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VARIATION IN BRANCHING PATTERN OF FEMORAL ARTERY

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ABSTRACT

The **femoral artery (FA)** is the principal arterial supply of the lower limb, and its branching pattern is crucial in clinical, surgical and interventional radiology practices. Variations in the origin, course and branching pattern of the FA and **profunda femoris artery (PFA)** have significant procedural implications, especially during vascular reconstruction, orthopedic interventions, catheterization, flap surgeries and trauma management (4, 2017). The deep femoral artery gives rise to the **medial and lateral circumflex femoral arteries**, which are vital in supplying the thigh muscles and hip joint; thus, their anomalous origin may complicate surgical approaches. This study was conducted to document the anatomical variations of the FA and its major branches in cadaveric lower limbs and to correlate findings with previously reported morphological variations (7, 2021). A total of 40 lower limbs were dissected following standard Cunningham's guidelines. The branching pattern and origin of profunda femoris artery were examined. Variations observed include high origin of PFA, altered emergence of circumflex branches. These variations have significant importance in **angiographic interpretation**, arterial graft harvesting, and avoiding iatrogenic injuries during surgical procedures involving the femoral triangle (11, 2022). Knowledge of these variations is essential for clinicians because unrecognized deviations may lead to inadvertent hemorrhage, misinterpretation of radiological images, procedural complications, or ischemic consequences during surgery (12, 2017). The study emphasizes that understanding the morphological spectrum of femoral artery branching can greatly enhance preoperative planning and patient safety. Our findings underscore the need for routine anatomical awareness during diagnostic and interventional procedures involving the femoral region.

Keywords: *Common femoral artery, Profunda femoris artery, Circumflex arteries.*

INTRODUCTION

The **femoral artery (FA)** represents a major vascular conduit supplying the lower extremity, originating as a continuation of the external iliac artery below the inguinal ligament and entering the femoral triangle where it descends vertically before continuing as the popliteal artery. Because of its superficial location and predictable accessibility, it serves as a landmark for numerous **diagnostic, interventional, and therapeutic procedures**, including cardiac

catheterization, angioplasty, vascular bypass, embolization and trauma management (3, 2018). The structural configuration of the FA and its branches—most importantly the **profunda femoris artery (PFA)** and the **medial and lateral circumflex femoral arteries**—plays an essential role in blood perfusion to the thigh compartments, hip joint, femoral head and vastus musculature (1, 2015). Variations in their branching patterns can influence various clinical situations, from orthopedic surgery to vascular grafting and regional anesthesia. The PFA is known for its functional prominence, and numerous studies have shown considerable variability in its origin, angle of branching, and distance from the inguinal ligament (8, 2019). These variations often develop due to embryological remodeling of the vascular plexus of the lower limb, in which multiple arterial channels fuse, regress, or enlarge asymmetrically, leading to non-standard arterial configurations (9, 2021). Such differences may lead to altered perfusion patterns, predisposing individuals to complications during direct surgical exposure, flap elevation, or radiologic interpretation. Surgeons performing procedures such as **total hip replacement, intramedullary nailing, femoral hernia repair, muscle flap harvesting** and lymph node dissections must therefore be familiar with these variations to prevent accidental injury (5, 2020). In trauma surgery, unexpected arterial patterns may complicate hemorrhage control, especially in penetrating injuries. In vascular surgery, anomalous origins may mislead catheter insertion or complicate guidewire advancement (10, 2020). Moreover, orthopedic failures such as avascular necrosis may be related to compromised circumflex branches when anatomical variants are not recognized. Several classical and contemporary anatomical studies have documented differing prevalence of high-origin profundas, abnormal circumflex vessels, duplications, and altered diameters (2, 2019). However, the frequency and clinical importance of these variations differ among populations, emphasizing the need for region-specific anatomical assessments. Therefore, this study aims to document the branching variations of FA in cadaveric specimens and to highlight their clinical significance across medical disciplines (14, 2020).

MATERIALS & METHODS

This cadaveric observational study was conducted on **40 dissected lower limbs** obtained from the Department of Anatomy, Rama Medical College, Hapur, UP, India. The sample consisted of **20 right and 20 left lower limbs** from adult cadavers. Each limb selected was devoid of trauma, congenital deformities, or previous surgical interventions that could alter morphometric anatomy (6, 2018). All specimens were preserved in **10% formalin**, and the dissections were performed according to **Cunningham's Manual of Practical Anatomy**, ensuring methodological uniformity (15, 2018). The skin and superficial fascia of the anterior thigh were carefully removed, followed by meticulous separation of the femoral triangle boundaries: the inguinal ligament superiorly, sartorius laterally, and adductor longus medially. The **femoral sheath** was identified and opened longitudinally to expose the femoral artery, vein, and nerve. The FA was traced from its point beneath the inguinal ligament to its continuation at the adductor hiatus as the popliteal artery.

RESULTS

In the present study of 40 lower limbs, the **femoral artery** showed a typical anatomical length in 26 specimens (65%), with 16 on the right and 10 on the left side. The **profunda femoris artery** most frequently originated posterolaterally from the FA in 70% of specimens, while a posteromedial origin was seen in 20% and a lateral origin in 10%. High origin of PFA—within 2 cm of the inguinal ligament—was seen in 18% of limbs. The **medial circumflex femoral**

artery originated independently from the PFA in 62% of cases, while in the remaining cases it arose directly from the FA. The **lateral circumflex femoral artery** originated from PFA in 75% of limbs and directly from FA in 25%. Accessory branches including muscular branches and perforators showed variability in origin and number. Termination patterns of FA were typical in all specimens at the adductor hiatus.

DISCUSSION

The results demonstrate notable variability in the branching pattern of Femoral artery High origin of profunda femoris artery (PFA) and variable circumflex arteries are clinically significant because they may alter surgical approaches to the femoral triangle, hip joint and thigh compartments (9, 2021). Our findings are comparable to previous studies documenting population-specific vascular variations. Awareness of these patterns reduces iatrogenic complications during angiography, orthopedic surgeries and vascular reconstructions. Anatomical deviations, if unrecognized, increase procedural risk.

SUMMARY

This study highlights important anatomical variations of the femoral artery and its profunda and circumflex branches. The incidence of high PFA origin and variable circumflex branching emphasizes the need for precise anatomical knowledge before surgical or radiologic procedures. Such variations influence vascular access, bypass grafting, orthopedic approaches and trauma care. Understanding these patterns enhances patient safety, reduces complications, and improves interpretation of imaging studies. These findings contribute to the anatomical data for clinicians and anatomists working in Indian tertiary care settings.

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