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Medial circumflex femoral artery with different origin and course: a case report and review of the literature

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The femoral artery (FA) and its branches play important roles in the arterial supply of the lower extremity. If the femoral artery is occluded, the circulation of the extremity is maintained by certain anastomoses. Therefore, identification of variations of these arteries is critical from a clinical and surgical point of view. During routine anatomical dissections for student education at the Department of Anatomy of the School of Medicine at Ondokuz Mayıs University, a variation of the medial circumflex femoral artery (MCFA) was observed and photographed in a male, formalin-fixed cadaver aged 55 years. In this case, MCFA branched off from the posterolateral aspect of the FA, 32 mm distal to the inguinal ligament. A frequency rate of 17–26% has been reported regarding this variation. However, MCFA emerging from the postero-lateral aspect of the FA and its course, as in this case, is not that frequent. Knowledge of anomalies in the emergence and course of the arteries that join the cruciate anastomosis and are important in the arterial supply of the head and neck of the femur appear to be a critical component that requires caution during surgical interventions towards this region. (Folia Morphol 2009; 68, 3: 188–191)

Key words: anatomy, medial circumflex femoral artery, variation

INTRODUCTION

The femoral artery (FA) and its branches play significant roles in the vascularization of the lower extremity [30]. The medial circumflex femoral artery (MCFA), which emerges from the deep femoral artery (DFA) at the level of the lateral circumflex femoral artery (LCFA), travels caudad between the psoas major and pectineus muscles [30]. At the upper margin of the adductor magnus, it gives off its transverse and ascending branches and anastomoses with the LCFA, inferior gluteal artery, and the first perforating branch of the DFA [30]. This anastomosis within the intertrochanteric fossa is known as the cruciate anastomosis [6, 22, 23, 30]. In case of an occlusion of the FA, the circulation of the lower extremity is accomplished via this anastomosis [5, 6, 21]. Owing to its surgical importance, the variations in the anatomy of the MCFA can play a significant role in the surgical outcome. Therefore, a rare variety of an unusual origin and course of MCFA is described.

MATERIAL AND METHODS

An anomaly of the MCFA was observed in the left lower extremity of a male formalin-fixed cadaver aged 55 years during routine anatomical dissections for student education at the Department of Anatomy of the School of Medicine at Ondokuz Mayıs University. The dissection was performed in the area from the inguinal ligament to the proximal one-third of the femoral region, including the femoral triangle.

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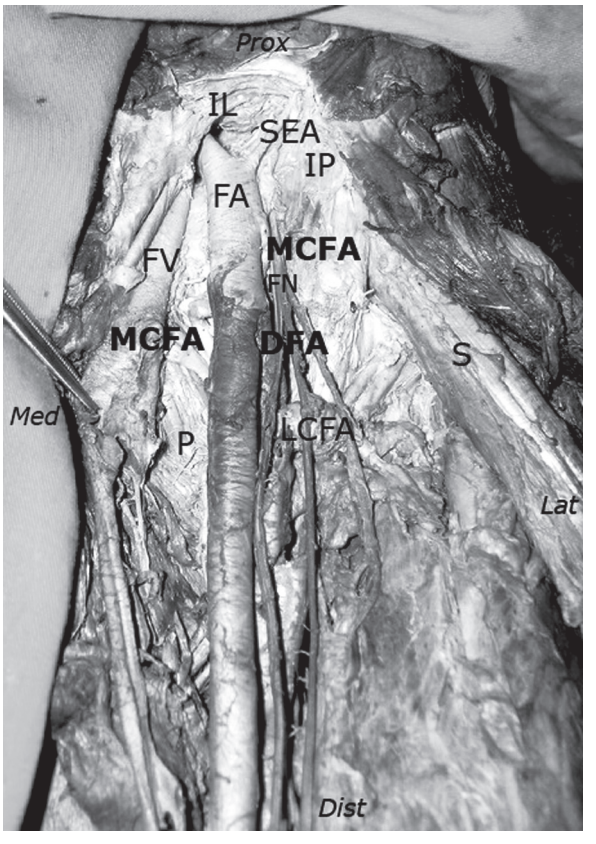

Figure 1. Photograph of a case with medial circumflex femoral artery, origin and course variation (anterior view); femoral artery (FA), femoral vein (FV), femoral nerve (FN), inguinal ligament (IL), pectineus muscle (P), iliopsoas muscle (IP), sartorius muscle (S), deep femoral artery (DFA), medial circumflex femoral artery (MCFA), lateral circumflex femoral artery (LCFA), superficial epigastric artery (SEA), proximal (Prox), distal (Dist), medial (Med), lateral (Lat).

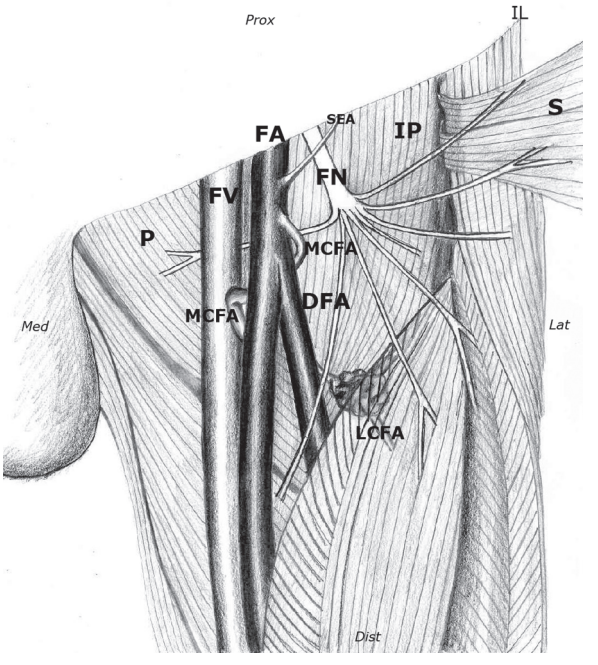

Figure 2. Illustration of a case with medial circumflex femoral artery, origin and course variation (anterior view); femoral artery (FA), femoral vein (FV), femoral nerve (FN), inguinal ligament (IL), pectineus muscle (P), iliopsoas muscle (IP), sartorius muscle (S), deep femoral artery (DFA), medial circumflex femoral artery (MCFA), lateral circumflex femoral artery (LCFA), superficial epigastric artery (SEA), proximal (Prox), distal (Dist), medial (Med), lateral (Lat).

RESULTS

During routine cadaver dissection for student education, we observed that MCFA branched off the posterolateral aspect of the FA, 32 mm distal to the inguinal ligament. After branching off from the posterolateral aspect of the FA, the MCFA ran along the anterior surface of the pectineus muscle, lying on the medial side of the femoral nerve, crossed the FA behind its back 12 mm distal to its origin, and passed deep between the psoas major and pectineus muscles (Figs. 1, 2). The diameter of the MCFA at its origin and at the point where it crossed the FA was 6 and 4 mm, respectively. The diameter of the MCFA gradually decreased thereafter. The distance between the origin of the MCFA and the external iliac artery was 32 mm while the distance between the origins of the MCFA and the superficial epigastric artery was 18 mm. The origin of the superficial epigastric artery was 14 mm away from the inguinal ligament and 41 mm away from the origin of the DFA. In the same case, the DFA gave off the LCFA 77 mm distal to the inguinal ligament. The diameter of the LCFA at its origin was 4 mm. The origin of the LCFA was 12 mm away from the origin of the DFA and 45 mm away from the origin of the MCFA. The wall of this artery exhibited an appearance consistent with thickening, distal to the part from which it originated. The distance between the origins of the MCFA and the DFA was 23 mm, the diameter of the FA before and after it gave off the DFA was 14 and 12 mm, respectively. The distance between the origin of the DFA and the inguinal ligament was measured as 55 mm, and the diameter of the artery was 10 mm. The courses of deep and superficial arteries were normal. The femoral vein and nerve were carefully dissected on both sides and no abnormalities were seen in their course or in the origin of their branches.

DISCUSSION

Arterial supply of the femoral head is usually compromised after femoral neck fractures [2, 14, 15, 21, 26]. The MCFA is the main artery that supplies the femoral head and neck [24], and it is usually injured during

Table 1. The origins of the medial circumflex femoral artery

Author, year	From DFA (%)	From FA (%)
Adachi, 1928	63.2	14
Emura et al., 1989	61.7	
Lippert and Pabst, 1985	58	
Massoud and Fletcher, 1997	81	18
Siddharth et al., 1985	63	26
Colborn et al., 1995		25
Lipshutz, 1916		19
Suder and Nizankowski, 1985		21

DFA — deep femoral artery; FA — femoral artery

femoral neck fractures. Therefore, clinicians and surgeons who are interested in this region should be familiar with the variations of this artery. Aseptic necrosis of the femoral head could occur after femoral neck fractures [2, 14, 15, 24, 26].

Variations in the origin of the DFA, MCFA, and LCFA are commonly observed. The normal origin of MCFA is from DFA. Adachi [1] found it in 63.2% of cases, Emura et al. [8] found it in 61.7%, Lippert and Pabst [16] found it in 58%, Massoud and Fletcher [19] found it in 81%, and Siddharth et al. [27] found it in 63%. Boltri et al. [3] reported two cases in which DFA arose from the medial aspect of the FA. Adachi [1], and Massoud and Fletcher [19] reported that the MCFA originated from the FA in 14% and 18% of cases, respectively. Colborn et al. [4] calculated the frequency to be 25%. A cadaveric study by Siddharth et al. [27] found that the MCFA originated from the FA in 26% and DFA in 63% of the cases. Marcade et al. [18], on the other hand, reported that the MCFA and the LCFA originated from the DFA together in 62% of cases while Lipshutz [17] determined the frequency of the MCFA originating from the FA to be 19%. Üzel et al. [29] reported a case with the common trunk of the DFA, LCFA, and the MCFA (trifurcation) at 0.9%. In a study conducted on human foetuses, Suder and Nizankowski [28] found 21% of cases of MCFA arising from the FA.

The origins of the MCFA are shown in Table 1. Studying 24 cadavers, Dixit et al. [7] reported that the MCFA originated from the DFA, the FA, or the common trunk of the DFA in 50%, 29.12%, and 20.88% of the cases, respectively, on the right, and in 75%, 12.5% and 12.5%, respectively, on the left. Kopuz et al. [13] also reported a case with the MCFA and inferior epigastric artery arising from a common trunk from the FA. In contrast to the findings of Dixit et al. [7], that the origin of the MCFA was 11–30 mm away from the origin of DFA on the left side, we found this distance to be 41 mm. Perera [25] argued that the origin of the DFA was shifted distally when the MCFA and the LCFA originated from the femoral artery. Dixit et al. [7] reported that the distance between the origin of the DFA and the inguinal ligament varied between 46 and 54 mm on the left. A distance of 55 mm between the origin of the DFA and the inguinal ligament measured in the present case is in agreement with the findings of Perera [25].

The frequency of the variation observed in the present study is in the range of 17–26%. However, the MCFA originating from the posterolateral aspect of the FA and its subsequent course is not very common. Emura et al. [8] carried out a study on 179 cadavers and found a case in which the LCFA branched off from the lateral aspect of the FA, spiralled posterior to the FA, and coursed medially.

Variations in the arterial supply of the lower extremity are the result of anomalies during embryological development [13, 16, 22]. The first vessels to develop in the extremities are the primary axial artery, which drains to the peripheral marginal sinus, and its branches [22]. With the development of the extremities, new vessels bud off from existing vessels and the distribution of the vessels undergoes changes [22]. The arterial system of the lower extremity starts to develop when the embryo is 6 mm in length and ends at intrauterine 3 months [11, 12, 20]. When the embryo is 9 mm, the sciatic artery arising from the posterior root of the umbilical artery comprises the main artery of the lower extremity [11, 12, 20, 22]. In mammals, the FA, which is the continuation of the external iliac artery, becomes the main artery of the lower extremity. The primary axial artery is represented by the DFA at the thigh. When the embryo grows to 14 mm in length, anastomoses between the femoral and sciatic arteries occur around the adductor canal [12]. Parallel to the development of the FA and its branches, the upper part of the sciatic artery persists as the inferior gluteal artery, despite the fact that a great proportion of it involutes [20, 22]. In accordance with embryological descriptions of other authors, we propose the following ontogenetic interpretation of the anomaly: the MCFA appears as an independent vessel from the rete femorale, the blood flow destined for its territory makes an unusual choice of source channels, and instead of arising from the posteromedial aspect of the FA as is usual, it arises from the posterolateral aspect of the FA. Alterations during this complex developmental stage could result in many variations in

the lower extremity. We believe that the origin and course anomaly, as in the present case, possibly stems from anastomoses between the femoral and the sciatic arteries going through different developmental stages.

During posterior surgical approaches to the pelvis and hip, the deep branch of the MCFA can be injured. This, in turn, results in the disruption of the arterial supply of the femoral head [9]. Comprehensive knowledge of the extracapsular anatomy of the MCFA (origin, course, and branches) would safeguard against avascular necrosis of the femoral head when the posterior approach is required in procedures such as reconstructive surgery of the hip and acetabular fracture fixation [9]. Similarly, knowledge of the anatomy of the MCFA and its branches is critical during flap surgery to be performed in the upper medial femoral region [10].

The origin and course anomalies of these arteries, which are involved in the cruciate anastomosis and arterial supply of the femoral head and neck, manifest as a component that requires caution during surgical interventions towards this region.

REFERENCES

1. Adachi B (1928) Das Arteriensystem der Japaner. Kaiserlich-Japanischen Universitat zu Kyoto, Kyoto.
2. Agur AMR, Dalley AF (2005) Grant's atlas of anatomy. 11th Ed. Lippincott Williams & Wilkins, Philadelphia-Baltimore-New York-London.
3. Boltri F, Ardissone F, Barile C (1979) Apropos of 2 unusual variations of origin and course of the deep femoral artery. Minerva Chir, 34: 705–708.
4. Colborn GL, Mattar SG, Taylor B, Skandalakis JE, Lumsden AB (1995) The surgical anatomy of the deep femoral artery. Am Surg, 61: 336–346.
5. Cornelius R, Penelope GR (1997) Hollinshead's textbook of anatomy. 5th Ed. Lippincott-Raven, New York.
6. Cunningham's textbook of anatomy (1995) 12th Ed. Oxford Medical Publications, Oxford.
7. Dixit DP, Mehta LA, Kothari ML (2001) Variations in the origin and course of profunda femoris. J Anat Soc India, 50: 6–7.
8. Emura S, Shoumura S, Ishizaki N, Yamahira T, Ito M, Chen HY, Isono H (1989) The anatomical study on the branches of the femoral artery (II). Comparison with the findings of Adachi's classification. Kaibogaku Zasshi, 64: 196–205.
9. Gautier E, Ganz K, Krugel N, Gill T, Ganz R (2000) Anatomy of the medial femoral circumflex artery and its surgical implications. J Bone Joint Surg Br, 82: 679–683.
10. Hallock GG (2003) The medial circumflex femoral (gracilis) local perforator flap: a local medial groin perforator flap. Ann Plast Surg, 51: 460–464.
11. Hootnick DR, Levinson EL, Randall PA (1980) Vascular dysgenesis associated with skeletal dysplasia of the lower limb. J Bone Joint Surg Am, 62: 1123.
12. Kim D, Orron DE eds. (1992) Peripheral vascular imaging and intervention. In: Normal and variant anatomy of the aorta and peripheral arteries. Mosby, St Louis, pp. 201–203.
13. Kopuz C, Yildirim M, Öztürk A, Malazgirt Z (2000) Rare origin of the inferior epigastric and medial circumflex femoral arteries arising from a common trunk. Eur J Plast Surg, 23: 438–440.
14. Langer R, Langer M, Scholz A, Astinet F, Schwetlick G, Felix R (1993) Femoral head perfusion in patients with femoral neck fracture and femoral head necrosis. J Belge Radiol, 76: 145–149.
15. Langer R, Scholz A, Langer M, Astinet F, Schwetlick G, Ferstl F, Felix R (1991) Superselective intra-arterial DSA in femur head necrosis and femoral neck fractures. Fortschr Geb Röntgenstrahl Bildgeb Verfahren, 154: 587.
16. Lippert H, Pabst R (1985) Arterial variations in man: classification and frequency. Bergmann, München.
17. Lipshutz BB (1916) Studies on the blood vasculer tree. Anat Rec, 10: 361–370.
18. Marcade E, Leguerrier A, Scarabin JM, Rioux C, Logeais Y, Lanchou G (1978) Deep femoral artery. Anatomoradiological study. Bull Assoc Anat (Nancy), 62: 453–459.
19. Massoud TF, Fletcher EW (1997) Anatomical variants of the profunda femoris artery: an angiographic study. Surg Radiol Anat, 19: 99–103.
20. McClellan GL, Morettin LB (1982) Persistent sciatic artery: clinical, surgical and angiographic aspects. Arch Surg, 117: 817.
21. Moore KL, Dalley AF (1999). Clinically oriented anatomy. 4th Ed. Lippincott Williams & Wilkins, Baltimore.
22. Moore KL, Persaud TVN (1998) The developing human clinically oriented embryology. 6th Ed. WB Saunders Company, Philadelphia-London-Toronto-Montreal-Sydney-Tokyo.
23. Munteanu I, Burcoveanu C, Andriescu L, Oprea D (1998) The anatomical variants of the profunda femoris artery and its collaterals. Rev Med Chir Soc Med Nat Iasi, 102: 156–159.
24. Oide T (1979) Selective medial circumflex femoral arteriography in idiopathic ischemic necrosis of the femoral head in adults. Nippon Seikeigeka Gakkai Zasshi, 53: 293-305.
25. Perera J (1995) Anatomy of the origin of the deep femoral artery. Ceylon Med J, 40: 139–141.
26. Shanahan D, Jordan RK (1997) Rare origin of the inferior epigastric artery from an anomalous medial circumflex femoral artery. J Anat, 191: 611.
27. Siddharth P, Smith NL, Mason RA, Giron F (1985) Variational anatomy of the deep femoral artery. Anat Rec, 212, 206–209.
28. Suder E, Nizankowski C (1985) Variations in the origin of the deep femoral arteries in human fetuses. Folia Morphol, 3–4: 262–269.
29. Üzel M, Tanyeli E, Yildirim M (2008) An anatomical study of the origin of the lateral circumflex femoral artery in the Turkish population. Folia Morphol, 67: 226–230.
30. Williams PL, Warwick R, Dyson M, Bannister LH (1989) Gray's anatomy. 37th Ed. Churchill Livingstone, London.