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A STUDY OF VARIATION IN BRANCHING PATTERN OF AXILLARY ARTERY

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ABSTRACT

Aim: To study variations in the branching pattern of axillary artery.

Material and method: The study was conducted at R.N.T. Medical College, Udaipur (Rajasthan) on 60 Upper Limbs of 30 adult cadavers (20 males and 10 females)

Results: During our study we have noticed anomalies in branching pattern in about 33% of cadavers. Some rare variations like absence of profunda brachii artery and its replacement by descending branches from posterior circumflex humeral artery, origin of profunda brachii artery from II part of axillary artery were also noticed during the study.

Conclusions: Knowledge of variations is important especially for orthopaedic and vascular surgeons to avoid complications during various surgical procedures in axillary regions and during angiographies respectively. Various clinical implications of variations in branching pattern are discussed in this study.

Key Words: Axillary artery, Variations in branching pattern

INTRODUCTION

Axillary artery is a continuation of the subclavian artery at the outer border of the first rib. The course of axillary artery is anatomically divided into three parts by the pectoralis minor muscle. The first part begins at the lateral border of the first rib and extends to the superomedial border of the pectoralis minor muscle. The second part lies deep to pectoralis minor muscle and third part lies between the inferolateral border of the pectoralis minor and the inferior border of the teres major muscle¹. The first part of the artery gives superior thoracic artery. The second part gives lateral thoracic and thoracoacromial artery. The third part gives subscapular artery, anterior and posterior circumflex humeral artery². It is very common to find the variations in the branching pattern of axillary artery. Knowledge of variations is important for orthopaedic surgeons as well as for vascular surgeons to avoid complications during various surgical procedures.

MATERIAL AND METHOD

The study was conducted at R.N.T. Medical College, Udaipur (Rajasthan) in 60 Upper Limbs of 30 adult cadavers (20 males and 10 females). Dissection of pectoral,

axillary region, arm and forearm was done according to the steps described in Cunningham's manual of practical anatomy³. Skin and superficial fascia were removed. pectoralis major and then pectoralis minor with clavipectoral fascia were studied and separated. During dissection of axilla, axillary artery and brachial plexus were cleaned and studied.

Observations: All the branches of three parts of axillary artery were carefully dissected and their relations with brachial plexus were studied. Variations in the branching pattern arising from three parts of axillary artery were recorded and photographed. Normal branching pattern was observed in about 40 upper limbs (67%). In 10 upper limbs (16.6%) anomalous branching pattern was found in II part of the artery while in another 10 upper limbs (16.6%) branching pattern variations were observed in III part. Some rare variations were also found during the study. One of the case showed profunda brachii artery from II part and while another showed bilateral absence of profunda brachii artery and its replacement by descending branch from posterior circumflex humeral artery.

Variations in the I part of axillary artery: No variation was observed in the 1st part of axillary artery.

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Superior thoracic artery maintained its usual course.

Variations in the II part of axillary artery: (1) In 8 upper limbs (13%), bilaterally a common trunk from II part gave origin to posterior circumflex humeral artery, subscapular artery and lateral thoracic artery (Fig 1) while anterior circumflex humeral artery branched normally from III part of axillary artery.

(2) In one upper limb (2%) profunda brachii artery was from II part (Fig 2). Anterior and posterior circumflex humeral artery and subscapular artery branched from a common trunk of this profunda brachii artery.

(3) One upper limb (2%) had unilateral common trunk for lateral thoracic artery, posterior circumflex humeral artery, subscapular artery and circumflex scapular artery.

Variations in III Part of axillary artery: As already mentioned III part of 13% upper limbs didn't have any branch. All the branches of III part were from II part of the artery. In another 13% of limbs a common trunk for origin of anterior and posterior circumflex humeral artery and subscapular artery was observed.

An interesting variation was noticed in one of the upper limb (approx.3%) as bilateral absence of profunda brachii branch. Additionally we also observed on right side - (Fig 3) Anterior and posterior circumflex humeral arteries and subscapular arteries were originating from a common trunk from III part. Profunda brachii artery was absent. Brachial artery divided into radial artery and ulnar artery at the level of insertion of coracobrachialis. In posterior compartment of arm posterior circumflex humeral artery had a large descending branch which continues along with the radial nerve. Median nerve was lateral to both axillary artery and radial artery. Median nerve passed deep to radial artery and then superficial to ulnar artery to gain its medial relation in elbow. On left side (Fig 4) II part of artery after giving lateral thoracic and thoracoacromial branches divided into two branches, a medial branch and a lateral branch. From the medial branch a common trunk for anterior and posterior circumflex humeral and subscapular artery was present. On tracing posterior circumflex humeral artery (Fig 5) in posterior compartment of arm a large descending branch from this artery continued along with radial nerve. Radial collateral and middle collateral branches were found to be from this descending branch which was probably due to absence of profunda brachii artery. Median nerve was formed in front of the medial branch. Lateral branch was superficial to the lateral root and musculocutaneous nerve. In the arm the medial branch followed the course of brachial artery and in forearm as ulnar artery and the lateral branch coursed as radial artery. Median nerve was medial to medial branch throughout its course in arm and then to ulnar artery in elbow.

The arteries of the limbs arise as a number of vessels contributing to a primitive capillary plexus, but eventually only one trunk – the subclavian – persists, and it has the positions and relations of the seventh intersegmental artery and probably represents its lateral branch. The main trunk to the upper limb, later forms the axillary and brachial arteries.⁴ The radial and ulnar arteries are the latest arteries to appear in the forearm. The anomalous blood vessels may be due to⁵

- (i) the choice of unusual paths in the primitive vascular plexuses,
- (ii) the persistence of vessels normally obliterated,
- (iii) disappearance of vessels normally retained,
- (iv) incomplete development and
- (v) fusions or absorption of the parts usually distinct.

Variations in branches of axillary artery are frequently found. Branches may arise together or their subbranches may be given off directly by main artery. Thus, instead of six, the branches may total anywhere from 5 -11. A rare but striking anomaly arises when instead of continuing as a single brachial artery, the axillary artery divides in the axilla into two branches. On entering the arm, one of the branches usually runs more superficially and may represent the radial or ulnar arteries, the deeper branch usually correspond to the brachial artery proper⁶. In our observation also in one of the case axillary artery has divided into two branches in axilla. Superficial one is continuing as Radial Artery and deeper one has given origin to all the branches of axillary artery and continues as brachial artery proper and then ulnar artery. (Fig-3)

Numerous type of variations in branching pattern of axillary artery are reported by various workers. Gaur S et al (2012)⁷ have reported that variations in branching pattern are found in about 28% of cases. We have observed variations in about 40% of the cases. Variations in the branching pattern (8%) of III part is the most frequently noted anomaly by them. During our study also we have reported variations in the origin of branches of III part most commonly. Absence of profunda brachii and its replacement by posterior circumflex humeral artery is reported by K.G.Rao et al (2012)⁸ also where posterior circumflex humeral artery had a hair pin bend like course. In our study we have also observed absence of profunda brachii artery and its replacement by a descending branches of posterior circumflex humeral artery. This variation was reported bilaterally by us. A common trunk for all the branches of II and III part of artery was noticed by Chitra et al (2013)⁹. Srimathi T (2011)¹⁰ have reported a common trunk for Thoracoacromial, Lateral thoracic, subscapular and posterior circumflex humeral

artery from II part of artery. Sharma T et al (2009)¹¹ and Sawant S. et al (2012)¹² have reported bilateral superficial brachial artery. In a study by Yang H et al (2008)¹³ in 304 extremities in Korea, superficial brachial artery was found in 12.2% of cases and is one of the commonest arterial variation found in that area. Division of superficial brachial artery into radial and ulnar artery is the commonest type of termination here. Considering the frequency of variations in the branching pattern of axillary artery it is important for the orthopaedic and vascular surgeons to be aware of these anomalies to avoid complications during the surgical procedures. Abnormal course of posterior circumflex humeral artery has been reported to be a cause of Quadrangular space syndrome by K.G.Rao et al (2012)⁸. There is extensive collateral circulation associated with the branches of subclavian and axillary arteries particularly around scapula so that the sound knowledge of neurovascular variation is important for surgeons. Anomalous origin of the radial artery may cause the failure of the radial approach of the coronary angiography¹⁴ and in the reconstructive surgery of the upper limb it can be ligated or cut considering it as a vein leading to disorder in circulation of the hand¹⁵. When the superficial brachial artery persists it is more vulnerable to the accidental injuries,¹³ it can be easily mistaken as a vein and intravenous injections into it can be disastrous.¹⁶ Knowledge of branching pattern of axillary artery is useful during antegrade cerebral perfusion in aortic surgery¹⁷, while treating axillary artery thrombosis, reconstructing axillary artery after trauma, using the artery for microvascular graft to replace damaged arteries, creating axillary coronary bypass shunt in high risk patients¹⁸ and during surgical procedures of fractured upper end of humerus. Thus we see that accurate knowledge of the normal and variant arterial pattern of the human upper extremities is important both for reparative surgery and for angiography¹⁹.

CONCLUSION

Variations in branching pattern of axillary artery are found frequently. We have noticed variations in about 33% of cases. Most of the variations are noticed in III part of axillary artery. No variation is reported in Ist part of the artery. Knowledge of variations is important for orthopaedic and vascular surgeons to avoid complications during various surgical procedures in axillary regions and during angiographies respectively.

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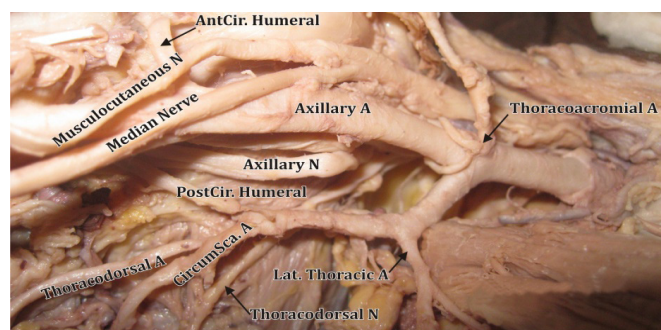


Figure 1: A common trunk from II part of axillary artery.

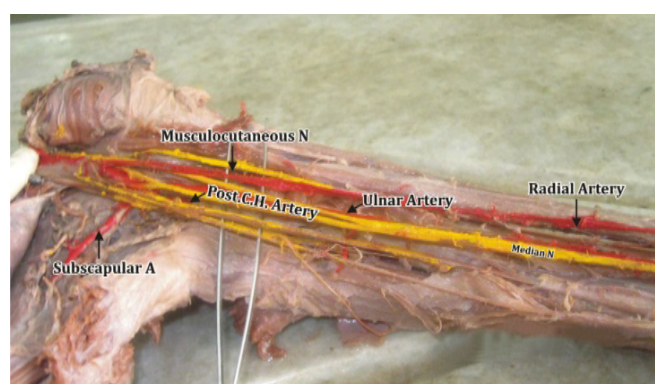


Figure 4: Left Upper limb Showing - II part of Axillary artery divided into Radial and Ulnar artery and absence of profunda brachii artery.

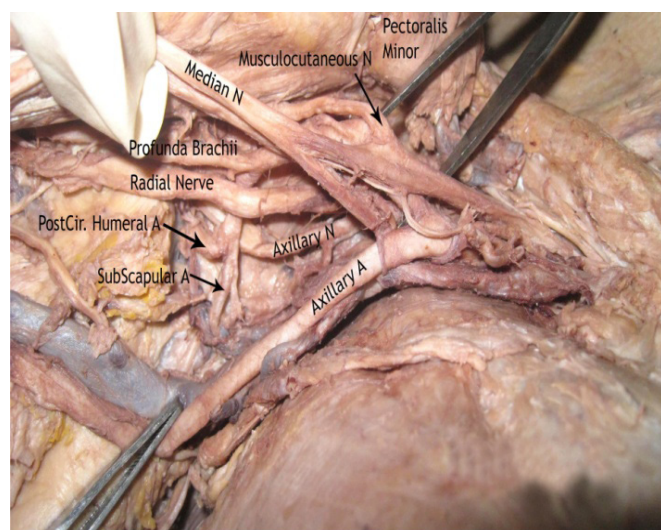


Figure 2: A common trunk from II part of axillary artery.

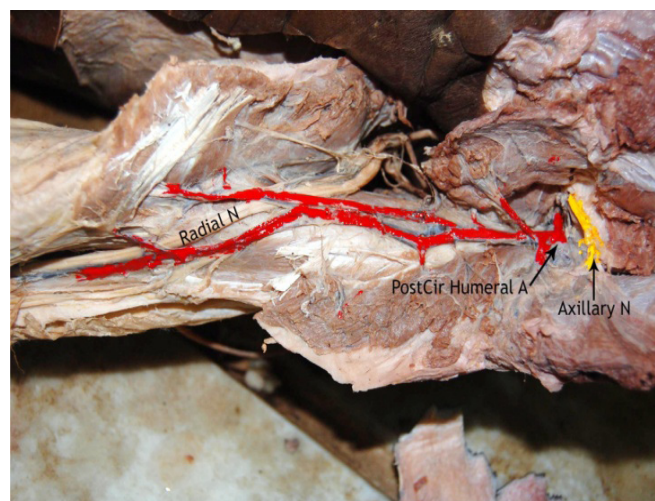


Figure 5: Descending branches from Posterior circumflex Humeral artery continues as Profunda.

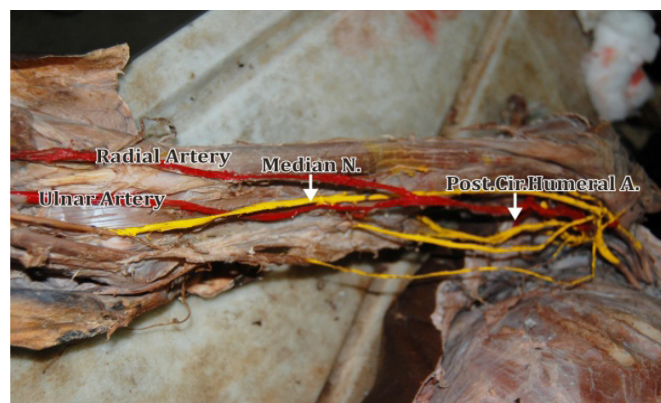


Figure 3: Right Upper Limb Showing Higher Division of Branchial artery and absence of Profunda Brachii Artery.