



A STUDY ON HIGH DIVISION OF BRACHIAL ARTERY AND ITS EMBRYOLOGICAL AND CLINICAL SIGNIFICANCE

Anatomy

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ABSTRACT

Variations in arterial patterns of the upper limb in adult human bodies have been frequently observed either in routine dissections or in clinical practice. The axillary artery continues as brachial artery in the upper limb which is the major artery of the upper limb. It bifurcates into its terminal branches radial and ulnar arteries usually at the level of neck of radius in the cubital fossa. Surgeries of the upper limb require the knowledge of the course of brachial artery. The artery has clinical significance as the artery is used for recording blood pressure, Doppler studies, and arteriography. Hence, knowledge of variations in the course and branching pattern of brachial artery is important. In present case study 4 out of 40 cadavers, on routine dissection of first year MBBS students of Department of Anatomy, Andhra Medical College, Visakhapatnam of axilla and arm, had showed unilateral high division of brachial artery and the branches of brachial artery radial and ulnar artery are seen arising proximal to its division in middle 1/3rd of the right arm.

KEYWORDS

brachial artery, high division, radial artery and ulnar artery, median nerve

Introduction:

Variations in arterial patterns of the upper limb in adult human bodies have been frequently observed either in routine dissections or in clinical practice. The axillary artery continues as brachial artery in the upper limb at the distal border of tendon of teres major which is the major artery of the upper limb. It bifurcates into its terminal branches radial and ulnar arteries usually at about a centimetre distal to the elbow joint at the level of neck of radius in the cubital fossa⁽¹⁾. Studies on brachial artery has presented about 25% major variations in the course and bifurcation of the brachial artery⁽²⁾.

The artery is superficial in its course in the arm lying immediately deep to the deep fascia and is accompanied by a pair of venae comitantes. Many researchers had documented variations in bifurcation of brachial artery most frequently they documented the bifurcation more proximally than usual into radial, ulnar and common interosseous artery⁽³⁾.

The line joining the epicondyles is considered as the reference point to determine the bifurcation of brachial artery. The bifurcation of brachial artery above this line is considered as high division⁽⁴⁾.

Surgeries of the upper limb require the knowledge of the course of brachial artery. The artery has clinical significance as the artery is used for recording blood pressure, Doppler studies, and arteriography. Hence, knowledge of variations in the course and branching pattern of brachial artery are important in the field of orthopedic, vascular and plastic surgeries⁽⁵⁾.

Results:

During routine dissection of first year MBBS students of Department of Anatomy, Andhra Medical College, Visakhapatnam of axilla and arm, four out of 40 of the adult cadavers had showed high division of brachial artery.

CASE 1: High division of brachial artery seen in middle 1/3rd of the right arm. The branches of brachial artery radial and ulnar artery are seen arising proximal to its actual division in middle 1/3rd of the right arm (fig. 1). The course of brachial artery lies completely on the medial side of median nerve in the arm and median nerve is crossing ulnar artery at the cubital fossa (fig.1). The course of radial and ulnar artery was normal in the forearm. The course of brachial artery on the left side was normal.

CASE 2: Right upper limb showing bifurcation of brachial artery (BA) lying posterior to the median nerve (MN). right upper limb showing

division of brachial artery (BA) in the upper third of the arm (the bifurcation of the artery lied posterior to the median nerve). The course of the radial artery (RA) and the ulnar artery(UA) is completely normal lying lateral and medial to the median nerve(MN) respectively (fig 2) Brachial artery on left side is normal.



Figure 1: High division of brachial artery in middle 1/3rd of the right arm. Radial artery present superficial to ulnar artery. Median nerve is present lateral to brachial artery in arm and median nerve is crossing ulnar artery at cubital fossa



Figure 2a. right upper limb showing bifurcation of brachial artery (BA) lying posterior to the median nerve (MN).



Figure 2b. right upper limb showing division of brachial artery (BA) in the upper third of the arm (the bifurcation of the artery lied posterior to the median nerve). The course of the radial artery (RA) and the ulnar artery(UA) is completely normal lying lateral and medial to the median nerve(MN) respectively.

CASE 3: There is bifurcation of brachial artery (BA) in middle of the arm of right upper limb and brachial artery (BA) is medial to the

median nerve (MN). Ulnar artery (UA) and radial artery (RA) are medial to the median nerve (MN) and ulnar artery (UA) is thicker and lies lateral to radial artery (RA). In the lower third of the arm and near to the cubital fossa radial artery seen crossing over the ulnar artery (UA) and median nerve (MN) and comes to lie complete lateral to median nerve (MN) in cubital fossa and continues laterally in the forearm. Ulnar artery (UA) is medial to the median nerve (MN) in the arm and is being crossed by the median nerve (MN) in the cubital fossa. (fig3)



Figure 3. showing bifurcation of brachial artery (BA) in middle of the arm of right upper limb and brachial artery (BA) is medial to the median nerve (MN). Ulnar artery (UA) and radial artery (RA) are medial to the median nerve (MN) and ulnar artery (UA) is thicker and lies lateral to radial artery (RA). In the lower third of the arm and near to the cubital fossa radial artery seen crossing over the ulnar artery (UA) and median nerve (MN) and comes to lie complete lateral to median nerve (MN) in cubital fossa and continues laterally in the forearm. Ulnar artery (UA) is medial to the median nerve (MN) in the arm and is being crossed by the median nerve (MN) in the cubital fossa.

CASE 4: There is bifurcation of brachial artery (BA) in the middle of the arm of right upper limb. The bifurcation is medial to the median nerve (MN). In the middle of the arm radial artery (RA) is completely medial to the median nerve (MN) and ulnar artery (UA). In the lower third of the arm radial artery (RA) crossing ulnar artery (UA) and median nerve (MN) and comes to lie on the lateral aspect in the cubital fossa and continues laterally in the forearm. Ulnar artery (UA) lies medial to the median nerve (MN) and continues medially in the cubital fossa and forearm (fig 4). Other side brachial artery is normal.



Figure 4. showing bifurcation of brachial artery (BA) in the middle of the arm of right upper limb. The bifurcation is medial to the median nerve (MN). In the middle of the arm radial artery (RA) is completely medial to the median nerve (MN) and ulnar artery (UA). In the lower third of the arm radial artery (RA) crossing ulnar artery (UA) and median nerve (MN) and comes to lie on the lateral aspect in the cubital fossa and continues laterally in the forearm. Ulnar artery (UA) lies medial to the median nerve (MN) and continues medially in the cubital fossa and forearm.

Discussion:

Variations in the vascular patterns of upper limb are quiet common which are usually the result of their complex embryonic development. Studies on brachial artery has presented about 25% major variations in the course and bifurcation of the brachial artery(2). The major common variation is high division of brachial artery with high origin of radial and ulnar arteries. Rossi junior et al in their studied had observed this variation in both the upper limbs in only one specimen out of 56 cadavers they dissected thereby concluded that this variation is rare bilaterally(6).

Table no. 1: Variations of brachial artery according to recent literature(7,8):

Variation	Incidence
Superficial brachial artery	3.6% to 9.6%
High bifurcation of the brachial artery	8%
High origin of radial artery	15%
High origin of ulnar artery	2%
High division of a superficial brachial artery	<1%

In our study, unilateral high division of brachial artery was reported in 4 out of 40 cadavers.

Embryological consideration:

Each upper limb of embryo is supplied from axillary artery which is derived from lateral branch of seventh intersegmental artery that is subclavian artery. The proximal part of the main trunk of this artery forms axillary and brachial arteries and its distal part continues as anterior interosseous artery and deep palmar arch. Radial and ulnar arteries are last to become evident in the forearm from the axis artery, that is brachial artery. Initially, the radial artery arises more proximally than the ulnar artery (9). In the cases of our study, there is failure of disappearance of the proximal origin of radial artery, and failed to establish connection with main trunk near the origin of ulnar artery. Thus at a higher level there is origin of radial and ulnar artery.

Conclusion:

The variation of high division of brachial artery and its short course in the arm had been discussed in the present study are quiet common. It is important to have precise knowledge of such vascular variations for surgeons who conduct micro-vascular reconstructive surgeries, radiologists who perform various radiologic diagnostic techniques and for the clinicians in their day to day practice for measurement of blood pressure.

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