

# Case Report: The Unilateral High Bifurcation of the Brachial Artery



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## ABSTRACT

The upper limb vascular pattern shows a significant number of diversities in the arterial or venous system. Although variations are usually found in the forearm region, the brachial artery variations are less common. In this report, we described a rare case of a higher bifurcation level of the brachial artery giving rise to the radial and ulnar arteries at the middle portion of the arm. It is crucial for surgeons or even radiologists to be familiar with the diverse morphological patterns of the brachial artery and its branches. Moreover, they should be aware of latent hazards in the therapeutic procedures to diminish surgical complications while operating on the upper extremities.

## 1. Introduction

The brachial artery starts at the lower border of the teres major muscle and slightly distal to the elbow joint. Moreover, it terminates by branching into the ulnar and the radial arteries at the intercondylar level. The radial artery frequently runs deep to the brachioradialis muscle along the proximal lateral side of the forearm. At the distal portion of the forearm, it runs adjacent to the flexor carpi radialis tendon and medial to the pronator quadratus muscle. The ulnar artery usually runs on the medial side of the forearm deep to the flexor carpi ulnaris and goes towards the wrist. Then, it forms the deep and superficial palmar arterial arches by making

anastomoses with the radial artery. However, this usual distribution pattern might not always be the case [1].

Deviations from the normal arterial branching pattern in the upper limb could be found in up to 20% of the population. Most of these variations occur in the forearm arteries, whereas brachial artery variations are less prevalent [2]. From the embryological aspect, most of these variations are formed by a failure in the limb bud arterial paths regression [3]. Having a better perspective view of the possible variations in the upper limb vasculature pattern could result in preventing surgical complications and helping to accurately address the underlying issues. Being aware of such variations could be beneficial in many surgeries on the upper extremities, such as

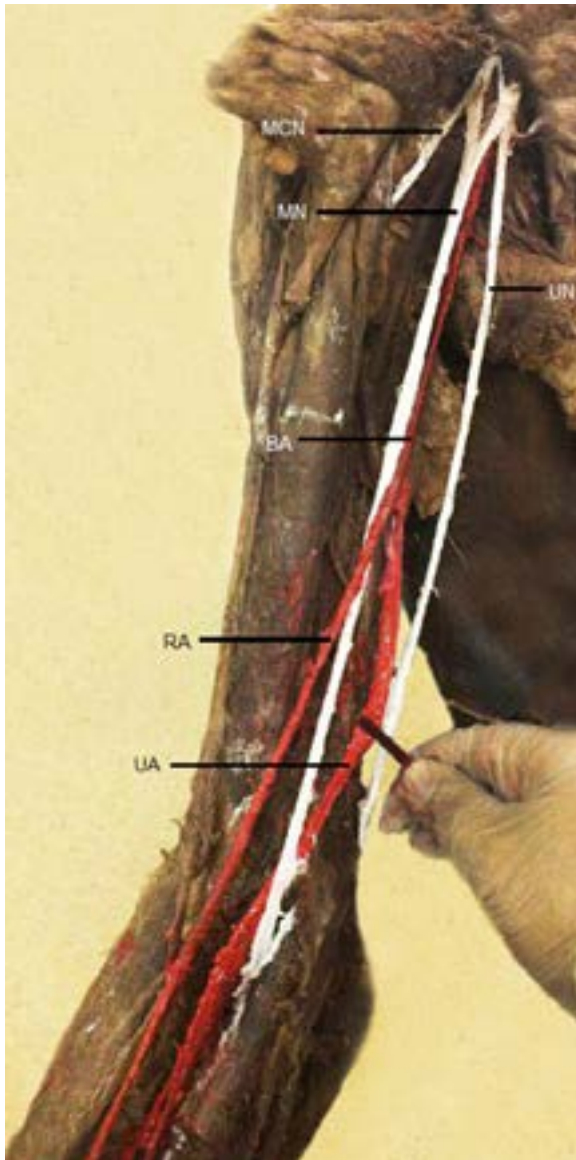
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ANATOMICAL SCIENCES

**Figure 1.** Right arm, anterior aspect

BA: Brachial Artery; MCN: Musculocutaneous Nerve; UN: Ulnar Nerve; MN: Median Nerve; RA: Radial Artery; UA: Ulnar Artery

flap surgeries, coronary artery bypass by the radial artery, fasciotomy to treat acute compartment syndrome, and limb amputations [4].

## 2. Case Report

We encountered a rare unilateral vascular variation during a routine dissection on the arm of a male cadaver at the Department of Anatomy, Iran Medical School. There was a high take-off of the radial artery from the brachial artery at the middle portion of the arm adjacent to the lateral side of the median nerve. The radial artery

then continued its path towards the forearm by passing deep to the median nerve (Figure 1). The rest of the radial artery branches seemed to have normal distribution pattern. The ulnar artery showed no deviation from the normal arterial pattern and it gave rise to the common interosseous branch just below the elbow joint. Other vasculatures of the limb seemed to be as usual.

## 3. Discussion

Vascular variations in the upper limb have been mentioned in some studies. Variability in the vascular pattern or arterial anomalies of the upper limb depends on the growth or regression in the arterial plexus in the limb buds during the embryological period [5]. In the limb buds, variation in the arterial plexus grow can result from changes in the blood flow and vascular tissue demand [6-8]. Therefore, a regression in the arterial growth may occur due to supplying the tissue demand by other vascular branches [9].

The brachial artery usually divides into its final branches at the intercondylar line level; however, in 10% to 12.3% of the cases, the radial artery can take-off from the brachial artery, slightly proximal to the elbow joint [10]. In the present case, the bifurcation level of the brachial artery was located at the middle portion of the arm, which is rare.

In 82.65% of the cases, the ulnar artery arises from the brachial artery just distal to the superior margin of the radius head [11] and just 33.11-33.45 mm distal to its origin. Moreover, it gives rise to the common interosseous artery, which further divides into anterior and posterior interosseous branches. The common interosseous artery is usually a branch from the ulnar artery; however, it could also arise from the radial artery [12]. In our case, the course and branching pattern of the ulnar artery in the forearm was as usual.

In an angiographic study on 81 patients, anomalies of the major upper limb arteries were discovered in 9.8% of them. In 8.6% of the cases, a higher take-off of the radial artery from the brachial artery was detected [13].

In the clinical cases, investigating the anatomic vascular variations may be impossible to conduct directly, unless by applying noninvasive exams, like Magnetic Resonance Angiography (MRA) or Color Doppler Imaging (CDI) [14].

## 4. Conclusion

The brachial artery is widely applied in the diagnostic and curative processes of many diseases, such as coronary artery bypass, peripheral vascular diseases, chronic renal failure, and even catheterization. Furthermore, during the interventional radiology, identifying the relationships and course of this artery and its major branches, they have remarkable operational importance when conducting reparative surgeries on the whole upper limb. Thrombosis, gangrene, and even limb loss might occur following the improper cannulation of these arteries [14, 15]. Therefore, it is crucial for surgeons or even radiologists to be familiar with the diverse morphological pattern of the brachial artery and its branches. In addition, they should be aware of latent hazards in the therapeutic procedures to diminish surgical complications while operating on the upper limb.

## Ethical Considerations

### Compliance with ethical guidelines

All ethical principles were considered in this article.

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### Authors' contributions

Amirhossein Mohammadi and Rafieh Alizadeh contributed equally to this work.

### Conflict of interest

The authors declared no conflicts of interest.

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