

# Case Report: Variation in Bifurcation Pattern of Brachial Artery

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Forouzan Absalan was appointed PhD of Anatomical Science at Tarbiat Modares University. Through these times she has worked on two projects: The effects of tumor necrosis factor- $\alpha$  on development of vitrified mouse morulae and expression of TNF- $\alpha$  receptors on embryonic cells and evaluating the expression of Bcl-2, p53, Bax and Survivin after transplantation of spermatogonial stem cells in testis of unilateral cryptorchidism mouse model. After graduation she initiates working at the IVF center in Shiraz for 1 year and then she moved to Ahvaz for working in Jundishapur Medical Faculty. She has published one Persian and 12 ISI indexed paper.

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## ABSTRACT

Recognizing the arterial variations of human upper extremities is of potential clinical practice because this area is involved in arterial handling and invasive medical procedure. During dissection of the left upper limb of a 35-year-old male embalmed cadaver, we saw brachial artery bifurcation in the middle third of proximal portion of the arm. Its medial branch descended along the medial side of the arm, medial to the median nerve. This branch then redirected laterally after crossing with median nerve. In this part, it lied posterior to the nerve until reached the lateral aspect of the arm. At the elbow level, the medial branch continued as radial artery. The lateral branch of brachial artery remained lateral to the median nerve until reached the elbow. In this part, it continued as ulnar artery after crossed the median nerve anteriorly and descended as interosseous artery.

## 1. Introduction

The increasing use of invasive diagnostic methods in cardiovascular problems makes it crucial that the vascular variations be well determined [1]. For example, variations in upper limb arteries are common with reported frequencies of 11% to 24.4% [2]. During the embryonic development, many possibilities that exist in formation of upper limb vessels seem responsible for various arterial branching patterns [3].

The brachial artery is the direct continuation of axillary artery just below the lower margin of teres major muscle, ends about 1 cm bellow the elbow joint, where it divides into the ulnar and radial arteries. Bifurcation of brachial artery at a higher level has been reported in one out of eight or ten individuals [3]. Usually, brachial artery divides more proximally into radial, ulnar, and common interosseous arteries. Most often, the radial artery arises proximally, leaving a common trunk for ulnar and common interosseous; sometimes the ulnar artery arises proximally, radial and common interosse-

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**Figure 1.** Left upper limb showing brachial artery and its bifurcation in the proximal portion of the arm

ous forming the other division; the common interosseous may also arise proximally [4].

The brachial artery courses with the median nerve within the medial intermuscular septum, and that the median nerve is the only large structure to cross the anterior surface of the brachial artery [5]. Numerous alternatives that exist during the embryonic formation of upper limb vessels seem to be responsible for anomalous arterial branching patterns [6]. The objective of this report is to describe a rare case of a unilateral high division of the brachial artery found in male cadaver during dissection.

## 2. Case Report

During routine dissection of upper limb for medical students in our Medical School, we observed and thus recorded unusual variations in the course and branching pattern of the left brachial artery in a 35-year-old male cadaver. The incision was applied longitudinal to the middle portion, then skin was pulled apart and subcutaneous tissues and brachial biceps muscle were lateralized to observe the brachial artery. The procedure revealed an abnormal artery bifurcation in the proximal portion of the middle third of the arm. Normal anatomical course was observed in the axillary arteries in both upper limbs. The principle brachial artery in the left upper limb descends from axillary artery where median nerve laid anteromedial.

In the proximal portion of the middle third of the arm, the brachial artery bifurcating was observed, that formed two lateral and medial branches. By passing posterior to the median nerve, the medial branch headed medially and turned towards the lateral side in the distal third of the arm and crossed the median nerve heading to form the radial artery in the forearm. However, its lateral branch continued medially toward the brachial biceps

muscle and in the distal third of the arm crossed posterior to the medial branch so that it headed toward the cubital fossa, where it formed the common interosseous artery and then continued as ulnar artery (Figure 1).

The radial artery was larger in size, crossing from medial to lateral side anteriorly by the median nerve, and descended under the deep fascia representing the usual brachial artery. The course of the ulnar and radial arteries was normal in the forearm and covered by deep fascia, however, we were surprised to find that the radial artery giving origin to the common interosseous artery which descended deep to pronator teres and subdivided into the anterior and posterior interosseous arteries. Moreover, no variation was observed in the formation pattern of the left superficial palmar arch. Unilateral variations are rare when compared to the bilateral variations. This study is just an attempt to enlighten the clinical and embryological implications of such variations.

## 3. Discussion

The axis artery of the upper limb is derived from the seventh cervical intersegmental (subclavian) artery. This artery grows distally along the ventral axial line and terminates in hand as palmar capillary plexus. Main trunk of axis artery forms axillary artery, brachial artery, anterior interosseous artery, and deep palmar arch. The digital arteries of the hand arise from the palmar capillary plexus. Radial and ulnar arteries are last to appear in the forearm as sprouts of the brachial artery [7].

Vascular variability in the upper limb is due to defects in growth or regression of vascular plexus during embryonic development. This may be due to a defect at any stage of development of vessels such as selection of unusual paths in primitive vascular plexus, obliteration of persistence of vessels normally and incomplete

development fusions and absorption of the parts usually distinct [8]. In addition, ectodermal-mesenchymal interactions and extracellular matrix components are controlling the initial patterning of limb blood vessels [7]. In this manner, differences in the mode and proximo-distal level of branching has been caused anomalous pattern of vascular variations.

High bifurcation of brachial artery occurs in embryo due to persistence of the upper portion of the radial artery arising from the brachial artery proximal to the beginning of the ulnar artery and then breakdown of growth of a new connection of the radial artery from the brachial artery at the level of ulnar artery origin [9].

Diagnostically, prior anatomical knowledge of upper limb arterial variations may disturb the evaluation of arteriography images and can have serious implications in orthopedic, plastic and vascular surgeries [10]. Blood pressure, which is normally measured in the arm in the brachial artery, is also affected when there are double [9]. In this manner, being closer to the heart caused that brachial artery more time is needed for medical practice [11]. We hope that this article could assist radiologists, vascular surgeons and orthopedists to make correct diagnosis and more precise surgical interventions.

#### 4. Conclusions

In light of the evidence presented in our study, it must be quite interesting for health professionals to be aware of an individual's anatomy before undergoing invasive procedures. High division of the brachial artery has a profound applied effect especially in the field of vascular surgery and radiology, and the possibility of this variation should be bore in mind before any vascular surgery in the region of the forearm or while interpreting arteriograms of the upper limb.

#### Ethical Considerations

##### Compliance with ethical guidelines

This is an anatomical case report article and don't have any ethical guidelines.

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##### Conflict of interest

All authors certify that this manuscript has neither been published in whole or in part nor is it being considered for publication elsewhere. The authors have no conflict of interest to declare.

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