

## CASE REPORT



## A MEDIAL CIRCUMFLEX FEMORAL ARTERY PASSING ANTERIORLY TO THE FEMORAL VEIN: REPORT OF A BILATERAL CASE

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### ABSTRACT

The passage of the medial circumflex femoral artery anterior to the femoral vein is an extremely rare anatomical variation. It can lead to an iatrogenic arteriovenous fistula after cardiac catheterization. We report here the first bilateral case of passage of the medial circumflex femoral artery anterior to the femoral vein. During a dissection on the femoral trigone in a 73-year-old male cadaver, a medial circumflex femoral artery passing anterior to the femoral vein was observed on both sides. On both sides, it originated from the anteromedial aspect of the femoral artery. It was traveling downwards and inwards. It passed anteriorly to the femoral vein and the pectineus muscle before passing between the latter and the adductor longus muscle. On the left side, it passed above the arc of the great saphenous vein, on the right side, it passed above the junction of the superficial circumflex iliac vein into the femoral vein. The medial femoral circumflex femoral artery passing anteriorly to the femoral vein is an extremely rare anatomical variation. Knowledge of this variation is important for cardiovascular surgeons during endovascular interventions such as cardiac catheterization as well as for radiologists when performing Doppler ultrasound or CT angiography.

**Keywords:** Medial circumflex femoral artery, femoral vein, pectineus muscle, adductor longus muscle, arteriovenous fistula.

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### INTRODUCTION

The medial circumflex femoral artery (MCFA) originates from the deep artery of the thigh, sometimes from the femoral artery. It runs posteriorly and medially, and leaves the femoral triangle passing between the pectineus muscle and the iliopsoas muscle (Bouchet and Cuilleret, 1995). It is responsible for most of the arterial supply to the femoral head (Moore and Dalley, 2007). Variations in the course of the MCFA are rarely reported in the literature. To our knowledge, there are only 6 cases of variation in the course of the MCFA reported in the literature (Sañudo et al., 1993;

Çiftcioğlu et al., 2009; Yamamoto et al., 2020; Touré et al., 2022). Three of these 6 cases concerned the passage of the MCFA in front of the femoral vein (Sañudo et al., 1993; Yamamoto et al., 2020; Touré et al., 2022). All these cases were unilateral and were not associated with the passage of the MCFA between the pectineus muscle and the adductor longus muscle. We report in this article the first bilateral case of passage of the MCFA anterior to the femoral vein and leaving the femoral triangle passing between the pectineus muscle and the adductor longus muscle. Knowledge of variations of

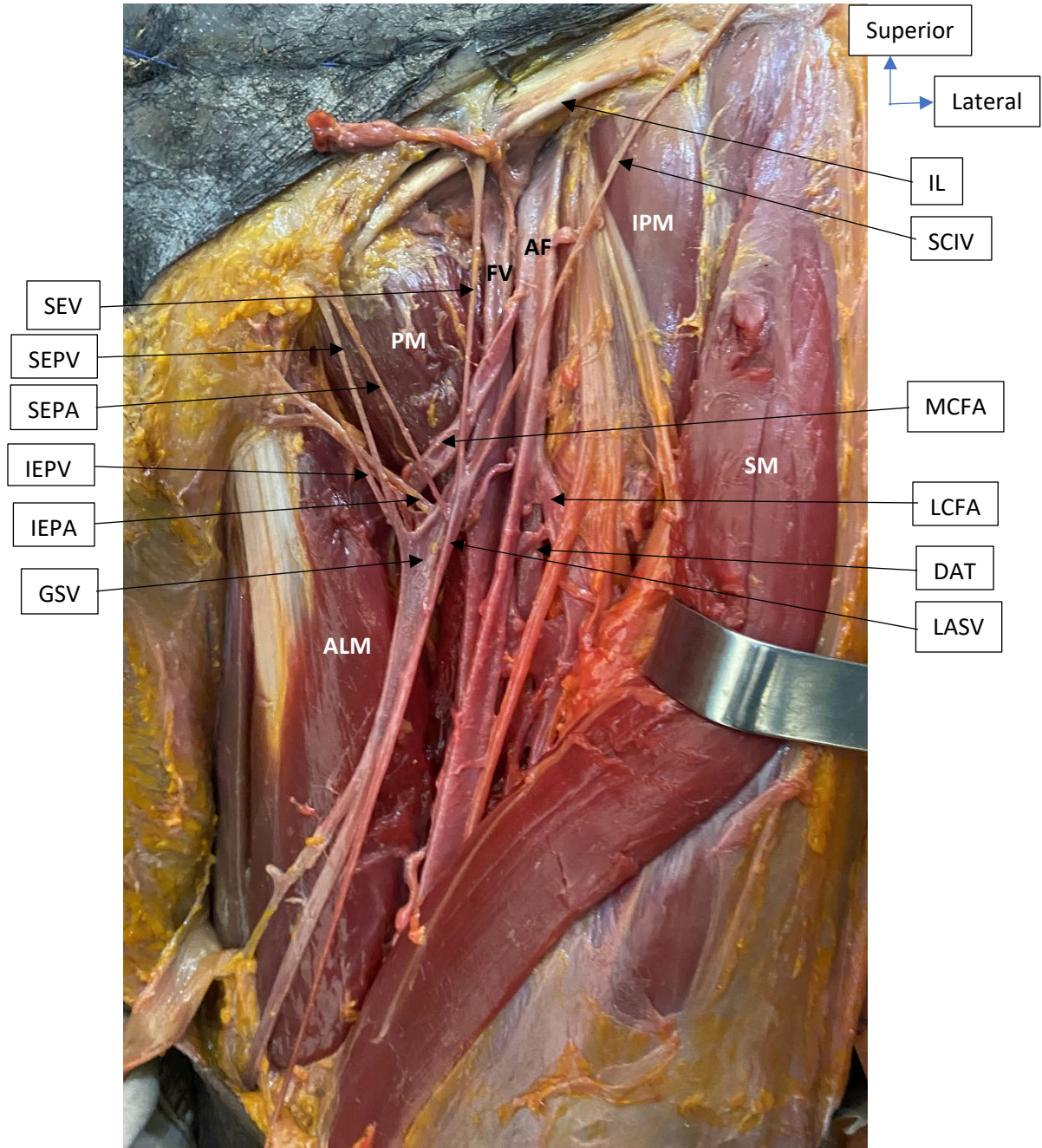
the MCFA makes it possible, during certain procedures such as arterial bypass to preserve the vascular supply to the pelvic limbs, to limit avascular necrosis of the femoral head (Al-Talalwah, 2015). An

arteriovenous fistula can occur after certain endovascular procedures such as cardiac catheterization when the MCFA courses anterior to the femoral vein (Yamamoto et al, 2020).

### CASE REPORT

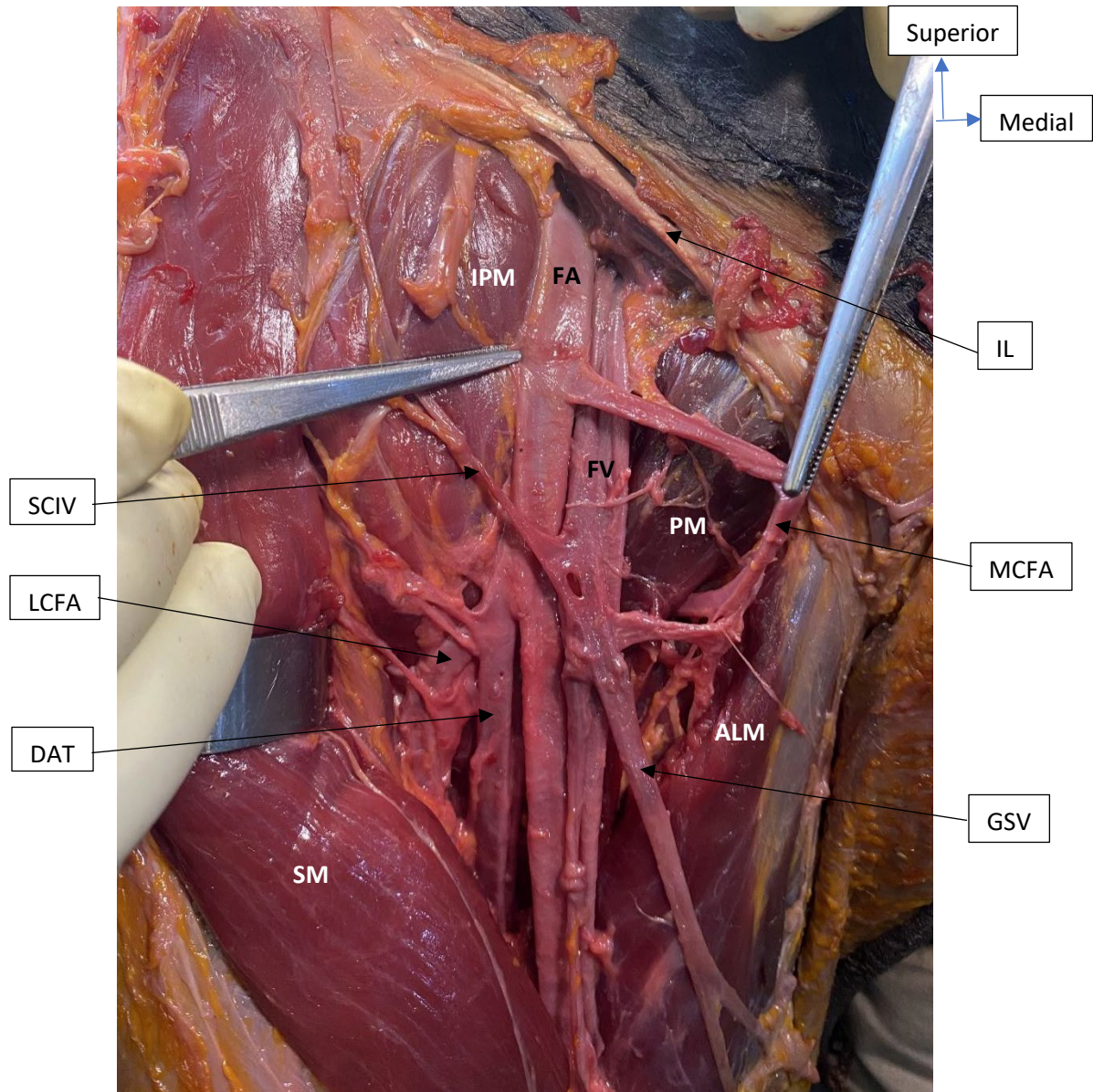
During a dissection on the femoral trigone in a cadaveric male subject, aged 73 years, a MCFA passing in front of the femoral vein was observed on both sides. **Left side:** The MCFA originated from the anteromedial aspect of the femoral artery 26mm below the inguinal ligament. It had an oblique course downwards and inwards. It passed in front of the femoral vein and the pectineus muscle, above the arc of the great saphenous vein, behind the superficial epigastric vein and the external pudendal arteries. It left the femoral triangle passing between the pectineus muscle and the adductor longus muscle (Figure 1). Its diameter at its origin was 6mm. The lateral circumflex femoral artery originated directly from the femoral artery at the same level as the deep artery of the thigh. The latter, in the femoral triangle, gave

only one collateral branch which went to the quadriceps muscle. **Right side:** The MCFA, as for the left side, originated from the anteromedial aspect of the femoral artery, but 19mm below the inguinal ligament. Its course was also oblique downward and inwards. Before passing between the pectineus muscle and the adductor longus muscle, it passed anteriorly to the femoral vein and the pectineus muscle, above the junction of the superficial circumflex iliac vein into the femoral vein and behind the epigastric vein superficial (Figure 2). Its diameter at its origin was 6mm. The deep artery of the thigh gave, in the femoral trigone, the lateral circumflex femoral artery and a branch which went to the quadriceps muscle.



**Figure 1: Right femoral trigone showing the MCFA passing in front of the femoral vein and between the pectenus muscle and the adductor longus muscle.**

ALM=Adductor longus muscle, DAT=Deep artery of the thigh, FA= Femoral artery, FV=Femoral vein, GSV= Great saphenous vein, IEPA=Inferior external pudendal artery, IEPV=Inferior external pudendal vein, IL=Inguinal ligament, IPM=Iliopsoas muscle, LASV=Lateral accessory saphenous vein, LCFA= Lateral circumflex femoral artery, MCFA=Medial circumflex femoral artery, PM=Pectenus muscle, SCIV=Superficial circumflex iliac vein, SEPA=Superior external pudendal artery, SEPV=Superior external pudendal vein , SEV=Superficial epigastric vein, SM=Sartorius muscle



**Figure 2: Left femoral triangle showing the ACFM passing anterior to the femoral vein and between the pectineus muscle and the adductor longus muscle.**

ALM=Adductor longus muscle, DAT=Deep artery of the thigh, FA= Femoral artery, FV=Femoral vein, GSV= Great saphenous vein, IL=Inguinal ligament, IPM=Iliopsoas muscle, LCFA= Lateral circumflex femoral artery, MCFA=Medial circumflex femoral artery, PM=Pectineus muscle, SCIV=Superficial circumflex iliac vein, SM=Sartorius muscle.

## DISCUSSION

Variations during MCFA are extremely rare. To our knowledge, a MCFA passing anterior to the femoral vein has only been reported 3 times in the literature. Sañudo et al., (1993) reported, in a woman and on the left side, a MCFA passing in front of the femoral vein. In this case, the MCFA originated from the external iliac artery via a common trunk with the obturator and inferior epigastric arteries. Yamamoto et al., (2020) reported in a man on the right, a MCFA which originated from the common femoral artery, and which passed in front of the femoral vein. Touré et al., (2022) observed, in a man on the left, a MCFA which originated from the femoral artery via a common trunk with the obturator and inferior epigastric arteries, and which passed in front of the femoral vein before passing between the pectineus muscle and iliopsoas muscle. All of these cases were unilateral. This makes the present study the first bilateral case of the MCFA passing in front of the femoral vein. In classical anatomy books, the MCFA leaves the femoral triangle passing between the pectineus muscle and the iliopsoas muscle (Rouvière and Delmas, 1991; Bouchet and Cuilleret, 1995). Only one case of variation in the exit point of the MCFA of the femoral triangle has been reported in the literature. This case was reported by Touré et al., (2022) who observed, in a man on the right, a MCFA passing posterior to the femoral vein before leaving the femoral triangle passing between the pectineus muscle and the adductor longus muscle. This is different from the present case, which is bilateral, and in which the MCFA, before leaving the femoral triangle passing between the pectineus muscle and adductor longus muscle, passed in front of the femoral vein. Other rare variations during the MCFA have been reported in the literature. Çiftcioğlu et al., (2009) reported a case of MCFA originating from the posterolateral aspect of the femoral artery, running along the anterior surface of the pectineus muscle, medially to the femoral nerve and which

passed posterior to the femoral artery before passing between the psoas muscle and the pectineus muscle. Touré et al., (2022), in their case report, observed a MCFA originating from the lateral aspect of the femoral artery via a common trunk with the deep circumflex iliac artery, descending vertically between the femoral artery and the femoral nerve before engaging between the psoas muscle and the pectineus muscle. Classically, the MCFA originates from the deep artery of the thigh. Many variations on the origin of MCFA have been reported in the literature. In the meta-analysis by Tomaszewski et al., (2016), the MCFA originates from the deep artery of the thigh in 64.6% and from the femoral artery in 32.2%. All variations in the course of MCFA reported in the literature are associated with variations of the origin of MCFA. Apart from that reported by Sañudo et al., (1993) in which the MCFA originated from the external iliac artery through a common trunk with the obturator and inferior epigastric arteries, in all these variations, the MCFA originated from the femoral artery (Çiftcioğlu et al., 2009; Yamamoto et al., 2020, Touré et al., 2021). In the present case, the ACFM originated from the femoral artery on both sides. The variations in origin and branching of the vessels of the pelvic limb can be explained embryologically. From the arterial plexus of the ventral aspect of the thigh (called rete femoris) the MCFA develops (Çiftcioğlu et al., 2009). The persistence or elimination of capillary channels, which is determined by the increase in blood flow in the capillaries, allows the final arterial pattern to be established. Anatomical variations may therefore be due to the persistence of unusual ducts arteriosus (Sañudo et al., 1993). In addition, the relationships between the arteries and the femoral vein can be affected by the entry of the femoral vein into the femoral rete (Sahin et al., 2003). Passing the MCFA anterior to the femoral vein can lead to an iatrogenic

arteriovenous fistula after cardiac catheterization (Yamamoto et al., 2020,). Variations in the course of the MCFA expose the latter to iatrogenic lesions during surgical interventions at the level of the femoral triangle such as surgical repair of femoral hernias and femoral endarterectomy. In the present study, the MCFA contracted quite close relationships with the arc of the great saphenous vein and some of its tributary veins. This constitutes, during surgery of the saphenofemoral junction in the surgical treatment of varicose veins of the pelvic limb, a risk of injury to the MCFA that could lead to aseptic necrosis of the femoral head. During this surgery with the presence of anatomical variations like the present case, the surgeon may injure the MCFA during exposure of the saphenofemoral junction or during ligation or sectioning of the great

saphenous vein or the tributary veins of the arc of the arc of the great saphenous vein. In conclusion, the passage of the MCFA anterior to the femoral vein is an extremely rare anatomical variation. Knowledge of such variation is important during endovascular interventions such as cardiac catheterization because it may be responsible for an iatrogenic arteriovenous fistula after these interventions that are increasingly requested in clinical practice. It is also important for radiologists during Doppler ultrasound or CT angiography for the diagnosis of arteriovenous fistulas. **Ethical statement:** The authors state that every effort was made to follow all local and international ethical guidelines and laws that pertain to the use of human cadaveric donors in anatomical research (Iwanaga et al., 2022).

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