Original Research Paper Anatomy

STUDY OF VARIATIONS IN THE BRANCHING PATTERN OF UPPER LIMB ARTERIES AND ITS EMBRYOLOGICAL SIGNIFICANCE

Dr. APARNA GULLAPALLI

Associate Professor, Department Of Anatomy, NRI MEDICAL COLLEGE, CHINNAKAKANI, GUNTUR District, ANDHRAPRADESH . PIN:522503.

ABSTRACT

Back Ground: The arterial variations in upper limb can occurs at the level of axillary, brachial, radial and ulnar arteries as well the palmar arches. Observed variations in branching patterns in radial arteries.

Material & Methods: In branching pattern of axillary arteries observed variations in 30 upper limbs in cadavers, Department of Anatomy at NRI Medical College, chinnakakani, Guntur.

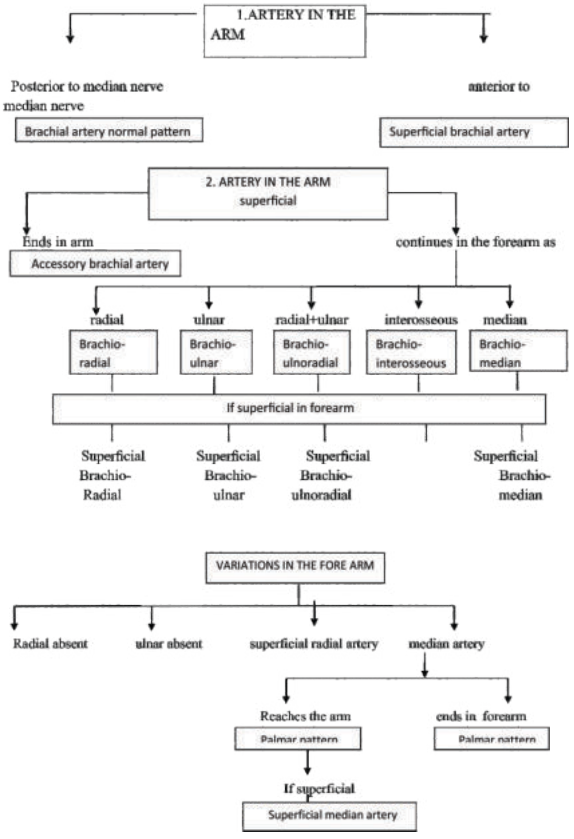
Results: Out of 30 upper limbs; 9 limbs have arterial variation, the rest are normal.

Conclusion: The knowledge of neuro vascular variation of upper limb arteries are important for surgeons who remove axillary lymph nodes, to surgeons who remove axillary lymph nodes, to anesthesiologists, orthopedic surgeons & also important in vascular & reconstructive surgery.

KEYWORDS : Axillary artery, Branchial artery, Radial ulnar arteries.

Introduction:

Variations concerning the arterial patterns in the upper limb are in high incidence. Such variations are given different terminology & of different criteria for classifying & sub classifying them by Schwalbe, [7]; Breme [1]; Muller [4]; Adachi [2]; Skopakoff [6]; Wankoff [8] ; Fuss et al [3]. Based on this criterion and terminology, the previous classifications and sub classifications are revised by Rodriguez-Niedenfudr et al[9] .



According to compendium of Human anatomic variation, major variations are present in about 25% of the brachial artery; variation in radial arteries 15%; ulnar arteries 2%.

Embryological patterns in the arteries of the arm are explained by singer E [5] & Arim kumarDutta[18].

Shiny vinila[17] et al reported high origin of radial artery with asymmetrical vasculature of upper limb.

The present study was designed to establish the anomalies in the branching pattern of the upper limb arteries are attributed to variations in the embryonic development.

Materials & Methods:

The cadaveric specimens for the study were obtained from the department of Anatomy, NRI Medical College, Chinakakani, Guntur.

Results & Discussion:

The axillary artery is continuation of sub clavian artery at outer border of 1st rib. The branchial artery was continuation axillary artey at lower border of teres major and bifurcating into radial and ulnar arteries at neck of radius.

Out of 30 specimens, the following variations have been observed and are correlated with embryological explanation;

1) In two cases (6%), the division axillary artery (high bifurcation of brachial artery) arises from 2.5cm below the lower border of teres major. (Fig:1)

Fig:1 showing high bifurcation of brachial artery
BA- brachial artery; RA- radial artery; UA- ulnar artery

2) In one arm (3%) the 2nd part of axilary artery gave common trunk (CT) for lateral thoracic & sub scapular and cercumflex scapular arteries.(Fig:2)

Bhargava[13] considered this common trunk as an original axillary brachial trunk, which failed to develop in early fetal life and became obstructed.

Some authors reported, that the CT arises from the 3rd part of axillary artery[10,11,12].

Fig2; 2nd part of axillary artery showing CT

AA-axillary artery, TAT- thoracoaromial artery,CT-common trunk, LTA-lateral thoracic artery, SSA-sub scapular artery, DSA- dorsal scapular artery, CSA- circumflex scapular artery

3) In 2 cases (7%), the interoseous median artery arised from interoseous trunk and runs with AIA (Fig:3)

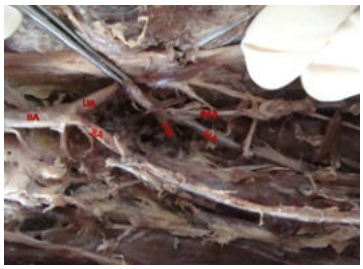


Fig3; showing IMA

IMA- interoseous median artery, AIA-anterior interoseous artery, PIA-posterior interoseous artery

4} In another specimen, the superior ulnar collateral branch is arising from profunda brachi. The radial recurrent branch is arising from ulnar artery. (Fig:4,5)

Fig:4, showing arising of SUCA

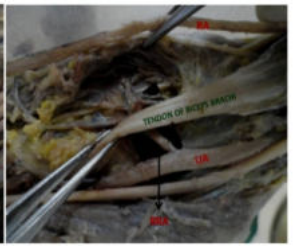


Fig:5, showing RRA from UA

BA- brachial artery; UA-ulnar artery
PBA- profunda brachi artery; ; RRA-radial recurrent artery;SUCA- superior ulnar collateral branch RA- radial artery

5) In two (7%) specimens, the SRA, communicated with the original brachial artery in cubital fossa. SRA purshed a superficial course in forearm& entered dorsum of hand by running superficial to the extensors and long adductor of thumb. In 1st dorsal inter digital space it has given radialis indicis artery. (Fig: 6 ,7)

Fig:6, showing CB
CB-communicating branch

Fig:7, SRA giving branch to RIA
RIA-radial indicis artery

The incidence of the type of superficial artery reported here (with division into its two terminal branches - radial and ulnar - in the (cubital fossa) is 7% according to Skopakoff [6]

High origin of the radial artery is not uncommon. In a retrospective review by Celik et al[19]., high origin of the radial artery from the brachial artery was the most frequent variation, found in 87.5% of all variations.

6) In one specimen the superficial radial artery formed a diamond shaped an anastomotic arcade at first dorsal interoseous space. From this radial arcade, the arteria princeps pollicis branch and radialis indicis branch and a branch to superficial palmar arch is arises. (Fig:8)

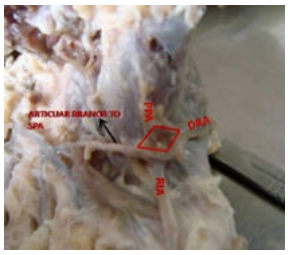
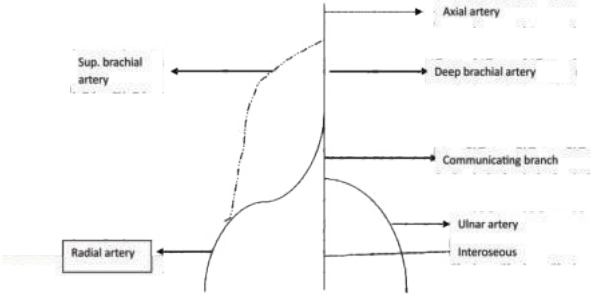


Fig:8, showing arterial arcade DRA-deep radial artery, PPA-princeps pollicis artery

Embryological explanation:

Variations in branching pattern are due to defects in embryonic development of the vascular plexus of upper limb bud. This may be due to an arrest at any stage of development of vessels followed by regression, retention or reappearance, thus leading to variations in the arterial origin and course of major upper limb vessels. Such anomalous branching pattern may represent persisting branches of the capillary plexus of the developing limb buds and their unusual course may be a cause for concern to the vascular radiologists and surgeons, and may lead to complications in surgeries involving the axilla and pectoral regeions

The axis artery of upper limb is derived from the lateral branch of the seventh intersegmental artery . The superficial brachial artery develops in axillary region from the axial trunk and continuous superficially in the arm on lateral side. At the elbow, an anastomotic branch develops between the main trunk of brachial artery and existent superficial branchial artery proximal part of superficial radial artery regresses and distal portion enlarges to form the radial artery proper.



There is significant embryological explanation for variations in the arterial patterns of upper limb. According to Singer staging of development.

Stage1: The lateral branch of seventh intersegment artery, i.e., subclavian artery extends to the wrist and terminates by forming capillary plexus; its distal portion forms the anterior interosseous artery.

Stage 2: Median artery arises from the anterior interosseous artery grows along the median nerve to communicate with palmar capillary plexus. By this time the anterior interosseous artery undergoes regression.

Stage 3: The ulnar artery arises from brachial artery and unites distally with the existing median artery to form superficial palmar arch.

Stage 4: The superficial brachial artery develops in axillary region from the axial trunk and traverses the medial surface of the arm, runs diagonally from the ulnar to the radial side of the forearm to the posterior surface of the wrist to divide over the carpus into digital branches.

Stage 5: Three changes occur simultaneously. . One among these three is development of an anastomotic branch at elbow between the main trunk of brachial artery and the existent superficial brachial artery.

In present study, the presence of median artery findings goes with stage 2.

The superficial brachial artery persisted instead of regression and showed continuation with the rest of the radial artery and probably the short arched communicated vessel might be the original artery at its commencement and these findings goes with the description given in Singer's stage 4

Clinical importance

The knowledge of such variation is important for the diagnostic, interventional and surgical procedures. Nowadays, the superficial radial artery is widely used for coronary artery by-pass graft surgery (CABGS), it may be mistaken for a vein and accidental injection of drugs in this artery may result in complications.

Knowledge of branching pattern of axillary artery is necessary during antegrade cerebral perfusion in aortic surgery14, while treating the axillary artery thrombosis15, using the medial arm skin flap16, reconstructing the axillary artery after trauma, treating axillary artery hematoma and brachial plexus palsy, considering the branches of the axillary artery for the use of microvascular graft to replace the damaged arteries, creating the axillary-coronary bypass shunt in high risk patients, catheterizing or cannulating the axillary artery for several procedures, during surgical intervention of fractured upper end of humerus, and shoulder dislocations. Therefore, both the normal and abnormal anatomies of the axillary artery should be well known for accurate diagnostic interpretation and surgical intervention.

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