

A Study on Bifurcation of Brachial Artery in South Indian Population (Tamil Nadu and Puducherry)

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Abstract

Aims: The primitive aim of the study is to determine the level of termination of the brachial artery in the South Indian population (Tamil Nadu and Puducherry). **Methods and Material:** The present study was carried out in 30 cadavers in the department of Anatomy, at Sri Lakshmi Narayana Institute of Medical Sciences, Puducherry from 2014 to 2017. The dissection was done precisely according to the Cunningham's manual of anatomy upper limb and lower limb. The variations were observed and the photographs were taken for reference. **Statistical Analysis Used:** SPSS T-TEST. **Results:** In 60 upper limbs, 3 (5%) specimens possessed a higher level of bifurcation of brachial artery. **Conclusions:** A Higher bifurcation of brachial artery can be present in a significant number of patients; hence its presence should be evaluated during vascular mapping prior to any clinical procedures.

Keywords: Brachial Artery; Bifurcation; Radial Artery; Ulnar Artery.

Introduction

The main arterial supply of the arm comes from the brachial artery. It begins as the continuation of 3rd part of axillary artery, it extends from the lower border of teres major to the level of neck of radius. On its course it gives origin to arterioprofundabrachii, superior & inferior ulnar collateral artery, nutrient artery and few muscular branches [1]. Further it terminates in the Cubital fossa at a distance of 3.0cms from the intercondylar line, near the neck of radius into radial and ulnar artery [2]. Variations in the arterial anatomy are less frequent unlike venous system. Among the arteries of limbs brachial artery variations are the most reported ones, out of which a high division of brachial artery is the most common, least prevalent are the high origin of radial artery or the existence of a double brachial artery [3]. In the upperlimb, six different patterns of brachial artery have been described till now. Anatomically and clinically the knowledge of detailed description of vascular pattern and its

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variations are of utmost important. Variations in the course and branching pattern of the brachial artery are of great importance in cardiac catheterization for angioplasty, radiology and arterial grafting [1].

Subjects and Methods

The present study was done in the Department of Anatomy of Sri Lakshmi Narayana Institute of Medical Sciences, Pondicherry from a period 2014 to 2017. The study was carried out during the routine dissection for 1st year M.B.B.S students. In 30 cadavers 60 upper limbs (30 right and 30 left) were dissected according to the manual of Cunningham's manual of anatomy. The measurement was taken using a metric scale and nylon thread.

The Following Parameters were Observed

1. Normal course of the brachial artery in the arm
2. Brim of the brachial artery
3. Terminal branching pattern of brachial artery

Results

Out of 60 limbs dissected, a variation in the terminal branching pattern of the brachial artery was encountered in three cadavers. The terminal

branching pattern was higher than usual. This was observed unilaterally occurring in both the limbs irrespective of their sides, in our study we observed one on the right limb and two on the left limb. The observations are described as below:

Cadaver 1

A higher level bifurcation of the brachial artery into radial and ulnar artery was seen. The brachial artery bifurcation was found higher than the usual, which was 13cm from the intercondylar line. This was found on the left upperlimb of a male cadaver Figure 1. The right upperlimb bifurcation was at the usual site.

Cadaver 2

Another similar variation of a high level bifurcation of the brachial artery was found unilaterally occurring in a male cadaver on the left upperlimb. The artery bifurcated into radial & ulnar artery at a distance of 7.5cm from the intercondylar line. At the level of bifurcation, the ulnar artery was lying initially on the lateral side and radial artery was on the medial side. By the time it reaches the cubital fossa, the radial artery crosses the ulnar artery to reach the lateral aspect of the limb and further continues its normal course Fig 2. No variations were observed on the left limb of the cadaver.

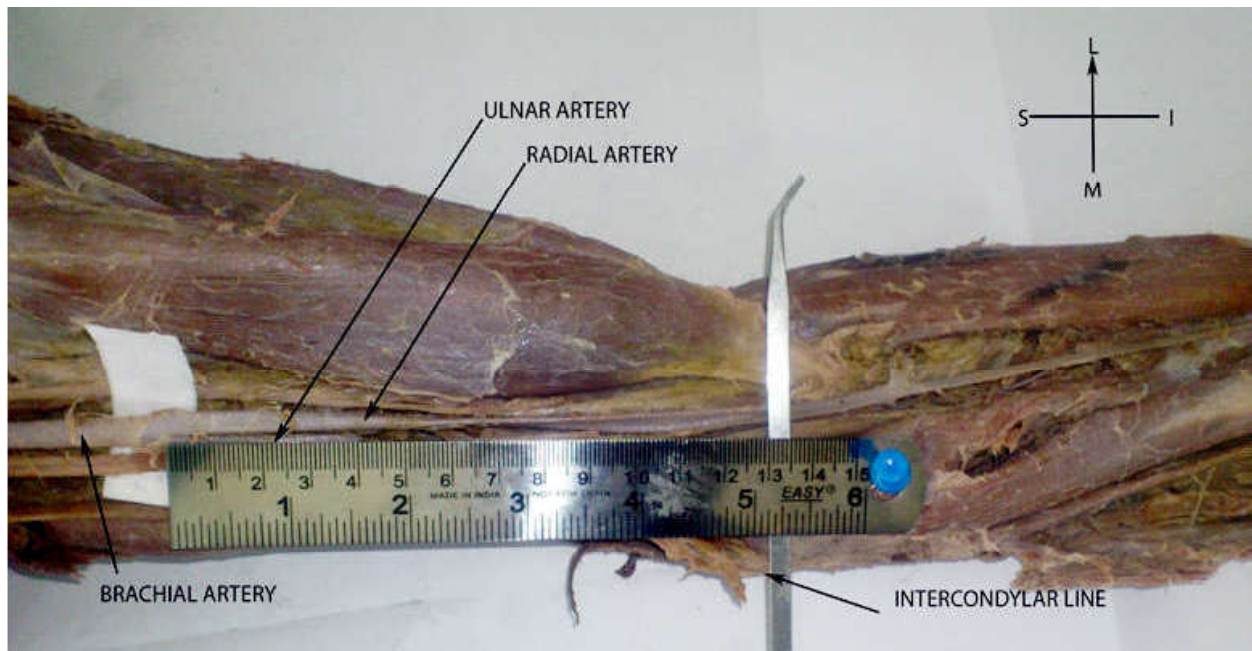


Fig. 1:

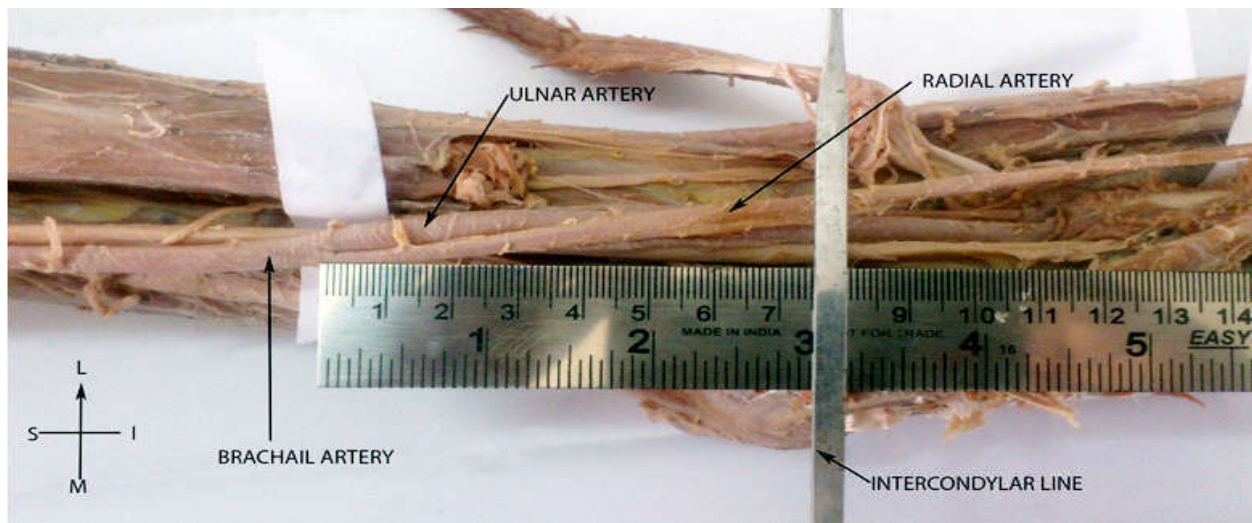


Fig. 2:

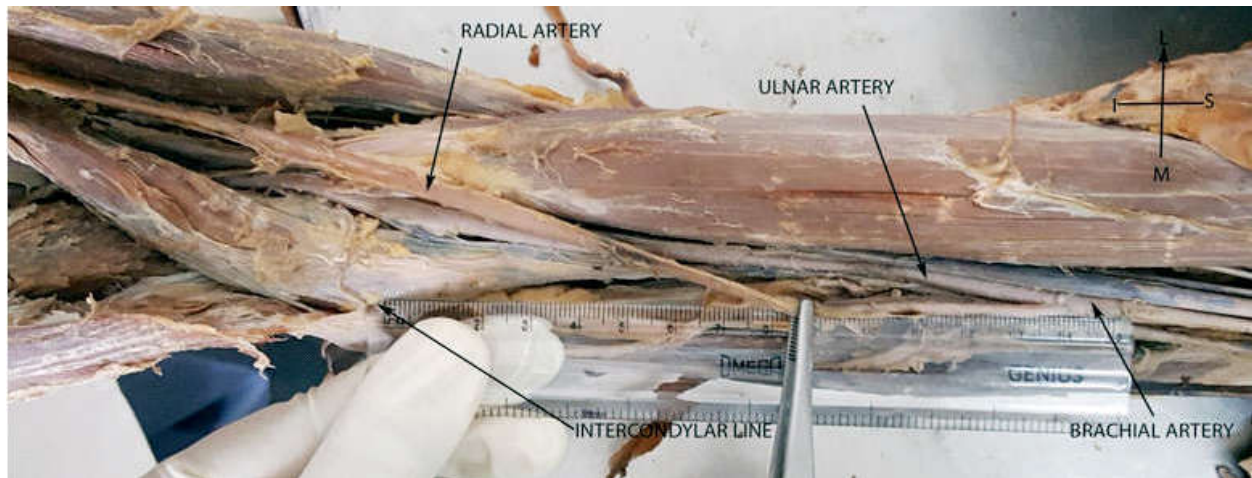


Fig. 3:

Cadaver 3

In another male cadaver, high level bifurcation of brachial artery at a distance of 13.5cm from the intercondylar line was observed on the right upper limb. Here too after the bifurcation, the ulnar artery was lying on the lateral side and radial artery was on the medial side initially and by the time it reaches the cubital fossa the radial artery crosses the ulnar artery and reaches the lateral aspect of the limb Fig 3. The left limb had a normal course of brachial artery with branches.

The radial artery in the arm gave small branches to the muscles and continued distally crossing the elbow joint into the distal part of the forearm normally. The ulnar artery also gave the same course as in the arm, cubital fossa beyond which it continued as a normal ulnar artery.

Discussion

Anomalies in origin of principal arteries might be prone to damage in orthopedic and plastic surgeries. Diagnostically the evaluation of angiographic images may be difficult [4].

In the present study, brachial artery is bifurcated into its terminal branches proximal to the intercondylar line into radial artery and ulnar artery. All the other branches of brachial artery were found to be having a normal origin and course. In all the three limbs the brachial artery presented with higher level terminating branching pattern, but it occurred unilaterally on one side only. The other limb brachial artery branching pattern was normal.

SATYNARAYANA. N observed an unusually short segment brachial artery with a high up

division of brachial artery at the level of insertion of coracobrachialis in the middle of the right arm [5]. The brachial artery was 11.5cm in length and having slightly less caliber than usual. However, it bifurcated normally into radial and ulnar arteries [6]. In another study, the high division of the brachial artery observed in an individual situated 20 cm above the cubital fossa and 8.5cm below the axilla, in the right arm and 21.5 cm above the cubital fossa and 7.0 cm below the axilla in the left arm by 23 Rossi et al [7].

Vishal et al have reported a case of high division of brachial artery into medial and lateral branches, 9.5 cm distal to the lower border of teres major muscle [8]. Brachial artery variations occur in almost 20% of the cases and are encountered during routine clinical practice or dissection [9-11]. The brachial artery may be absent in rare cases [12], trifurcating [13,14], or divided at a higher level [15]. The division of anomalous arteries in the arm are determined with the line between the two condyles called intercondylar line of the humerus. Brachial artery giving its terminal branches proximal to the intercondylar line is considered as a variation [16].

The terminating branching pattern of brachial artery was also studied in detail by earlier investigators [2,11,17-19]. The highest percentage of variations contributes to the high origin of radial and ulnar artery. A high origin of radial artery may arise as high as the axillary artery but most commonly arises from the proximal one third of the arm [10]. Many authors have described the arterial variations in detail [10,20,21]. McCormack observed in 750 cases, in which he found 18.5% anatomical variations, 77% of the cases with the high origin of radial artery and 12.2% variations of ulnar artery [10]. In another study done by Pelin observed an

incidence of 14.27% of high origin of the radial artery (axillary or brachial artery) in dissections of cadavers and 9.75% in an angiographic study [22].

In a study done in 25 cadavers, 1 specimen reported a high level of bifurcation variation out of three [23]. A case of bifurcation was reported as high as just below the lower border of teres major [4]. In our study done in 30 cadavers, 3 specimens are found to have a higher bifurcation of the brachial artery and no other variations were observed.

In a Brazilian cadaveric study high division of brachial artery was found in only 0.5%. The bifurcation of the brachial artery was found above bicondylar line in 11.1% cases [24]. In a recent study, early bifurcation of the brachial artery was found in the middle of the arm in 1 out of 25 cadavers [23].

High Brachial artery Bifurcation can have major clinical implications including high failure rate and decreased functional patency of an arteriovenous fistula. In a clinical study, ultrasound examination was used to map the arteries of the upper extremities. 69 out of 481 (12.3%) demonstrated High Brachial artery Bifurcation [25]. The presence of high Brachial artery Bifurcation should be evaluated during vascular mapping prior to an arterio - venous access creation, as it can have a significant impact on the AV access [4].

Embryological Basis

A review of embryological development can to an extent explain this type of variation. Peripheral vascular anomalies are in one way or the other related to the genesis, regression or persistence of one or the other segment of the embryological axial artery [11,26]. Arterial supplies of limb buds are derived from the intersegmental arteries and are supplied by axis artery. Axillary and brachial arteries are formed from the proximal part of the main trunk, the distal part of the trunk persists as an anterior interosseous artery. Last arteries to appear in the forearm are the radial and ulnar arteries.

Radial artery emerges from the main trunk more proximally than the ulnar artery. A new connection is established later by the radial artery with the main trunk near the origin of ulnar artery, the upper portion of the original stem usually disappears to a large extent. The radial artery does not establish a new connection with the main trunk near the origin of ulnar artery if the proximal origin of radial artery fails to disappear. Thus the radial artery originates at a higher level than usual [4].

Conclusion

Clinicians and academicians should be well aware of this commonly occurring variation of higher terminal bifurcation of the brachial artery, with its course well before the cubital fossa and at the level of cubital fossa as it is an important artery of the upperlimb used in various clinical procedures.

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