

## A study of variations in the branching patterns of Brachial artery in the North Indian population

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### Abstract:

*The **brachial artery**, the main arterial supply to the upper limb, exhibits several anatomical variations that hold clinical significance for **angiographic procedures, orthopedic surgeries, and vascular interventions**. This study aimed to evaluate the variations in the branching patterns of the brachial artery among the **North Indian population**, emphasizing clinically relevant deviations that may influence diagnostic and surgical outcomes. This descriptive cadaveric study included 40 upper limbs from 20 adult cadavers in the Department of Anatomy. After careful dissection, observations were recorded regarding the origin, course, and branching pattern of the brachial artery. The most common variation identified was a **high bifurcation of the brachial artery**, occurring in 15% of specimens, consistent with previously reported incidences ranging from 10% to 22% (1,2). Additionally, **superficial brachial artery** was found in 7.5% of specimens, a variation known to complicate intravenous cannulation and flap surgeries (3,4). Rare patterns such as the presence of an **accessory brachial artery** (2.5%) and **trifurcation** (5%) were also documented. These findings align with the embryological theory of persistent superficial vascular channels (5,6). The clinical importance of identifying these variations extends to trauma management, vascular grafting, and the interpretation of angiographic imaging (7,8). Failure to recognize them may result in iatrogenic injury, ischemic complications, or misdiagnosis (9,10). The study underscores the need for surgeons, radiologists, and anesthesiologists to be aware of these variations to prevent procedural complications (11,12). Population-based studies such as the present one assist in refining anatomical knowledge crucial for routine clinical practice (13,14). In conclusion, the study demonstrates a significant frequency of anatomical variations in the brachial artery among North Indians, reinforcing the importance of accurate preoperative assessment and anatomical understanding (15).*

## Keywords:

*Brachial artery, High bifurcation, Superficial brachial artery, Upper limb anatomy, Vascular variations*

## Introduction:

The **brachial artery** is the major continuation of the axillary artery, responsible for supplying oxygenated blood to the upper limb. Its typical course extends from the lower border of the teres major muscle to the level of the neck of the radius, where it normally bifurcates into the **radial and ulnar arteries**. However, numerous anatomical studies have reported variations in its branching pattern, which carry considerable clinical implications (1). Awareness of these variations is critical for clinicians performing vascular surgeries, angiographic procedures, orthopedic interventions, and anesthetic blocks (2,3). Anatomical variations of arteries typically arise due to deviations in the embryological development of the vascular system. Persistence or regression of superficial and deep vascular channels leads to alternate branching patterns, including **high bifurcation, superficial brachial artery, accessory arteries**, and rare trifurcations (4,5). These variations may alter hemodynamics and affect surgical access, making them of interest to anatomists and clinicians alike (6). In the North Indian population, limited data exist on the prevalence of these variations, despite the region's large patient load and the increased reliance on interventional radiology and microvascular reconstructive procedures (7). A high bifurcation of the brachial artery may lead to unexpected bleeding during surgeries or altered pulse patterns, complicating clinical assessments (8). Similarly, a superficial brachial artery may be mistaken for a vein during venipuncture, resulting in accidental arterial injury (9). Understanding these variations is essential for planning **arterial grafts**, performing **Doppler studies**, and interpreting contrast imaging (10,11). Even minimally invasive procedures such as trans-radial coronary angiography require precise knowledge of upper-limb vascular anatomy to avoid catheter-related complications (12). Cadaveric studies play an indispensable role in documenting the anatomical spectrum of vascular variations. Cadavers provide an opportunity for meticulous dissection, enabling detailed visualization of branching patterns that may not always be captured through imaging methods alone (13,14). Given the anatomical diversity seen across populations, region-specific data offer valuable insights that could aid in surgical training and patient safety. The present study was therefore undertaken to evaluate and describe the **variations in the branching patterns of the brachial artery** in the North Indian population, contributing to the growing anatomical literature and assisting clinicians in minimizing procedural risks (15).

## Materials and Methods:

This descriptive cadaveric study was conducted in the Department of Anatomy at Rama Medical College, Hapur, Uttar Pradesh. A total of 40 upper limbs from 20 adult cadavers (both male and female) were included. All cadavers were preserved using standard formalin-based embalming procedures and were free of upper-limb congenital deformities or prior surgical interventions. Dissection was performed according to the guidelines of Cunningham's Manual

of Practical Anatomy. The skin and superficial fascia were carefully reflected to expose the neurovascular structures of the arm. The brachial artery was identified at the lower border of the teres major muscle and traced distally toward the cubital fossa. The branching pattern, variations in origin, bifurcation level, and presence of accessory or superficial arteries were recorded. A **high bifurcation** was defined as the division of the brachial artery proximal to the normal level of the neck of the radius. A **superficial brachial artery** was defined as a branch coursing superficial to the median nerve. All findings were photographed and documented for verification.

## Results :

Out of 40 upper limbs studied, the normal branching pattern of bifurcation into radial and ulnar arteries at the cubital fossa was observed in 70% of specimens. **High bifurcation** was noted in 15%, with division occurring proximal to the mid-arm. A **superficial brachial artery** was observed in 7.5% of limbs, arising high and coursing superficial to the median nerve. **Accessory brachial artery** was present in 2.5% of specimens, while **trifurcation** was found in 5%. These variations showed strong correlation with previously published data (1–5).

## Discussion :

The present study confirms that variations in the branching pattern of the brachial artery are relatively common in the North Indian population. High bifurcation and superficial arteries remain the most frequent findings, consistent with global anatomical trends (1,2). Recognition of these patterns is vital to avoid iatrogenic injuries during surgical and interventional procedures (3–5)

## Summary :

This cadaveric study documented significant variations in the branching patterns of the brachial artery among North Indians, including high bifurcation, superficial brachial artery, and rare accessory branches. Such variations are of major clinical relevance during vascular surgeries, orthopedic interventions, and angiographic procedures. Accurate anatomical knowledge can prevent complications and improve patient.

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