

Case Report

Unilateral high division of brachial artery and its clinical significance

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ABSTRACT

Upper limb arterial variations are commonly encountered and have been reported in many articles. The present study showed a high division of brachial artery in the middle third of arm into its terminal branches, the radial artery laterally and the ulnar artery medially. This study is an attempt to discuss the anatomy, embryological basis and clinical implications of such variations. Knowledge of such anomalous vessels is significant from clinical point of view.

Keywords: Brachial artery, Development, Division, Radial artery, Ulnar artery, Variations

INTRODUCTION

The principal source of arterial supply to the arm is brachial artery. The Axillary artery at the distal border of the teres major muscle continues as brachial artery which then terminates at the level of neck of radius distal to the elbow joint into two branches- lateral one is radial artery and medial one is ulnar artery. Other branches taking origin from it are profunda brachii artery, superior ulnar collateral artery, inferior ulnar collateral artery, muscular branches and nutrient artery to humerus.¹ The median nerve is in close relation to the brachial artery. It crosses the artery in front from lateral to medial side in the middle of the arm.²

Frequent variations have been documented related to the division of brachial artery. It divides more proximally than usual into radial, ulnar and common interosseous artery. Sometimes high division of brachial artery results into two arteries approaching the cubital fossa than the usual one.^{3,4} A similar finding is observed in present study.

Brachial artery has several clinical applications such as blood pressure recording and pulsed Doppler sonographic

measurements. Hence, an intimate knowledge of variations in the course and branching pattern of brachial artery is of paramount importance to the physicians, radiologists and plastic and vascular surgeons.⁵

CASE REPORT

The present study was carried in a middle aged embalmed female cadaver during routine dissection of upper limb by undergraduate students in the department of Anatomy at PGIMS, Rohtak, Haryana, India. Skin, superficial fascia, deep fascia and muscles were separated using a scalpel and forceps. The origin, course and branches of vessels and nerve were studied on both the sides.

A high division of brachial artery was seen on the left side of the upper limb. The brachial artery was carefully traced for its origin, course, termination and branches. A variation was seen on the left side of the upper limb where the brachial artery bifurcated into terminal branches in the middle third of the arm (Figure 1).

After origin both medial and lateral branches run inferiorly. Radial artery was laterally placed and

accompanied the median nerve throughout its course. In the cubital fossa, it passed below the median nerve. Ulnar artery was medial in position and was thin in comparison to radial artery. It was almost parallel in course with ulnar nerve and displaced laterally as it reached cubital fossa. The median nerve crossed the brachial artery in front in upper part of arm and came to lie laterally.

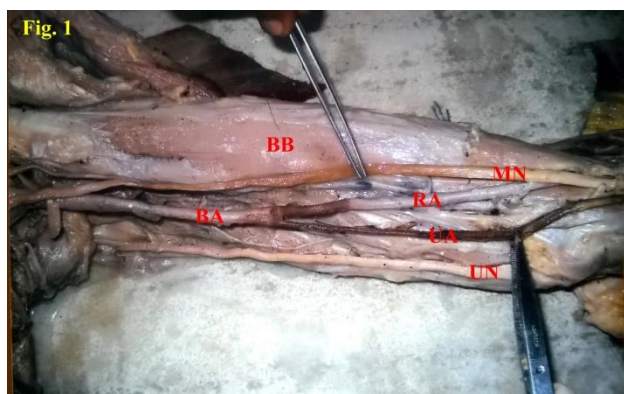


Figure 1: Dissected Specimen of left arm region (anterior aspect) showing biceps brachii muscle (BB), median nerve (MN), brachial artery (BA), radial artery (RA), ulnar artery (UA) and ulnar nerve (UN).

DISCUSSION

Von Haller was the first one to note arterial variation in the upper limb in 1813.^{6,7}

Arey and Jurjus stated following explanations for anomalous vessels: 1) Choice of unusual paths in the primitive vascular plexus; 2) Persistence of normally obliterated vessels; 3) Disappearance of normally retained vessels; 4) Incomplete development; 5) Fusion and absorption of normally distinct parts; 6) Combination of factors leading to an atypical pattern.⁸ In a study involving 750 dissected upper extremities, Mac Cormack et al reported the percentage of major arterial pattern variation as 18.53%.⁹ Rossi Junior et al published a study of 56 cadavers where only one specimen with a bilateral variation (1.78%) was seen.¹⁰ Rodriguez et al described seven arterial variations in upper limb in their study of 384 limbs. In 11% cases, brachial artery was seen coursing superficial to median nerve known as superficial brachial artery.¹¹

Guha et al observed high up division of brachial artery in the middle of the arm just alike our study but with variant median nerve and absent musculocutaneous nerve differing from present study.¹² Kumar and Rathnakar and Elizabeth also reported a high division of brachial artery into radial and ulnar artery similar to present study but differed being present on right side.^{2,13} Satyanarayana et al also mentioned the embryological basis and clinical significance of high division of brachial artery.¹⁴ In his case the median nerve passed superficial to the artery just alike our study. Bidarkotimath et al noted higher division

of brachial artery in two cases.^{6,7} Mitra et al also reported higher bifurcation of brachial artery.¹⁵ Madhyastha et al also observed a case of division of brachial artery in the upper third of arm.¹⁶ Bannur et al reported unilateral higher trifurcation of brachial artery on the right side.⁵

Anomalous blood vessels can be explained on the basis of embryological development of the vascular plexus of limb buds. The lateral branch of 7th inter-segmental artery forms the axis artery of the upper limb bud. The Axillary artery is derived from the proximal part of the main trunk and continues as brachial artery whereas its distal part gives rise to anterior interosseous artery. Radial and ulnar arteries appear relatively late. Radial artery arises more proximally from the main trunk and later establishes a new connection with the main trunk at or near the level of origin of ulnar artery. To a larger extent, the upper part of the main stem disappears. Thus, origin of radial and ulnar artery are at same level.¹⁷ In the present study, proximal origin of radial artery did not disappear and it failed to establish a new connection with the main trunk near the ulnar artery origin. Thus, the radial artery took origin at a higher level and main artery continued as the ulnar artery thereby showcasing the higher division of brachial artery.

A case had been reported where brachial artery bifurcation variant posed a hidden threat during percutaneous brachial artery catheterization technique.¹⁸ Preoperative surgeries of upper limb require an intimate knowledge of such variant pattern along with relation and course of such major vessels.⁹ If such variations could not be identified during surgeries, these may lead to severe secondary hemorrhage.¹⁹

CONCLUSION

Faulty embryological development of limb vessels may lead to anomalous division pattern of major arteries. Such morphological variations bear considerable practical importance for the radiologists, cardiologists, orthopaedic and vascular surgeons and clinicians as well. Brachial artery utilization has been increased for diagnostic and interventional radiology and for blood pressure measurement. Hence possibility of occurrence of such variations should be kept in mind before initiating any clinical procedure.

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