PFA from External iliac artery	1	4.76%
Mean Distance of origin of PFA from midpoint of inguinal ligament	3.16cm from midpoint of inguinal ligament in right lower limbs			3.07cm from midpoint of inguinal ligament in left lower limbs		

**Table1:** Site and Source of origin of PFA and its mean distance.

	Right lower limbs (10 in number)			Left lower limbs (11 in number)		
Site of origin of PFA	Lateral	2	20%	Lateral	1	9.09%
	Posterior	4	40%	Posterior	6	54.54%
	Posterolateral	4	40%	Posterolateral	4	36.36%
	Total Lateral origin				3	14.29%
	Total Posterior origin				10	47.62%
	Total Posterolateral origin				8	38.1%
Source of origin of PFA	Independent origin of PFA from FA	7	70%	Independent origin of PFA from FA	8	72.72%
	Common trunk origin of PFA from FA with LCFA and/or MCFA	3	30%	Common trunk origin of PFA from FA with LCFA and/or MCFA	2	18.18%
	External iliac artery	0	0	External iliac artery	1	9.09%
	Origin of PFA from FA (right and left sides)			Origin of PFA from FA (right and left sides)	20	95.24%
	Independent origin of PFA from FA (right and left sides)			Independent origin of PFA from FA (right and left sides)	15	71.42%
	Common trunk origin of PFA from FA (right and left sides)			Common trunk origin of PFA from FA (right and left sides)	5	23.8%
Mean Distance of origin of PFA from midpoint of inguinal ligament	Origin of PFA from External iliac artery			Origin of PFA from External iliac artery		
	3.16cm from midpoint of inguinal ligament in right lower limbs			3.07cm from midpoint of inguinal ligament in left lower limbs		

## DISCUSSION

The mean distance of origin of the PFA from the midpoint of inguinal ligament on the right side was 3.16cm and on the left side was 3.07cm, indicates that the origin of the right PFA is usually distal to the origin of the left PFA by 0.09cm, which is less than the study by Bannister *et al.* and Manjappa *et al.*, and is also less than the average distance of origin reported by Snell 4 cm, Siddharth *et al.* 4.4 cm, and Dixit *et al.* 4.75 cm<sup>7, 9, 16, 17, 18</sup>. Review of literature shows that high origin of PFA mostly occurs near the inguinal ligament<sup>1,2,3,4,5,6,7, 8, 9, 10, 11</sup>. The present study appears to be the first report to demonstrate the unilateral pelvic origin of PFA from the left external iliac artery, 1.5cm above the midpoint of inguinal ligament. This high origin of PFA has clinical implications while performing revascularization by-pass surgeries such as aorto-common femoral artery bypass<sup>12</sup> and profundoplasty<sup>13</sup>, to relieve limb ischemia in atherosclerotic occlusive disease of aorto-iliac

segment and superficial femoral artery, as well as in true aneurysms of common iliac artery and PFA<sup>14</sup>. It may form a site for false aneurysms after trauma following intra-arterial procedures and may become a difficult access site for dilatation in stenotic lesions near its origin<sup>15</sup>.

## CONCLUSION

The origin of the PFA from the midpoint of inguinal ligament is placed more proximally than in other studies. However, the right PFA originates more distally than left in most cases. It is also important to bear in mind the lateral relation of femoral nerve, which can help prevent nerve damage or compression. The present report highlights a rare and unique unilateral pelvic origin of PFA. Precise knowledge of the anatomy and awareness of variations of the origin and location of PFA is crucial for surgeons.

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