A Series Of Study Of Anatomic Variation On Arterial System Of Upper Limbs In Nepalese Cadavers.

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Abstract

The arteries supplying the upperlimb exhibit lots of variations. The present study was conducted on 102 upper limbs of 51 Nepalese bodies (30 males and 21 females). The objective was to find out the variations, if any in prevailing branching pattern of arteries in upper limb of Nepalese population. Arterial variation at axillary, arm, forearm and palmar level had been noted. Various types of variation and their clinical implications are discussed.

Key words: Upper limb, arterial variation, axillary, forearm, palmar level.

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Introduction:

Variations in the origin, branching and course of the principal arteries of the upper extremities have long received the attention of anatomists, surgeons, cardiologists and particularly vascular specialists. The arterial pattern of the human upper limbs shown in text books is rarely encountered with major and minor variations being well documented. Often the arterial system of upper limb found in cadaver is very confusing to student because of the great variability from the descriptions and illustrations in text books and atlases. Analysis of series of dissections have been recorded but without uniformity of results.

Normality in anatomy consist of range of morphologies that are most typical and others less frequent, which are called variations and not considered abnormal.\(^1\) The normal arterial system in upper limb is that subclavian artery continues as axillary artery from outer surface of first rib. The axillary artery gives off superior thoracic artery from its first part, thoracoacromial and lateral thoracic from its second part and subscapular, anterior and posterior circumflex humeral from third part. Then it becomes the brachial artery when it crosses the lower border of teres major muscle. Brachial artery gives off profunda brachii and radial and ulnar collateral arteries in the upper arm. The brachial artery ends in the cubital fossa dividing into radial and ulnar arteries. Radial artery gives off radial recurrent artery and ulnar artery gives off common interosseous and ulnar recurrent arteries in the cubital fossa. Ulnar artery forms the superficial palmar arch of the hand with superficial palmar branch of radial artery whereas the radial artery forms the deep palmar arch with the deep branch of ulnar artery.\(^2\)

Many authors have published different series of reports about arterial anomalies of the upper extremities. This article is based on analyses of series of studies of anatomic variations of arterial system of upper limb that was carried out on 102 upper limbs.
**Materials and Methods:**

One hundred and two dissected upper limbs belonging to 51 cadavers (30 males; 21 females) were studied in Anatomy department of Manipal College of Medical Sciences and BP Koirala Institute of Health Sciences. Observations were made and detail findings on arterial systems, either normal pattern or variations, were noted down. The observations were made at four levels:

A) At Axillary level
B) Arm level
C) Fore arm level
D) Palmar level.

**Results:**

The types of variations and their frequency in percentage following the observation of 102 upper limbs:

The study result showed that superior thoracic artery was absent in 63.7% of total cases. Superior thoracic artery arose from thoracoacromial artery in 3.9% cases. Common trunk arising from second part of axillary artery and giving of lateral thoracic artery, subscapular artery and posterior circumflex humeral artery in 18.7% cases. Posterior circumflex humeral artery arose from subscapular artery in 1.8% cases. Lateral thoracic artery was found from thoracoacromial artery in 0.9% cases. Subscapular artery from second part of axillary artery was seen in 0.9% cases. Lateral thoracic artery from subscapular artery was found in 0.9% cases.

At arm level high division of brachial artery into radial and ulnar artery was found in 4.9% cases. Absence of collateral arteries and profunda brachii continued as muscular branch was seen in 0.9% cases.

At forearm level communication between radial and ulnar arteries was existed in 0.9% cases. In 12.7% cases there were common interroseeous artery arising from radial artery. Superficial ulnar artery was observed in 1.8% cases. Presence of median artery was seen in 0.9% cases.

At palmar level superficial palmar arch was found by ulnar artery alone in 31.3% cases. In 0.9% cases deep palmar arch got no contribution from ulnar artery.
Discussion:

Variations in the arterial anatomy of the upper extremities are quite common. Muhammad Saeed et al. observed in 3.8% cases a bilateral common subscapular-circumflex humeral trunk emerging from the 3rd part of the axillary artery and branching into the circumflex humeral and thoracodorsal arteries, and in 1.9% cases a bilateral thoracohumeral trunk arising from the 2nd part of the axillary artery and branching into the lateral thoracic, circumflex humeral, subscapular, and thoracodorsal arteries. Durgun et al. also observed, on the right side, the subscapular artery gave rise to a large posterior circumflex humeral artery in addition to the thoracodorsal and circumflex scapular arteries. In the study of Mildred Trotter on 384 arms, it was found that the supreme thoracic (superior thoracic) and the thoracoacromial originated from the axillary in all but five arms; in four of these, which were right arms (two white males, one negro male and one negro female), the supreme thoracic originated from the thoracoacromial and lateral thoracic arose from subscapular in 5 white-male axillae (6 percent), in 10 negro-male axillae (11 percent), in two white-female axillae (2 percent), and seven negro-female axillae (8 percent), lateral thoracic arose from the thoracoacromial in 3 white-male axillae (3 percent), in one negro-male axillae (1 percent), and in one negro-female axilla (1 percent). When the posterior circumflex came from the subscapular (in fifty-one axillae), the lateral thoracic arose from the subscapular also in four white-male axillae (8 percent), in five negro-male axillae (10 percent), and in three negro-female axillae (6 percent); and from the thoraco-acromial in three white-male axillae (6 percent), in three negro-male axillae (6 percent), and in one negro-female axilla (2 percent).

Bergman et al. also found the axillary artery giving rise to a common trunk for the subscapular, anterior, and posterior humeral circumflex, profunda brachii and ulnar arterial collateral arteries. BJ Anson reported origin of superior thoracic artery from thoracoacromial artery and also observed the origin of subscapular artery from second part of axillary artery. Gardner E, Gray DJ, O Rahilly R observed origin of thoracoacromial artery from either first or second part of axillary artery. Origin of lateral thoracic artery from thoracoacromial or subscapular arteries is also reported in text book of anatomy written.
Patnaik, Kalsey, Singla Rajan K, in their study of 50 upperlimbs of 25 cadavers, reported the absence of superior thoracic artery in 10% cases. De Garis et. al found from their study of arterial variations of upperlimb that circumflex arteries arose by a common trunk in 8% cases, lateral thoracic from subscapular artery in 6% cases. Superior thoracic from thoracoacromial in 0.01% cases and absence of thoracoacromial and various branches arose directly from axillary artery in 0.01% cases.

The present study showed that superior thoracic artery was absent in 63.7% of total cases, superior thoracic artery arose from thoracoacromial artery in 3.9% cases, common trunk arising from second part of axillary artery and giving of lateral thoracic artery, subscapular artery and posterior circumflex humeral artery in 18.7% cases. Posterior circumflex humeral artery arose from subscapular artery in 1.8% cases. Lateral thoracic artery was found from thoracoacromial artery in 0.9% cases. Subscapular artery from second part of axillary artery was seen in 0.9% cases. Lateral thoracic artery from subscapular artery was found in 0.9% cases.

B. Durgun et. al also found that radial and ulnar arteries arose from the brachial artery at the level of arm and also observed the arciform anastomosis between the radial and ulnar arteries. Jurjus et. al., in a case report, found no collateral arteries and profunda artery terminated as muscular branches. M.R. Kumar reported a large median artery arising from the main trunk of ulnar artery proximal to the origin of the common interosseous artery. Karlsson and Niechajev observed high origin of radial artery in 3.47% patients and in 0.43% patients ulnar artery had a high origin from the brachial artery. In the present study, high division of brachial artery into radial and ulnar artery at arm level was found in 4.9% cases, absence of collateral arteries and profunda brachii continued as muscular branch was seen in 0.9% cases and communication between radial and ulnar arteries was existed in 0.9% cases. Ajay Udayavar reported common interosseous artery arising from radial artey. In present study we also reported the radial artery giving common interosseous artery in 12.7% cases.

Fadel RA et. al, Yazar F et. al and Yildrim M et. al reported the Superficial ulnar artery. In present study it was observed in 1.8% cases. Colman and Anson studied the pattern of arterial arches of hand and found the incomplete superficial palmar
arcs in 21.5% cases and in 3% cases there was incomplete deep palmar arches. The deep palmar arch was found to be comparatively less variable than superficial palmar arch.\textsuperscript{23} In the present study superficial palmar arch was found by ulnar artery alone in 31.3% cases and in 0.9% cases deep palmar arch formed by radial artery only. This study also showed that superficial palmar arch more variable than deep palmar arch in line with Colman and Anson.

**Clinical Relevance:**

A thorough knowledge of the vasculature of the axilla and upper limb is of crucial clinical importance. The upper limb is frequently the site of trauma and other pathology like frequent abscess formation in axilla, space infection of palmar spaces, and various joint disease in joints of upper limb which all require interventions that demand of proper anatomical knowledge, especially of its regional blood vessels and lymphatics as well as their possible variations. Axillary lymph node dissections is an important part of many cancer operations, particularly those involving removal of breast.\textsuperscript{24} Surgeons should make every effort to preserve and protect, among other structures, the axillary artery and vein. Anomalous origin and distribution of the arteries in upper limb make them more vulnerable to trauma during surgery. Such aberrations may cause difficulty for cardiologists in catheterization of the artery\textsuperscript{25,26} for radiologists in making radiological diagnosis, surgeons especially during raising the myocutaneous flap for surgical reconstruction and orthopaedic surgeons while dealing with trauma and disease of joints and bones of upper limb. Therefore both the normal and variant anatomy of the region should be well known for accurate diagnosis, better treatment and avoidance of iatrogenic injuries during interventional vascular procedures.
**Fig. 1** A Common trunk from third part of Axillary artery giving rise to lateral thoracic, Subscapular and continuing as posterior circumflex humeral artery.

AA – Axillary artery
PM – Pectoralis minor muscle
ST – Superior thoracic artery
TA – Thoracoacromial artery
AV – Axillary vein
LT – Lateral thoracic artery
MB(SA)– Muscular branch to serratus anterior muscle
SSA – Subscapular artery
TD – Thoracodorsal artery
TDN – Thoracodorsal nerve
PCH – Posterior circumflex humeral artery
CS – Circumflex scapular artery
LD – Lattisimus dorsi muscle
BA – Brachial artery
MN – Median nerve
BIB – Biceps brachii muscle
ABSJ – Articular branch to shoulder joint
Fig. 2 Higher division of brachial artery into radial and ulnar arteries.

UA – Ulnar artery  
RA – Radial artery  
BA – Brachial artery  
MN – Median nerve  
UN – Ulnar nerve  
BB – Biceps brachii muscle
References:


