

# A Cadaveric study on variations in brachial artery – An Anatomical perspective

Chada Jayasree<sup>1</sup>, C Kishan Reddy<sup>2</sup>

<sup>1</sup>Tutor, Department of Anatomy, Rajiv Gandhi Institute of Medical Sciences, Adilabad, <sup>2</sup>Professor and Head, Department of Anatomy, Prathima Institute of Medical Sciences, Nagunur, Karimnagar, Telangana, India.

Address for correspondence: Chada Jayasree, Tutor, Department of Anatomy, Rajiv Gandhi Institute of Medical Sciences, Adilabad, Telangana, India.

Email: jayasree.reddy123@gmail.com

## ABSTRACT

**Introduction :** Brachial artery being the direct continuation of axillary artery at the lower border of Teres major is the vital feeder vessel of the upper limb. Deviations in the normal course & branching pattern of the brachial artery were observed during routine undergraduate curricular cadaveric dissection.

**Aims & Objectives :** The present study was done to evaluate the incidence of brachial artery anatomical variations & enumerate its impact on clinical implications.

**Materials & Methods:** In the present study, a total of 50 adult upper limbs of 25 cadavers were studied. The upper limbs were dissected & observed using standard procedures during routine undergraduate curricular cadaveric dissection in Prathima Institute of Medical Sciences – Karimnagar.

**Results:** Deviations in anatomical course with high branching pattern were observed in two specimens. An unusual branch of brachial artery was observed in one more specimen.

**Conclusion:** High division of the brachial artery has profound clinical importance varying across the spectrum, from a simple procedure of recording blood pressure using auscultatory method to advanced radiovascular procedures and nevertheless vascular surgeries. These variations are to be considered before proceeding on to any vascular surgeries and interpretation of arteriograms involving these vessels. An unusual superficial ulnar branch of brachial artery is vulnerable to injury and accidental arterial injections. Therefore, sound knowledge of such unusual variations or deviations in brachial artery is important for both Radiologists and Surgeons to reduce diagnostic & therapeutic errors.

**Keywords:** Arterial variations, anatomical variations, bifurcation, axillary artery, brachial artery, ulnar artery, radial artery

## INTRODUCTION

The primary vital feeder vessel of the upper limb is the axillary artery, which continues down in the brachium as the

brachial artery at the level of distal border of teres major muscle. Initially the brachial artery lies medial to the humerus and gradually crosses over to anterior aspect of humerus as its journey continues to the cubital fossa. In the cubital fossa, brachial artery is crossed superficially by the median nerve via an lateral to medial course. Approximately at the level of neck of radius, the brachial artery terminates by dividing into right & the left branches named corresponding to the antebrachial bones as radial & ulnar arteries traditionally. It is noted that the brachial artery gives off following branches before terminating into radial & ulnar arteries (ie) profunda brachii, nutrient, superior & inferior ulnar collateral along with muscular branches.

If an artery is superficial, it is at risk during intravenous intervention, injections, infusions and draining of blood. Brachial artery with variations in the branches may present a superficial pulse and hazard to venaepuncture (Hazlett 1949) and lead to intra-arterial injections or ligature instead of vein in cubital fossa - "Pabst<sup>1</sup> and Lippest<sup>2</sup>".

Literatures along with various cadaveric & clinical studies suggest that various variations have been observed in course & branching pattern of the brachial artery. Conventional knowledge of brachial artery & its branches have played a major role in vascular surgeries involving these vessels. In current study, we have tried to elaborate the current existing knowledge regarding, the course & branching pattern of brachial artery

## MATERIALS AND METHODS

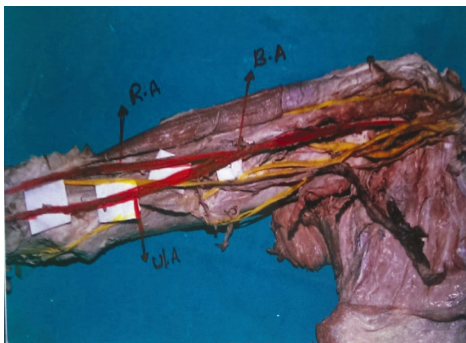
The present study was done in the Department of Anatomy of Prathima Institute of Medical Sciences over a period of two years, as part of routine under graduate dissection teaching schedule. Historically relevant dissection technique as per Cunningham's manual of practical Anatomy was used to dissect the specimens.

Totally 50 upper limbs of adult embalmed cadvers were dissected, to study the course & branching pattern of brachial artery. The observations were noted and statistically computed to obtain relevant data.

## RESULTS

Among the 50 upper limbs studied, 3(6%) upper limbs in total showed variations in brachial artery. 2(4%) upper limbs showed high bifurcation of brachial artery in bilateral upper limbs of a cadaver. 1(2%) upper limb showed unusual branching pattern of brachial artery [Table 1]

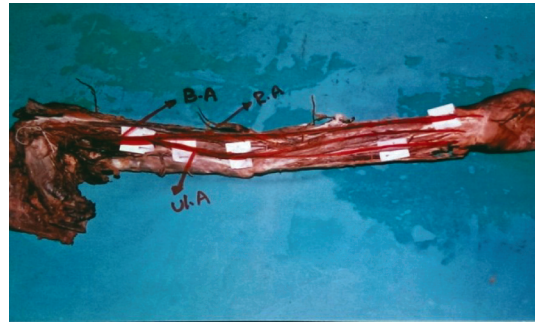
In bilateral upper limbs of a cadaver the brachial artery was observed to be terminating into radial and ulnar artery at an unusually higher level. The artery was seen dividing into terminal branches at the level of mid brachium, near the insertion of coracobrachialis muscle, just after the origin of profunda brachii artery. Instead of bifurcating at the level of neck of radius in the cubital fossa, it was seen bifurcating at a higher level (Figure 1,2,3), superior & inferior ulnar collateral arteries arised from the ulnar artery before it crossed the elbow joint. Muscular branches for the muscles of the arm were seen to be arising from profunda brachii and as well as form ulnar and radial arteries before they crossed over to the forearm. The course of ulnar & radial artery in forearm was as usual.



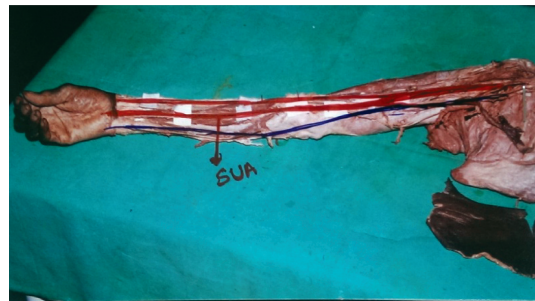
**Figure 1. Showing high bifurcation of brachial artery in the arm of a right upper limb.**



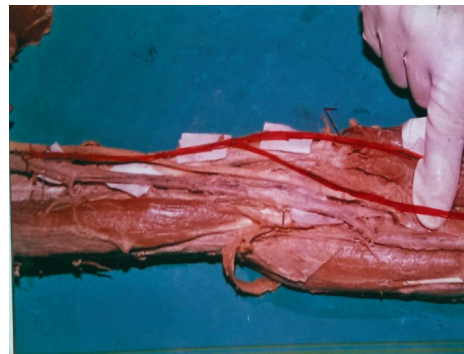
**Figure 2 High bifurcation of brachial artery showing radial & ulnar arteries in forearm of right upper limb.**



**Figure 3: Showing high bifurcation of brachial artery in the left upper limb.**



**Figure 4: Showing superficial ulnar artery at elbow and forearm**



**Figure 5: Showing unusual origin of ulnar artery in right upper limb**

In right upper extremity of a cadaver, an unusual branch of brachial artery was observed. This branch originated just below the origin of profunda brachii artery (Figure 4) and was placed at the mid brachium below the insertion of coracobrachialis. The artery was seen descending on medial aspect of arm passing in front of the medial epicondyle in an superficial plane. The artery then travelled the whole forearm (Figure 5) in an median superficial plane. Later this artery entered the palm superficial to the flexor retinaculum and terminated by dividing into two branches superficial and deep. Superficial branch was seen taking part in formation of superficial palmar arch. The deep branch joined the radial artery & completed the deep palmar arch. This brachial artery branch was seen placed superficially throughout the arm & forearm without any branches or communications in its course. The arterial

branch mentioned above has been named as superficial ulnar artery and not superficial brachial artery, because of its contribution towards formation of superficial & deep palmar arch from ulnar side.

**Table 1: Showing variations in brachial artery**

S.No.	Variation	No. of limbs	Percentage
1	High bifurcation of brachial artery	2	4%
2	Unusual origin of superficial ulnar artery	1	2%

## DISCUSSION

Present study shows 4% variation in high bifurcation of brachial artery, which is similar to the observation of celik HH, sargon MF, konan A, Kural, Thoma A<sup>3</sup>. Present study shows 2% variation in origin of ulnar artery which is similar to the authors Panicker J.B, Thilakan & Chandi G, Simic P, Borovecki F, Jalsovee D. Arterial variations in the arm are numerous and occur at the level of axillary, brachial, radial and ulnar arteries as well as in the palmar arches. It is obvious that accurate information concerning unusual pattern of the arteries in the upper limbs is relevant clinically, especially in order to avoid accidental injury of intraarterial injections. It is important during surgical exploration to avoid damage to the artery. Accurate knowledge of the relationships and course of these major arterial conduits and particularly of their variations in their patterns is of considerable practical importance.

High bifurcation of brachial artery and the abnormal course of the ulnar artery is of interest to the clinicians, in particular, radiologists, vascular and plastic surgeons. An anomalous brachial artery was reported by Patnaik V V G<sup>4</sup>, Jurius, Sfeir, Bezirdjin R<sup>5</sup>. The brachial artery after giving off profunda brachii artery with no collaterals divides in its upper one third into two equal sized arteries, brachial artery #1 & #2. Brachial artery #1 is possibly a high origin and persisting radial artery. It gives no collaterals in arm. At cubital fossa it is subcutaneous and divides into two equal sized Radial and Ulnar arteries, which are superficial to flexor muscles of forearm and are terminated by branches running above the thenar and hypothenar eminences respectively. Brachial artery #2 is possibly a high origin artery of the common interosseous. The course of this artery resembles the course of brachial artery of the embryo and supplies the anterior compartment of brachial muscles and continues as the common interosseous artery, which in turn divides into superior and inferior ulnar collaterals and the anterior and posterior interosseous recurrent branch. It does not regress but has a major role in forming the deep palmar arterial arch in the hand.

Celik H.H<sup>6</sup>, observed high division of brachial artery in two cadavers. In the first case the brachial artery of right upper limb divided into its two terminal branches immediately after passing between the lateral and medial roots of median

nerve and just below the origin of profunda brachii artery. The lateral branch was the radial and medial one was ulnar artery. In the second case it is divided into two terminal branches just below the origin of profunda brachii artery.

A bilateral case of high origin of radial artery was reported by Icten N, Sullu Y<sup>7</sup> and Tuncer I Panickers<sup>8</sup>, J.B. Thilakam and Chandi.G have reported a case of unusual origin of ulnar artery. They found the deviation of ulnar artery in a right upper limb of adult male cadaver from its usual mode of origin one in thirteen cases.

Simic P, Borovecki F found an anomalous superficial Ulnar artery in the left arm of 60 yr old cadaver. It originated from brachial artery approximately 6cm distal to profunda brachii artery. It crossed over the median nerve and at palm, it formed the superficial and deep palmar arches with the branches of radial artery. Combined Vascular anomalies were encountered by Ozan H<sup>9</sup> during dissection of right and left Upper limbs of a 70 years old female cadaver

The cause of variation is usually genetically based and vascular pattern were formed or decided at 10-16 weeks. The change also would occur due to hemodynamic. Once the arterial patterns were formed, they were permanent throughout the life.

## CONCLUSION

An accurate knowledge of anatomical variation of brachial artery course, branching, bifurcation, termination, the course of terminal branches and their relations with surrounding structures is essential prerequisite during vascular and reconstructive surgeries of arm and forearm. Anatomical variations of brachial artery noted in this study are rare and very important clinically. Therefore high bifurcation of brachial artery and superficial ulnar artery noted in this study may be mistaken for a vein and may be injected with intravenous drugs and may get injured during venipuncture and percutaneous brachial catheterization, there may be difficulties while measuring blood pressure. A detailed knowledge of such arterial variations is essential not only to anatomists but also to Radiologists, Orthopaedicians, Vascular and Plastic surgeons.

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