

# Dissection of the Common Femoral Artery at the Bamako Anatomy Laboratory

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## Abstract

**Objectives:** The purpose of this work was to determine the dimensions of CFA before the birth of the deep thigh artery, describe the mode of termination of the CFA, search for CFA collaterals, and describe the anatomical variations of the CFA. **Methodology:** This was a prospective study conducted at the Anatomy Laboratory of the Faculty of Medicine and Odonto-Stomatology of Bamako. CFA arteries of 12 fresh corpses of adults include 9 men and 3 women. A total of 24 CFA arteries were dissected and photographed. **Results:** The mean length of CFA was  $50.9 \pm 12.55$  mm (range: 31 and 93 mm). Its average diameter was  $9.12 \pm 1.17$  mm (range: 7 and 12 mm). In 70.83%, the CFA artery ended without any particularity. There was 29.17% anatomic variation in the CFA termination mode. The CFA divided into 3 branches (trifurcation) in 25%. The 3 branches were in 20.83%, the FS and a common core to LFCA and AQ; in 4.17%, they were the SFA, the DFA and the MFCA. In 4.17%, it divided into 4 branches which are: the SFA, the DFA, the MFCA and a common core to QA and LFCA. The CFA gave as collateral: circumflex superficial iliac artery in 22 cases (91.67%), superficial epigastric artery in 19 cases (79.17%), upper external pudendal artery in 20 cases (83.33%), and lower external pudendal artery in 14 cases (58.33%). We noted in our series 9 anatomical variations at the collateral level of the CFA or 37.5%. The CFA gave birth to the following branches: the MFCA in 4 cases or 16.67%, the LFCA in 1 case or 4.17%, the QA in 1 case or 4.17%, and a common core to the QA and LFCA in 3 cases or 12.5%. **Conclusion:** The length of CFA is important. The variations of CFA are frequent and important to know in clinical and surgical practice.

## Keywords

Artery, Femoral, Anatomy, Variations

## 1. Introduction

The femoral artery follows the external iliac artery. It is located at the antero-medial part of the thigh and extends from the inguinal ligament (femoral arch) to the hiatus of the third adductor (ring of the third adductor) [1]. The common femoral artery (CFA) according to Bouchet and Cuilleret [2], is part of the inguinal ligament midway between the anterior superior iliac spine and the pubic spine and divides to give the superficial femoral artery (SFA) and the deep femoral artery (DPA). According to these authors, it gives 4 collaterals: the superficial iliac circumflex artery (SICA), the subcutaneous abdominal or the superficial epigastric artery (SEA), the upper external pudendal arteries (UEPA) and lower external pudendal artery (LEPA). According to Rouvière [1], the femoral artery provides six collateral branches: the subcutaneous abdominal (superficial epigastric), the superficial iliac circumflex, the superior (shameful) external pudendal, the inferior external (shameful) pudendal, the deep femoral and the big anastomotic. There is no CFA for Rouvière. All the branches that leave this trunk are considered collateral. In this study the femoral artery will be described as follows: CFA that divides to give SFA and deep femoral. This is the classic tripod for surgeons.

CFA injury is common in groin trauma. It is used in clinical and surgical practice: palpation of the pulse, benchmark for venous punctures and block of the femoral nerve, arteriography and surgical approaches for removal or bypass. The CFA is the seat of obstruction by blood clot or atheroma plaque, especially at its bifurcation. For arteriographies of the lower limb, the approach is often at the level of CFA [3]. These are the reasons that led us to do this job.

The overall goal of this work was to study CFA by anatomical dissection.

The specific objectives were:

- to determine the dimensions of the CFA before the birth of the deep artery of the thigh,
- to describe the mode of termination of the CFA,
- to search for the collaterals of the CFA,
- to describe the anatomical variations of the CFA.

## 2. Methodology

This was a prospective study carried out in the Anatomy Laboratory of the Faculty of Medicine and Odonto-stomatology of Bamako from July 26, 2018 to June 11, 2019. We dissected the common femoral artery of each side of 12 fresh adult cadavers (9 men and 3 women) or 24 common femoral arteries. Inclusion criteria were fresh adult subjects with no scar in the inguinal regions. Exclusion criteria were corpses with inguinal area as scarred or corpses injected. The approach was inguinal [3]. For this, a cutaneous incision was made from the anterior superior iliac spine to the superior medial edge of the thigh passing through the pubic spine. A second incision started from the middle of the first until the junction of the upper 1/3 and 2/3 inferior of the anterior aspect of the thigh. A

transverse incision was made from the lower end of the second incision. Thus, three skin flaps were dissected and folded inside, outside and above. The subcutaneous cell tissue and the fascia of the thigh were detached and folded like the skin. The vascular sheath was opened, the CFA was separated from the common femoral vein. The CFA was dissected until the origin of the deep artery of the thigh (APC), as well as its collateral branches. The (DFA) and its collateral branches were also dissected.

After these dissections, the measurements were made thanks to a millimetric tape measure. The length of the CFA was determined by the distance between the DFA origin and the middle of the inguinal ligament. The femoral arteries were photographed with a Samsung Galaxy J7 phone before and after their removal. The following parameters were noted:

- the sex of the subject;
- the side of the dissected artery;
- the length and diameter of the CFA;
- the mode of termination of the CFA;
- the collateral branches of the CFA;
- the anatomical variations.

The data was entered and analyzed on the software Epi info 6. The final document was entered on Word 2016.

### 3. Results

#### Socio-demographic characteristics of cadaveric subjects:

The distribution of anatomical subjects by sex is summarized in **Table 1**. The distribution of anatomical subjects by size is summarized in **Table 2**.

**Dimensions:** In our study, the common femoral artery had an average diameter of  $9.12 \pm 1.17$  mm (extremes: 7 and 12 mm). The average length of the common femoral artery was  $50.9 \text{ mm} \pm 12.55$  (range 31 and 93 mm).

**Table 1.** Distribution of anatomical subjects by sex.

Sex	Effective	Pourcentage
F	3	25
M	9	75
Total	12	100

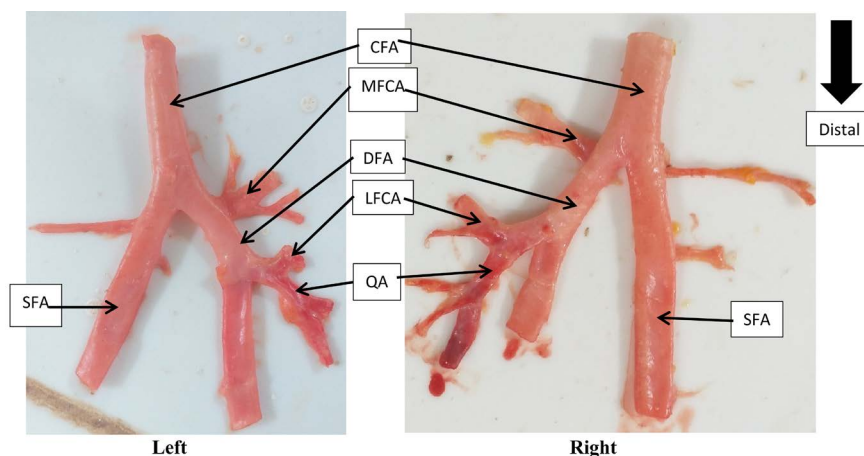
In our study, we performed 24 dissections in 12 cadavers (9 men and 3 women).

**Table 2.** Distribution of anatomical subjects by size.

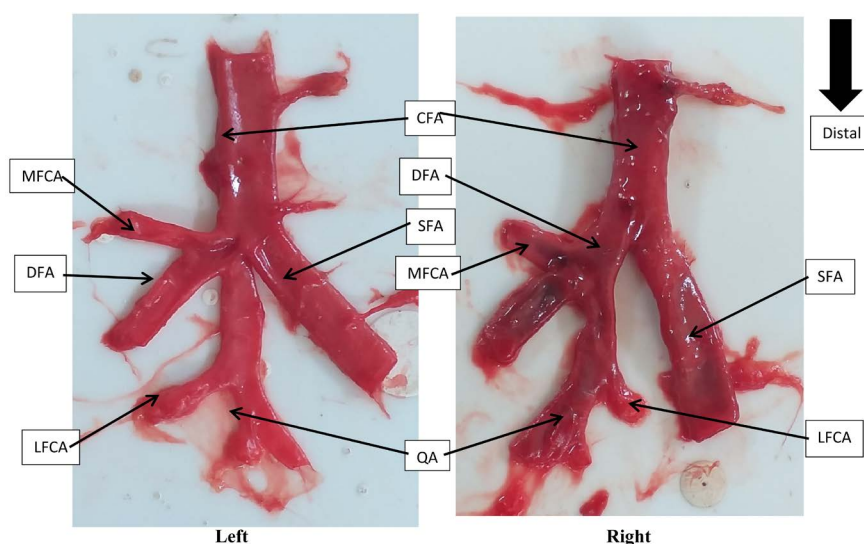
Size (in millimeter)	Effective	Pourcentage
1.57 - 1.70	4	33.33
1.71 - 1.82	8	66.67
Total	12	100

The average size of the anatomical subjects was  $1.73 \pm 7.01 \times 10^{-2}$  mm (extreme: 1.57 et 1.81).

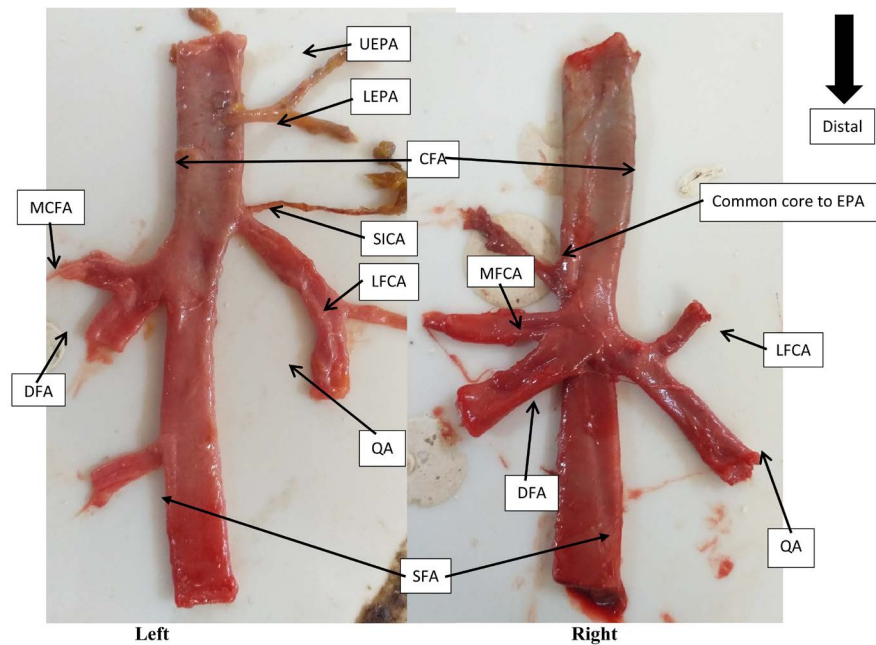
**Termination method:** In our study, the CFA ended by giving the DFA and the SFA 11 times (**Figure 1**, **Figure 2** on the right) is 45.83%. In 6 cases (25%), the femoral artery had a main trunk on which the collateral branches were born (**Figure 3** on the left). Seven anatomical variations were noted, *i.e.* 29.17%. Among which trifurcation (the CFA ended by giving 3 branches) (**Figure 2** on the left, **Figure 3** on the right) was noted 6 times (25%): in 5 cases, the FCA was completed by giving PCA, MS and a core curriculum to CLC and QA; in 1 case, it ended with PCA, MSDS and CMC. In 1 case, the CF ended by giving 4 branches which were the FS, the APC, the CMC and a common core to QA and CLC.



**Figure 1.** Arteries on both sides of a subject: at both sides the CFA ended in giving the SFA and the DFA. CFA = common femoral artery, DFA = deep femoral artery, LFCA = lateral femoral circumflex artery, MFCA = medial femoral circumflex artery, QA = quadriceps artery, SFA = superficial femoral artery.



**Figure 2.** Arteries on both sides of a subject: to the left, the CFA ended by giving 3 branches: the SFA, the DFA and core common at the QA and LFCA; to the right, the CFA ended by giving 2 branches: SFA and DFA. CFA = common femoral artery, DFA = deep femoral artery, LFCA = lateral femoral circumflex artery, MFCA = medial femoral circumflex artery, QA = quadriceps artery, SFA = superficial femoral artery.



**Figure 3.** Arteries on both sides of subject: to the left, the femoral artery had a single trunk, the CFA ended by giving 1 branch that was SFA, the DFA was a collateral in this case, the CFA gave birth in its journey by a common core to the QA and LFCA and from this trunk was born the SICA. To the right, the CFA ended by giving 3 branches: SFC, DFA and trunk QA/LFCA. CFA = common femoral artery, DFA = deep femoral artery, EPA = external pudendal arteries, LEPA = lower external pudendal artery, LFCA = lateral femoral circumflex artery, MFCFA = medial femoral circumflex artery, QA = quadriceps artery, SFA = superficial femoral artery, SICA = superficial iliac circumflex artery, UEPA = upper external pudendal artery.

**Collateral:** Of the 24 cases, the common femoral artery gave rise to its usual branches in the following proportions: circumflex superficial iliac artery in 22 cases (91.67%), superficial epigastric artery in 19 cases (79.17%), upper external pudendal artery in 20 cases (83.33%), lower external pudendal artery in 14 cases (58.33%).

As anatomical variations, the following branches were noted as collateral: the medial circumflex artery of the thigh in 4 cases, the circumflex lateral artery of the thigh in 1 case, the quadriceps artery in 1 case, and a common trunk at quadriceps artery and lateral circumflex artery of the thigh (**Figure 3** on the left) in 3 cases. In 2 cases, the superficial iliac circumflex did not originate directly from the CFA, but from its collaterals: in 1 case, it was born of QA and in the other case, it was born from the QA/CLC trunk (**Figure 3** to the left). In total, we noted 9 anatomical variations on the 24 cases (37.5%) at the collateral level of the CFA.

#### 4. Discussion

The mean length of CFA before division in our study was 50.9 mm  $\pm$  12.55 (range: 31 and 93 mm). In literature; the length of the FC varies between 40 and 50 mm according to A. Bouchet and J. Cuilleret [2]; it is on average 37.3 mm

according to Adachi & Hasebe [4], 43.3 mm  $\pm$  16.2 mm according to Schnyder [5]. According to C Tremblay [6], the length of the HR varies between 10 and 55 mm with an average of 37.7 mm, according to Ongoïba [3], it is 39.78 mm  $\pm$  15 (extremes: 0 and 80 mm), according to Tomaszewski [7], in a meta-analysis, the average length of DFA from its point of origin to the mid-inguinal point was 41.15 mm. In our study, the mean length of HR was greater than that found in the literature. The estimation of the length of the vessels, in particular the CFA, is very important in the clinic. The CFA artery is an artery that is very much in demand in the clinic. The palpation of the femoral pulse takes place in the inguinal region at about two finger-strokes below the crease of the groin. The inguinal ligament (crural arch) stretched from the anterior superior iliac spine to the pubic spine is an anatomical reference point for defining the CFA artery [2] [8] [9] [10]. In lower limb arteriography to study all division branches of the FC artery, the catheter should be placed in the trunk of the CFA. If the trunk of the CFA is too short or absent, the catheter may enter the FS artery. Thus, the branches of the DFA will not be seen on X-ray. In central venous punctures at the level of the lower limb and in the femoral nerve block, the main marker is the femoral pulse [3].

The diameter of the CFA in our study was 9.12  $\pm$  1.17 mm (range: 7 and 12 mm). According to Bouchet et Cuilleret [2], the diameter of the CFA varies from 10 to 15 mm. The termination mode of the CFA is variable. In our series, the CFA ended by giving the SFA (**Figure 2** on the left) in 6 cases or 25%. This is the type of distribution as in the classic description of Rouvière [1] where the femoral artery has only one main trunk, the other branches being considered as collateral. The CFA ended by giving the FS and the DFA (**Figure 1**, **Figure 2** on the right), it is the classic tripod of the surgeons. This type of division was the most common in our study with 45.83%. According to Ongoïba [3], in a series of 198 dissections, the CFA gave a single branch in 35 cases or 17.68%, it divided to give the SFA and DFA in 134 cases or 67.68%. This last type of division was the most frequent. Ogeng'o [11] noted CFA bifurcation in DFA and SFA in 72.1%.

In our series, the anatomical variations were noted at the level of the mode of termination of the CFA in 7 cases that is 29.17%. Trifurcation was noted in 6 cases, *i.e.* 25% of which the 3 branches were in 5 cases, the APC, the SFA and a common core at the LFCA and the QA (**Figure 2** on the left, **Figure 3** on the right), and in 1 case, they were, the DFA, the SFA and the MFCA. In 1 case (4.17%) the CFA ended by giving 4 branches which were, SFA, DFA, MFCA and a common core to QA and LFCA. Ongoïba [3], on a series of 198 dissections noted, absence of trunk CFA (DFA and SFA were born above the inguinal ligament of the external iliac artery) in 2 cases, trifurcation in 25 cases, or 13.63% of which the 3 branches were SFA, DFA and quadriceps artery. Ogeng'o [11] noted trifurcation in 27.9% whose branches were DFA, SFA and LFCA. DFA provides vascularization of almost all the muscles of the thigh while the FS artery is a pathway for vascularization of the rest of the lower limb [2] [9].



The collaterals of the common femoral artery, classically described by Bouchet and Cuilleret [2] are: the subcutaneous abdominal (superficial epigastric), the superficial iliac circumflex, the upper external pudendal artery and the lower external pudendal artery. In our study, the femoral joint gave rise to these branches in the following proportions: superficial circumflex iliac artery in 22 cases (91.67%), superficial epigastric artery in 19 cases (79.17%), upper external pudendal artery in 20 cases (83.33%), lower external pudendal artery in 14 cases (58.33%). We noted in our series 9 anatomical variations at the collateral level of the CFA or 37.5%. The CFA gave birth to the following branches: the MFCA in 4 cases or 16.67%, the LFCA in 1 case or 4.17%, the QA in 1 case or 4.17%, and a common core to the QA and LFCA (**Figure 3** on the left) in 3 cases or 12.5%. In 2 cases, the superficial iliac circumflex did not originate directly from the CFA, but from its collaterals: in 1 case, it was born of QA and in the other case, it was born from the AQ/LFCA trunk (**Figure 3** to the left). According to Ongoïba [3], the LFCA originates on the trunk of the CFA in 2.02%, the branches of the QA arise on the trunk of the CFA in 8.08%.

## 5. Conclusion

The length of CFA is important. The most common termination mode of the CFA is bifurcation. Trifurcation is the most common anatomic in the CFA termination mode. Anatomical variations of CFA collaterals are common. The variations of CFA are frequent and important to know in clinical and surgical practice.

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## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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