Unique variation in origin and branching pattern of profunda femoris artery: a case report

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Abstract

Introduction
The anatomical knowledge of variations in origin, course and branching pattern of the femoral and profunda femoris artery is of great significance to minimise the complications in various surgical procedures. This paper discusses a unique variation in origin and branching pattern of the profunda femoris artery.

Case Report

In an adult male cadaver, we observed a unique variation in the left femoral artery representing the origin of the profunda femoris artery just 1 cm below the inguinal ligament. Further, the profunda femoris artery 2 cm from its origin gave rise to the superficial circumflex iliac artery and superficial epigastric artery from a common trunk which was from the anterolateral aspect of the profunda and from its posterior aspect, very close to its origin, the profunda femoris gave rise to the medial circumflex femoral and from its lateral aspect to the deep circumflex iliac artery. Also, 6 cm from its origin, it gave rise to the lateral circumflex artery, which shows a normal branching pattern of the ascending, descending genicular and transverse branch. Additionally, at this point, profunda also gave rise to a muscular branch and an additional descending genicular artery which branches as rectus femoris and then pierces the vastus lateralis, descends down to end in the genicular anastomosis. The course and branches of the femoral artery in the adductor canal were normal. On the right side, the femoral and profunda femoris arteries showed a normal pattern.

Conclusion
To the best of our knowledge, these variations are unique and the first of its kind in the literature. So this knowledge is of great help to clinicians and surgeons.

Introduction
Arterial variations of the lower limb have been widely mentioned in various studies. At present, modern medical science and proper knowledge of the origin and branches of the femoral artery are important for anatomists, clinicians and surgeons in various procedures. The external iliac artery continues as the femoral artery behind the midinguinal point. In the thigh, the femoral artery branches as superficial epigastric, superficial circumflex iliac, superficial external pudendal, deep external pudendal, profunda femoris and muscular branches in the femoral triangle; it also bifurcates as descending genicular and muscular branches in the adductor canal. The femoral catheterisation is performed in this location.

The profunda femoris artery (PFA) is also called deep femoral artery (DFA). Normally, it arises laterally from the femoral artery (sometimes medial or rarely posterior) about 3.5 cm distal to the inguinal ligament and gives four perforated, muscular, lateral and medial circumflex femoral arteries. In the proximal leg, the PFA is frequently incorporated in vascular reconstructive procedures. The profunda femoris is used in various procedures such as ultrasound, arteriography, digital subtraction angiography, magnetic resonance, Doppler imaging and recently instead of femoral artery.

The lateral circumflex femoral artery (LCFA) is a lateral branch that arises near the root of the profunda femoris (often directly from the femoral artery), and it passes between the anterior and posterior divisions of the femoral nerve and divides into ascending, transverse and descending branches. The medial circumflex femoral artery (MCF) originates from the posteromedial aspect of the profunda, occasionally from the femoral artery. It gives off transverse and ascending branches at the upper margin of the adductor magnus and anastomoses with the LCFA, inferior gluteal artery and the first perforating branch of the DFA.

Normally, the deep circumflex iliac artery branches from the lateral aspect of the external iliac artery opposite to the origin of the inferior epigastric artery, then ascends and runs laterally to the anterior superior iliac spine behind the inguinal ligament. This paper reports a case of a unique variation in origin and branching pattern of the PFA.

Case Report

In an adult formalin-fixed male cadaver during routine anatomical dissection in the left lower limb, we noticed a unique variation in the left femoral artery representing the origin of the PFA just 1 cm below the inguinal ligament. Further, the PFA gave rise to the superficial circumflex iliac artery 2 cm away from its origin.

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and superficial epigastric from a common trunk which was arising from the anterolateral aspect of the femoral and superficial epigastric artery. The profunda femoris artery ascended anterior to the inguinal ligament and entered into the superficial fascia of the anterior abdominal wall and superficial circumflex iliac artery coursing laterally towards the anterior superior iliac spine. From its posterior aspect, very close to its origin, the PFA gave origin to the MCFA and from its lateral aspect to the deep circumflex iliac artery. The MCFA was descending medially from its origin and passed deep into the proper femoral artery and deep circumflex iliac artery from its origin and ascended below the inguinal ligament, then passed laterally towards the anterior superior iliac spine behind the inguinal ligament. Also, 6 cm from its origin, the PFA gave rise to the lateral circumflex artery which shows a normal branching pattern of the ascending, descending genicular and transverse branch. Additionally, at this point, the profunda also gave rise to the muscular branch and an additional descending genicular artery which branches as the rectus femoris muscle and then pierces the vastus lateralis, descends down to end in the genicular anastomosis (Figures 1 and 2). The course and branches of the femoral artery in the adductor canal were normal. On the right side, the femoral and PFAs showed a normal pattern.

**Discussion**

Previous reports have mentioned variations in origin and branching pattern of the femoral and PFA. In the present case, the profunda is exhibiting a high origin; it represents the origin of the superficial epigastric, superficial circumflex iliac, medial circumflex iliac and deep circumflex iliac arteries very close to its origin, and the additional descending genicular artery also arises from the profunda. To the best of our knowledge these variations are unique and the first of its kind in the literature. With these facts, the present case is of high value to the scientific literature database.

Normally, the profunda femoris arises laterally from the femoral artery (sometimes medial or rarely posterior) about 3.5 cm distal to the inguinal ligament. The profunda femoris originated above the inguinal ligament in 1 out of 431 cases, half an inch below the inguinal ligament in 3.01% of cases, and deep to inguinal ligament in 1.6% of cases. In the present case, it arose from the femoral about 1 cm below the midinguinal point. The knowledge regarding the point of origin of the profunda helps in avoiding the iatrogenic femoral arteriovenous fistula while performing femoral artery puncture.

The MCFA commonly arises from the posteromedial aspect of the profunda, occasionally from the femoral artery. When the MCFA arises from the femoral artery, the mean distance from the midinguinal point is 4.2 cm and in cases where it arises from the profunda femoris, the mean distance from the midinguinal point is 5.79 cm. But in the present study, the MCFA originated from the posterior aspect of the profunda femoris near its point of origin, that is, 1 cm below the midinguinal point. This finding does not correspond to any of the previous reports.

The deep circumflex iliac artery arises from the external iliac artery in 91.6% of cases and from the femoral artery in 8.4% of cases. In the present study, the deep circumflex iliac artery originated directly from the posterolateral aspect of the profunda femoris about 1 cm below the midinguinal point. This is also a unique variation, which adds to the knowledge of scientific literature. The knowledge of origin of the deep circumflex iliac from the PFA is...
important, as it is used in an osteomusculocutaneous flap, particularly in mandibular reconstruction and in the vascularised iliac crest flap.

The superficial circumflex iliac artery arises from the femoral artery in 83.3% of cases, from the deep circumflex iliac in 6.6% of cases, from the lateral circumflex femoral in 6.6% of cases and from the profunda femoris in 3.3% of cases. In the present study, it was found to be arising from the profunda femoris, which is yet another unique variation.

In a previous study, the LCFA originated from the profunda femoris at an average of 2.5 cm distal to the origin of the profunda femoris in 52 out of 64 (81.25%) limbs and it originated from the femoral artery at an average of 6 cm distal to the origin of the PFA from its lateral aspect and additionally at this point, the profunda also gave rise to the muscular branch additionally at this point, the profunda femoris artery. In the pre

64 limbs. In the present study, LCFA arose 6 cm distal to the origin of the PFA from its lateral aspect and additionally at this point, the profunda also gave rise to the muscular branch and an additional descending genicular artery.

Conclusion
To the best of our knowledge these variations are unique and the first of its kind in the literature. With these facts, the present case is of high significance to minimise the complications in hip joint replacement, clinical procedures such as catheterisation, repair of femoral hernia, surgical interventions for embolism, angiography, digital subtraction angiography, colour Doppler flow imaging, osteomusculocutaneous flap, vascularised iliac crest flap and vascular reconstructive surgeries and all other procedures performed in the femoral region, where the knowledge of the femoral artery and PFA is important. So, this knowledge is of great help to clinicians and surgeons.

Abbreviations list
DFA, deep femoral artery; LCFA, lateral circumflex femoral artery; MCFA, medial circumflex femoral artery; PFA, profunda femoris artery.

References

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