

Case Report: A Case Report on Variation in Bifurcation of Brachial Artery

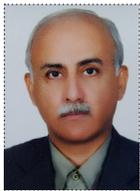
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ABSTRACT

Variations in arterial anatomy are less frequent, contrary to the venous system, and most of these variations affect visceral arteries. Variations in the brachial artery are the most frequently reported and so far a minimum of six different patterns have been described. The most common of these patterns is the superficial brachial artery, which lies superficially to the median nerve. Much less prevalent is the high origin of the radial artery (brachioradial artery) or the existence of a doubled brachial artery (accessory brachial artery). The current study presents a pattern of brachial artery variation which was previously undescribed. During dissection of the right upper limb of a 50 year-old male embalmed cadaver, the bifurcation of the brachial artery in the proximal portion of the middle third of the arm was observed. In this case, the medial branch reaches the medial aspect of the arm, posterior to the median nerve. Afterwards, this medial branch redirects laterally and crosses the median nerve again, this time lying anterior to the nerve till it reaches the lateral aspect of the arm. At the elbow level, the medial branch originates from the radial artery. The lateral branch of the brachial artery remains lateral to the median nerve and continues as ulnar artery and originates from the interosseous artery. It was also observed that the left brachial artery was smaller in size, and bifurcated high in the arm into the superficial radial and ulnar arteries. It was also interesting to note that the common interosseous artery was originated from the left radial artery in the cubital fossa, which descended deep to pronator teres where it was divided into the anterior and posterior interosseous arteries. These variations are discussed comprehensively and compared with the previous reports. Also, it is asserted how clinically the findings are significant.

Key Words:

Anatomical variations, Brachial artery, Cadaver

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1. Introduction

Continuation of the axillary artery gives origin to brachial artery, originating at the distal edge of the teres major muscle tendon and ends to radial and ulnar arteries, inferior to the elbow joint, at the radial head level. As reported in the literature, in nearly 20 percent of the cases, anatomical variations of this artery were observed and found in routine dissections or clinical practice [1-2]. Rarely, the brachial artery may be totally absent [3] or it may be divided in a higher level. It may be trifurcating or originating from accessory branches that may bifurcate into radial and ulnar arteries as well [4-5].

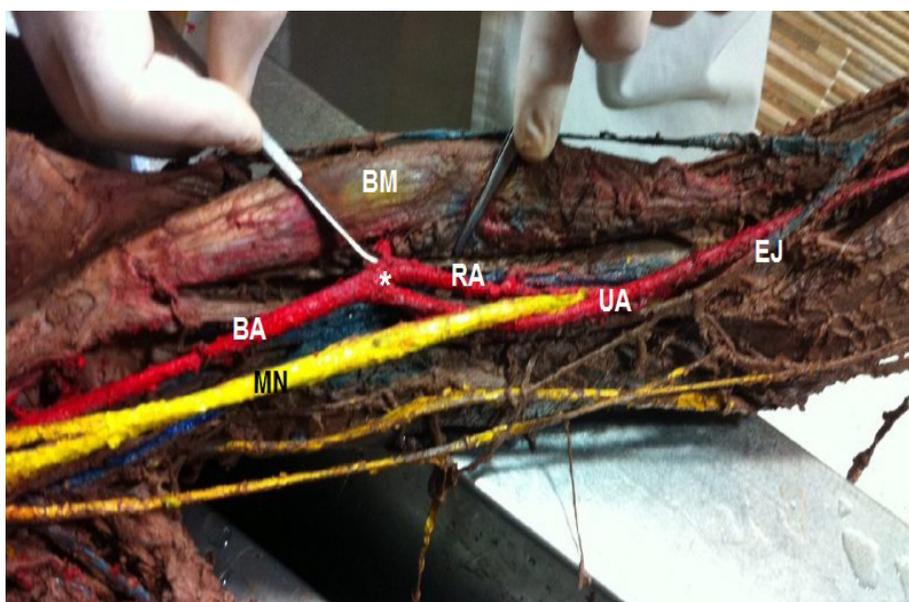
The knowledge of these variations is of high interest to interventional surgeons, radiologists, and anatomists. The current study reports on one of these previously unknown variations in the brachial artery, which contributes to the clinical practice, surgeons, and radiologists. Moreover, it is of great significance to angiographic and surgical practice to recognize and document the developmental variations in the course, distribution, and branching pattern of the arteries of the upper limb. The reason why upper limb vascular variations are frequent has to do with the complex and multiple sites of their embryonic development. These variations are rather prevalent and have been reported since the 17th century. Since then, literature witnesses many gross anatomical and radiographic reports published on different uncommon branching

and distribution patterns of upper limb arteries. Yet, there have also been debates over the terminology and course of these variations. The current report describes bilateral variation in the course and branching pattern of the brachial artery in the referred cadaver.

2. Case Report

During routine cadaver dissection in the practical sessions of the post graduate program at Shahid Beheshti University of Medical Sciences, Tehran, Iran, we observed and thus recorded developmental variations in the course and branching pattern of the right and left brachial arteries in a 50-year-old male cadaver preserved in formaldehyde solution.

The incision was applied longitudinal to the middle portion, then the skin was pulled apart and subcutaneous tissues and brachial biceps muscle were lateralized to observe the brachial artery. The procedure led to observing an abnormal artery bifurcation in the proximal portion of the middle third of the arm. Next, following the routine sequence of anatomical planes dissection of arm, the dissection was performed and extended to the anterior area of the forearm. All the procedure and findings were documented. Normal anatomical course was observed in the axillary arteries in both upper limbs. Also, branching pattern with the branches of brachial plexus cords had normal distribution around it. Nevertheless, a shared trunk gave origin to the anterior and posterior



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Figure 1. Brachial artery on the left. Abbreviations: BA: brachial artery, BM: biceps muscle, RA: radial Artery, UA: ulnar artery, MN: median nerve, EJ: elbow joint. During the ascending, arteries are not elongated but degenerated and are replaced by new blood in higher levels of the aorta. Remain unstable inferior renal artery leads to the accessory renal artery [5].

circumflex humeral arteries of the third part of the axillary artery in both limbs.

The principle brachial artery in the right upper limb descended from axillary artery where median nerve laid antero-medial. In the proximal portion of the middle third of the arm, the brachial artery was observed bifurcating, that formed two lateral and medial branches. By passing posterior to the median nerve, the medial branch headed medially and turned towards the lateral in the distal third of the arm and crossed the median nerve heading to form the radial artery in the forearm. On the other hand, the lateral branch of it medially continued to the brachial biceps muscle and in the distal third of the arm crossed posterior to the medial branch so that heading 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. Ulnar and radial arteries descended in the forearm under the deep fascia and were superficial to the flexor muscles. The course of the ulnar and radial arteries was normal in the forearm, however, we were surprised to perceive 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.

3. Discussion

It is quite significant for surgical practice to recognize variations in the number and path of the upper limb arteries [6-8]. Moreover, since knowledge in this area improves diagnosis and reduces the risks associated with invasive techniques and also the probability of iatrogenic injuries, anatomists and many specialists in other medical areas are attracted to this phenomenon. These anatomical variations can normally be explained from the view point of embryology.

From the viewpoint of embryo development, the arteries of the upper limbs originate from the primitive axial artery and superficial brachial artery [9-12]. Primitive axial artery give origin to the brachial, axillary, and interosseous arteries; however, the median artery transiently arises as a branch of the interosseous artery, involuting towards the artery associated with the median nerve [13-14]. Proximally, the superficial brachial artery connects to the brachial and axillary segments of the primitive axial artery via several trunks. The superficial brachial artery distally anastomoses with the brachial artery (branch of the primitive axial artery) via medial branch of

the superficial brachial artery (superficial antebrachial artery) and another lateral branch of superficial brachial artery.

The antebrachial artery gives origin to two branches: one branch is median, anastomosing with the deep trunk of the radial artery, the terminal branch of the primitive axial artery, and the other, the ulnar branch, which anastomoses with the trunk of the deep ulnar artery (terminal branch of the primitive axial artery). Because of these anastomoses, there is an increase in the local blood flow that causes involution of proximal segment of the superficial brachial artery, i.e. the origin of the radial artery (Senior; Singer) and an ulnar artery would originate directly from the primitive axial artery. The cause of the morphogenetic alterations observed in the anatomy of the arteries of the upper limbs is the changes in the origin or involution of these segments.

It is notable that the incidence of high bifurcation of the brachial artery is rare; in fact, only 0.5% of 202 cadavers dissected [15] demonstrated this phenomenon. In a pioneering study in Brazilian cadavers, 72 adult upper limbs cadavers of both sexes were examined [16], which were preserved in formaldehyde solution, and analyzed the bifurcation of the brachial artery making use of the biepicondylar line (LBE) of elbow and its relationship with the median nerve as reference: in 87.5% of the cases the brachial artery distally bifurcated from this line, 11.1% bifurcated proximally, and the level of it 1.4% of cases. When the bifurcation was distal to LBE and it was proximal to LBE, the median nerve crossed the brachial artery in only two cases.

The median nerve crossed the brachial artery ventrally in 54.9% and dorsally in 23.5% of the cases. Several authors have described arterial variations of the upper limb in details [17-18]. The latter with a sample size of 650 cases found 18.5% of anatomical variations, where 77% of the cases had high origin of radial artery, while the ulnar artery accounted for 12.2% of the variations. In another study, 14.27% incidences of high origin of the radial artery (brachial or axillary artery) were recorded in dissections of cadavers and 9.75% in an angiographic study [19]. Also, a case of arterial malformation is reported in a 61-year-old female cadaver dissection [20]. In this case, the origin of radial artery occurred in the axillary artery with superficial path in an anterior compartment of the arm which deeply converged at the brachial artery in the cubital fossa.

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