



HIGH UP DIVISION AND VARIATIONS IN BRANCHING PATTERN OF BRACHIAL ARTERY – A CADAVERIC STUDY IN EASTERN INDIAN POPULATION

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ABSTRACT Brachial artery is the continuation of axillary artery at lower border of teres major muscle and ends by dividing into radial and ulnar artery at cubital fossa. Variations in the arterial pattern have become area of interest for medical personnel for decades. In present study we dissected 50 upper limbs in our Department and found 8% cases of high up division of brachial artery with mean internal diameter 0.49cm and 0.45cm at its level of formation and termination respectively. Width of radial and ulnar branch was same in 2 cadavers and different in rests out of this 8% cases. In 3 cases radial artery initially was medial to ulnar artery and wound round latter to run on its lateral side. Other branches of brachial artery had normal origin and course. This variation was explained embryologically. This knowledge is important for anatomists, surgeons and physicians.

KEYWORDS : Brachial artery, High division, Radial artery, Ulnar artery.

INTRODUCTION

Brachial artery is the continuation of axillary artery at distal border of teres major muscle. At upper 3rd of arm, it remains medial to humerus and then lies in front of it upto its termination and divides into radial and ulnar artery at the level of neck of radius in the cubital fossa.¹

For last several years the branching pattern of brachial artery has become the area of interest for anatomists, radiologists, nephrologists, surgeons, intensivists and general physicians. In coronary artery bypass surgery², surgery for breast carcinoma³, prediction of late in-stent coronary restenosis^{4,5}, pulsed Doppler sonographic measurement⁶, creation of arterio-venous fistula in end stage renal disease patients⁷, even in routine procedures like blood pressure monitoring, brachial artery is important. For vascular surgeons branching pattern of brachial artery plays important role, mainly during trauma⁸. Radiologists also need profound knowledge regarding the anatomy of this artery for different kinds of imaging studies.

The objective of our study was to enlighten the topographic variation of termination pattern of brachial artery, relative position of radial and ulnar arteries after their commencement, comparison between the two terminal arteries at the site of formation regarding their width, comparison between internal diameters of brachial artery at the site of formation with that of termination.

MATERIAL AND METHODS

This study was conducted over 25 cadavers (50 upper limbs) in the Department of Anatomy, IPGME&R, Kolkata. Dissection was done according to the method described in Cunningham's manual. Brachial artery and its branches were dissected and the following observations were made.

1. Length of brachial artery (from the point of formation to the point of termination in cases of high up divisions).
2. Site of origin of all branches with their course.
3. Comparison between the width of radial and ulnar arteries at commencement.
4. The internal diameter of the brachial artery at the site of its formation and termination (this measurement was taken with the help of slide callipers. After cutting, the artery was spread over the dissection table and its circumference was measured with the help of slide callipers. Finally the diameter was calculated by using the formula, i.e. $2\pi r = \text{circumference}$. $r = \text{radius}$, $2r = \text{diameter}$).

All the measurements were taken thrice and the mean value of each were taken to avoid observational bias.

RESULT

Out of 50 upper limbs we found only 4 (8%), where brachial artery terminated into radial and ulnar artery in upper 3rd of arm (mean length 2.75cm). In rest 46 cases it terminated at the level of neck of radius.

Other branches of brachial artery had normal origin and course. Out of these 4 limbs, ulnar arteries were laterally and radial arteries were medially placed at the time of formation in 3 cases, whereas, in rest 1 case radial and ulnar artery were laterally and medially placed from their commencement (fig: 1). Out of these 3 cases, the terminal arteries crossed each other at upper 3rd (just after formation, fig: 3) of the arm in only 1 cadaver and in rest 2 cadavers crossing occurred at distal half of arm. Rest of the course of these two terminal arteries were normal. In 50% cases with high up bifurcation of brachial artery, the width of radial and ulnar arteries were same (fig: 2 & fig: 4), whereas, in 25% cases radial artery was thicker than ulnar (fig: 1) and in rest 1 cadaver (fig: 3) ulnar artery was wider than radial. The mean internal diameter of brachial artery at its commencement measured 0.49cm and 0.45cm at its termination.

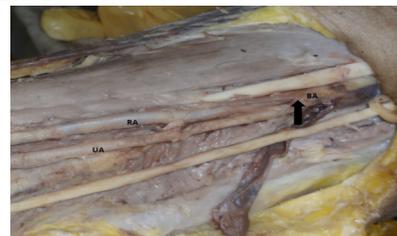


Fig 1 shows division of brachial artery (BA) into radial artery (RA) and ulnar artery (UA) at upper 1/3 of arm, shows point of bifurcation. Thickness of RA>UA

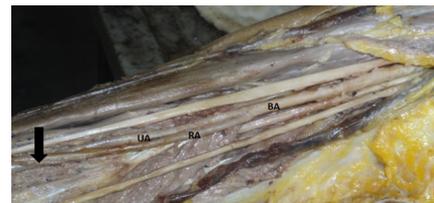


Fig 2 shows bifurcation of brachial artery (BA) into radial artery (RA) and ulnar artery (UA) at upper 1/3rd of arm, crossing over (→) of RA and UA at distal half of arm, thickness of RA=UA

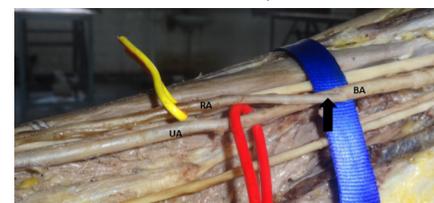


Fig 3 shows bifurcation of brachial artery (BA) into radial artery (RA) and ulnar artery (UA) at upper 1/3rd of arm, crossing over (→) of RA and UA just after formation, thickness of RA<UA

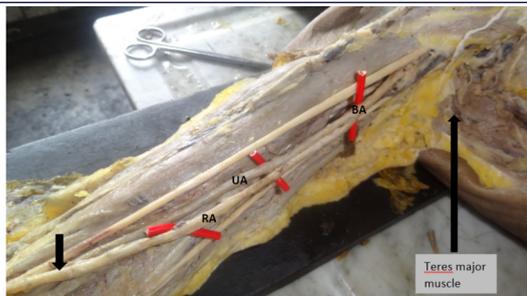


Fig 4 shows bifurcation of brachial artery (BA) into radial artery (RA) and ulnar artery (UA) at upper 1/3rd of arm, crossing over (→) of RA and UA at distal half of arm, thickness of RA=UA

DISCUSSION

Being clinically important, upper limb arteries have been the topic of discussion for last few decades^{8,9,10,11,12,13,14,15,16,17}. Many case reports and several studies from different parts of India as well as the world have been reported. Variations have been described in Gray's anatomy book as the following- the brachial artery divides more proximally than usual into two trunks and then reunite; trifurcates into radial, ulnar and common interosseous arteries; radial artery may arise proximally leaving a common trunk for the ulnar and common interosseous arteries; ulnar artery may arise proximally and rest may continue as common trunk for radial and common interosseous artery¹.

In 2012 Vandana R et al found high division of brachial artery in the proximal 1/3rd of arm in 5% cases¹⁸. High bifurcation of brachial artery was found only in 0.5% cases in 1981 in a study done by Bertolazzo et al¹⁹. In another study of south India Sirikonda et al in 2016 reported 10% cases of high division of brachial artery⁸. A study done in western and eastern India in 2014 by Subhash M Gujar et al reported 3.33% cases of high up division of brachial artery¹⁴. There are several case reports from Northern India regarding high up bifurcation of brachial artery²⁰. In our study we found 8% cases of high up division of brachial artery, within upper 1/3rd of arm.

The mean length of brachial artery in high up division we found 2.75cm. In 5% cases Sirikonda et al found it as 2cm⁸. Chandrika Teli et al reported a case with 1.5cm length of brachial artery in 2013²¹. In 2009, Madhyastha S et al found a case of brachial artery with 4cm length²².

In 2013 Mitra B et al found unilateral high up division of brachial artery with laterally placed ulnar and medially placed radial artery, which crossed ulnar artery at distal half of arm in a Bengali male cadaver¹³. Sirikonda et al found single case, where radial artery was medial initially and then wound round lateral to the ulnar artery in the cubital fossa. We found 6% cases, where initially radial and ulnar artery were placed medially and laterally respectively, finally crossed each other and run normally⁸.

We found only 2 cases where width of two terminal arteries were same, but, one was wider than the other in 0.5% case, among specimens with high up division of brachial artery. In 2016 Sirikonda et al found a single case with thin ulnar artery⁸.

We found mean internal diameter of brachial artery was 0.49cm at its commencement and 0.45cm at its termination, whereas, Pundge et al reported it as 0.47cm and 0.42cm respectively¹⁷.

Arey and Jurjus et al in their studies mentioned six explanations regarding this variation like unusual paths in the primitive vascular plexus, persistence of vessels which get normally obliterated and vice versa, incomplete development, fusion and absorption of parts which are normally distinct and combination of above^{23,24}. In present study, the embryological explanation for variations may be haemodynamic. Variation in different stages of formation of capillary plexus, which gradually differentiate to form different blood vessels of upper limb, may also be responsible for it²⁵.

CONCLUSION

Knowledge about the course of upper limb vessels is important from clinical and surgical point of view both diagnostically and therapeutically²⁶. Our study was an effort to enlighten on the variations

of brachial artery. We found variations in branching pattern of brachial artery, difference in the calibre of the terminal branches and variations in course. We also found that numerous variations were present between person to person and also bilaterally in same individual.

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