

ORIGINAL RESEARCH

A Prospective Study on the Variations in the Anatomy of Brachial Artery and Its Branching Patterns on Cadavers

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ABSTRACT

Background: Branching pattern of the brachial artery is important during percutaneous arterial catheterization, so as to prevent any complications arising from accidental damage to the anomalous vessel and knowledge of the variations are important for plastic surgeons.

Material and Methods: This study was conducted in the Department of Anatomy with the aim to know the variations in the anatomy of Brachial Artery and its branching patterns. This study included total n = 100 Upper limb specimens.

Results: We included n = 100 specimens in this study. Among 100 specimens, 84% showed normal branching pattern of brachial artery. Rest 16% specimens were showing variations. This study observed that 10% variation of branching pattern of brachial artery by trifurcation near its termination, 2% by Double profunda brachii artery arising from brachial artery, 2% High origin of radial artery & 2% High division of brachial artery.

Conclusion: This study concludes that exact knowledge of these arterial variations is extremely important as these are having frequent injuries and these variations are also involved in various surgeries around the shoulder, arm and fracture management of the humerus as well as multiple microvascular reconstructive surgeries and radiologic diagnostic techniques.

Keywords: Brachial Artery, Braches of Brachial Artery, DPBA.

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INTRODUCTION

The brachial artery is the main artery of the upper limb. The word “Brachial” has been derived from the Greek word Brakhion meaning ‘shorter’. Brachium also means ‘arm’. The brachial artery provides the main arterial supply to the arm. It is a continuation of the axillary artery at the inferior (distal) border of the tendon of teres major muscle and ends at the level of the neck of the radius bone by dividing into radial and ulnar arteries.^[1] The artery runs superficially in the arm, lying just deep to the deep fascia of the antero-medial aspect of the arm.^[2] Its various branches are profunda brachii artery, superior and inferior ulnar collateral arteries, nutrient artery to the humerus and various muscular branches to the arm. Numerous anastomoses have been reported in the brachial artery with proximal parts of radial and ulnar arteries. These anastomoses ensure blood flow during flexion of elbow joint.^[1] For orthopedics, plastic and vascular surgeries, and nephrological, radiological, diagnostic and therapeutic approaches an exact understanding of the origin, course and branching pattern of these arteries are extremely important.

It is extremely important to have the thorough knowledge of the anomalous branching pattern of the brachial artery while performing percutaneous arterial catheterization, so that any accident arising due to puncture of the anomalous vessel can be avoided. In cases of dialysis, the brachial and ante brachial arteries are the first and best choice for making an arterio-venous fistula in wrist as these last longer and are almost maintenance free. Apart from this, the brachial artery is used for measurement of arterial pressure, arterial puncture for gasometry, Flow Mediated Dilation (FMD), cardiac ventriculography and in obstetrics for assessing endothelial function.^[3]

MATERIAL AND METHODS

This study was conducted in the Department of Anatomy with the aim to know the variations in the anatomy of Brachial Artery and its branching patterns. This study included total n = 100 Upper limb specimens.

Data collection

These specimens were taken from human cadavers used for undergraduate studies. Specimens of upper limbs showing gross deformity, asymmetry or partially amputated were considered unsuitable for this study. The dissection was carried out to look for the brachial artery and its branches. The origin of brachial artery and its branches were identified. The branches of brachial artery were traced, cleaned and observed.

RESULTS

Around n = 100 upper limb specimens were included in this study. Among 100 specimens, 84% showed normal branching pattern of brachial artery. Rest 16% specimens were showing variations. This study observed that 10% variation of branching pattern of brachial artery by trifurcation near its termination, 2% by Double profunda brachii artery arising from brachial artery, 2% High origin of radial artery & 2% High division of brachial artery. We observed in this study, all cases of TRI brachial artery was terminating in the cubital fossa into radial, ulnar and radial recurrent arteries. Present study showed that, all cases of DPBA brachial artery showed presence of double profunda brachii artery arising from postero-medial aspect of brachial artery.

We had seen, all cases of HORA originating from proximal one third of brachial artery and coursing superficially in the arm, crossed superficial to median nerve and then descending laterally to it. Radial artery did not give origin to any branches in the arm.

We also studied, in all cases of HDBA after giving rise to profunda brachii artery and superior ulnar collateral artery, the artery was bifurcating in the proximal third of the arm into radial and ulnar arteries.

Table 1: Distribution according to branching pattern

Types	No.	Percentage
Normal	84	84%
Variation	16	16%
TOTAL	100	100%

Table 2: Distribution of cases according to variations of brachial artery

Variations	No.	Percentage
DPBA	2	2%
TRI	10	10%
HORA	2	2%
HDBA	2	2%

DPBA: - Double profunda brachii artery arising from brachial artery.

TRI:-Trifurcation of brachial artery.

HORA:-High origin of radial artery.

HDBA:-High division of brachial artery.

DISCUSSION

Various anatomical variations in the vessels of upper limb have been reported and these may be because of chemical factors, hemodynamic forces, fetal position in the uterus, genetic predisposition as well as due to various developmental anomaly. In the present study, trifurcation of brachial artery was detected in 10% of variations and it terminated in the cubital fossa into radial, ulnar and radial recurrent arteries. Trifurcation of brachial artery was also reported by Patnaik VVG et al.,^[4] in 2002 but it accounted only for 2%. Malcic-Gurbuz et al.^[5] in 2002 reported trifurcation into radial, ulnar and superior ulnar collateral arteries while Bilodi AK in 2004 reported trifurcation into radial, ulnar and common interosseous arteries. In few individuals, profunda brachial artery is also observed and its origin is quite varied. The origin of the profunda brachii artery has been described into seven types by other studies. In the 25% of subjects studied, there are substantial variations in brachial artery as per Compendium of Human Anatomic Variation. The variations of brachial artery are in the form of high proximal division into terminal branches i.e. radial artery (15%), ulnar artery (2%), common interosseous artery, cial median antebrachial artery. The two divisions of high vas aberrans and super division have been reported to occur at any point of time of vessel. In other study, a case of high division of the brachial artery was reported bilaterally and this was located 20 cm above the right cubital fossa and 21.5 cm from the left one close to the axilla in a male cadaver (1.78%).

This bilateral high division of the brachial artery is extremely rare. In a 2002 study of Quarrat-Ul-Ain et al.^[6] high division of brachial artery was reported in two out of 88 upper limbs of cadavers. It has been observed that the bifurcation of the brachial artery was a major site for embolism and a high bifurcation may lead to ischemia of a larger area. It has been reported that High origin of radial artery (HORA) is the commonest arterial variation in the upper limb of 9.75% of angiographic studies and 20.3% of the dissected specimens. In 2001 Rodriguez et al,^[7] reported high origin of radial artery in 39 (20.3%) out of 384 upper limbs. Anastomosis of brachioradial artery has been observed through a vessel with a sling like loop or rectilinear form with brachial artery at the cubital fossa. Persistence of the embryological vessel explains the embryological basis of proximal or initial segment of radial artery which gives rise to high origin of radial artery. These variations in the radial artery anatomy may sometimes lead to disappointments in Transradial procedures. To avoid these failures, imaging of the radial artery can thus be advised before these procedures.

The axial artery of the upper limb originates from the lateral branch of the 7th cervical inter-segmental artery. In the fetus, the main arterial trunk extends towards the ventral axial line and ends in capillary plexus of the developing limb bud. From the proximal part of this trunk, axillary and the brachial arteries originate and the distal part grows into the anterior interosseous artery and the deep palmar arch. The ulnar artery originates from a branch of brachial trunk and grows down the ulnar side of the forearm. On the other hand, the radial artery in the earlier part of fetal life arises proximal to the ulnar artery and later on it arises near the level of origin of the ulnar artery. This earlier part regresses almost completely. During the fetal development, the profunda brachii, nutrient branch and ulnar collaterals outgrow from the primary axial vessel.

In the upper extremity, various arterial variations are frequently observed. The upper limb arteries have been reported by Rodriguez-Niedenfuhr et al,^[8] to be originating at the same rate as the limb from an initial capillary plexus that grows from the dorsal aorta.

CONCLUSION

It has been an established fact that these variations appear by remodeling processes involving persistence, enlargement and differentiation of selected parts. Exact knowledge of these arterial variations is extremely important as these are having frequent injuries and these variations are also involved in various surgeries around the shoulder, arm and fracture management of the humerus as well as multiple microvascular reconstructive surgeries and radiologic diagnostic techniques. This anatomical knowledge is also important for cardiac catheterization and arterial grafting. As the transradial approach angioplasty and percutaneous coronary procedures has the benefit of minimizing the technical site complications in comparison to transfemoral approach.

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