

The Study of Variations in the Branches of Axillary Artery

Sharadkumar Pralhad Sawant¹, Shaguphta T. Shaikh² and Rakhi Milind More³

^{1, 2, 3} Department of Anatomy, K. J. Somaiya Medical College, Somaiya Ayurvihar, Eastern Express Highway, Sion, Mumbai, India

Correspondence should be addressed to Sharadkumar Pralhad Sawant, dr.sharadsawant@yahoo.com

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Abstract The outer border of the first rib manage the axillary artery which is the extension of the subclavian artery and three parts of the course of the axillary artery leads to this outer border. Axillary artery has six branches where branches of subclavian and axillary arteries around the scapula have extensive collateral circulation which is associated with them lead to variations in the branching pattern. Two procedures, classical incisions and dissection lead to achieve the exposure of axillary artery and its branches in 50 upper limbs of 25 cadavers including 20 males & 5 females. One specimen showed the anomalous branching of the axillary artery with the successful observation which results in the dividing of axillary artery of right upper limb into superficial brachial and deep brachial arteries. The axillary artery has branching pattern which was normal on the left side. The arterial system of the upper limb has variations which are well documented. On the basis of embryologic development of the vascular plexuses of the limb buds, the variations and anomalies of the arterial system to the upper limb can be explained best. A model has been proposed which demonstrates the development of the arteries of upper limb in 5 stages. This model explains the development of an axial system appears first and other branches develop later from this axial system. Charles et al, year 1931 specify 7 Types of origins for this artery where the origin of arteria profunda brachii is quite variable in 54.7% cases. In case of surgeons the sound knowledge of axillary artery variation plays important role because the axillary artery is more common lacerated by violence.

Keywords *Axillary Artery, Superficial Brachial Artery, Deep Brachial Artery, Anterior & Posterior Division of Deep Brachial Artery, Angiographic Studies*

1. Introduction

The outer border of the first rib leads to axillary artery which is the extension to subclavian artery where when divided by the pectoralis minor muscle anatomically results in the three parts of the course of the axillary artery. The first part starts on first rib having lateral border and make longer to the superomedial border of the pectoralis minor muscle. The first part of the axillary artery is enclosed by the axillary vein and brachial plexus along with axillary sheath on the other side the second part is deeply enclosed by pectoralis minor muscle and third part lies between the inferolateral border of the pectoralis minor and the inferior border of the teres major muscle (1). Axillary artery has branches six in numbers among these branches first part put forward superior thoracic artery branch where second part is lead by lateral thoracic and thoracoacromial branches. Third part of the axillary artery is lead by

fourth, fifth and sixth branches namely subscapular artery, anterior and posterior circumflex humeral arteries. Third part put forward artery, anterior artery and posterior circumflex humeral artery (2).

Surgeon who deals in removing the axillary lymph nodes to anesthesiologist and also the orthopedic surgeon both require the sound knowledge of neuromuscular variation by considering the frequency of procedures done in this region is a result of the branches of subclavian and axillary arteries which are around scapula have extensive collateral circulation associated with them. Usually one can find these variations in the branching pattern but sometimes many of the branches may originate from a common stem or arise separately (3).

2. Materials & Methods

Two procedures, classical incisions and dissection lead to achieve the exposure of axillary artery and its branches in 50 upper limbs of 25 cadavers including 20 males & 5 females of the department of Anatomy, K J Somaiya Medical College, Sion, Mumbai, India. There is proper documentation of methods which includes the live photographs of the variations.

3. Observation

One specimen showed the anomalous branching of the axillary artery with the successful observation which results in the dividing of axillary artery of right upper limb into superficial brachial and deep brachial arteries. The superficial brachial artery without lead to any branches remains continued in the arm. It divides into radial and ulnar arteries and ended in the cubital fossa. All branches given by the axillary artery are originated from the deep brachial artery. Branches such as superior thoracic, thoracoacromial, lateral thoracic artery and articular branch are led by the deep brachial artery to the shoulder joint and divided into anterior and posterior divisions.

Anterior circumflex humeral, posterior circumflex humeral and profunda brachii artery are led by the anterior division, on the other side the posterior division which is subscapular artery lead to circumflex scapular and thoracodorsal artery. The costal surface of the subcapularis muscle is coursed by subscapular artery to the posterolateral thoracic wall. Profunda brachii artery along with the radial nerve passes in to the arm and articular branch passes in to the anterior aspect of the shoulder joint. Coracobrachialis is coursed deeply by anterior circumflex humeral artery. The heads of the biceps brachii muscle move towards the surgical neck of humerus. Posterior circumflex humeral artery along with the axillary nerve passes into the quadrangular space and the axillary vein remained anteromedial to axillary artery.

The superficial brachial artery has cords of brachial plexus behind it and anterior to the deep brachial artery. The axillary artery has branching pattern which was normal on the left side. The photographs of the variations were clicked and saved for proper documentation.

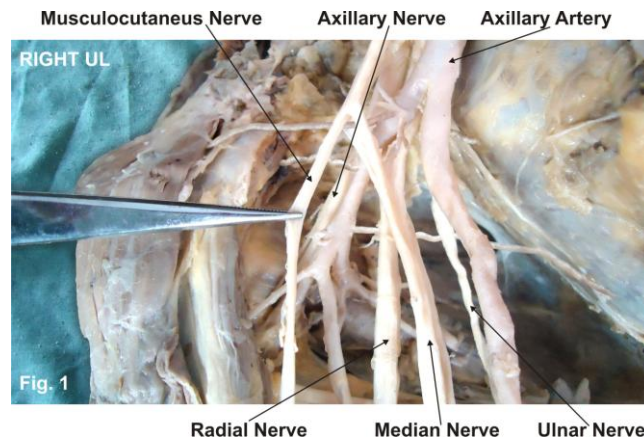


Figure 1: Photograph representation of the axillary artery of right upper limb divided into superficial brachial and deep brachial arteries.

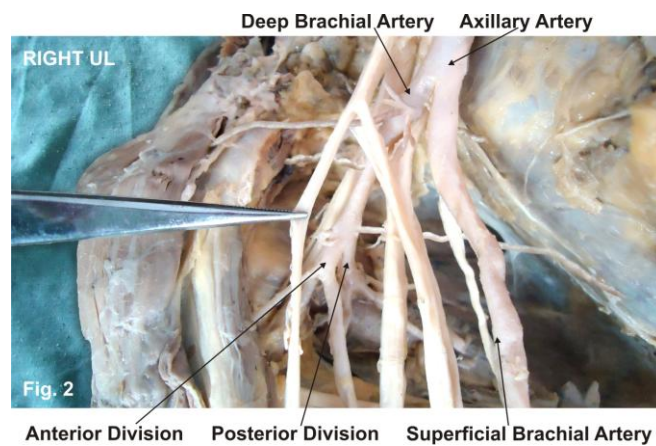


Figure 2: Photograph representation of the superficial brachial artery continued in the arm without giving any branches. The deep brachial artery divided into anterior & posterior division.

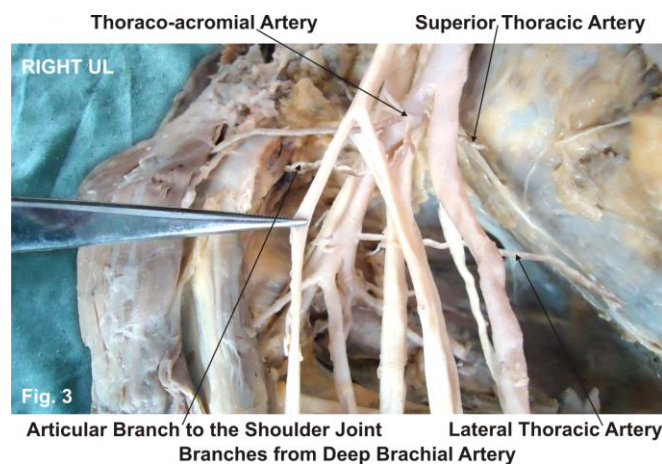


Figure 3: Photograph representation of the deep brachial artery first gave superior thoracic, thoracoacromial, lateral thoracic artery & articular branch to the shoulder joint.

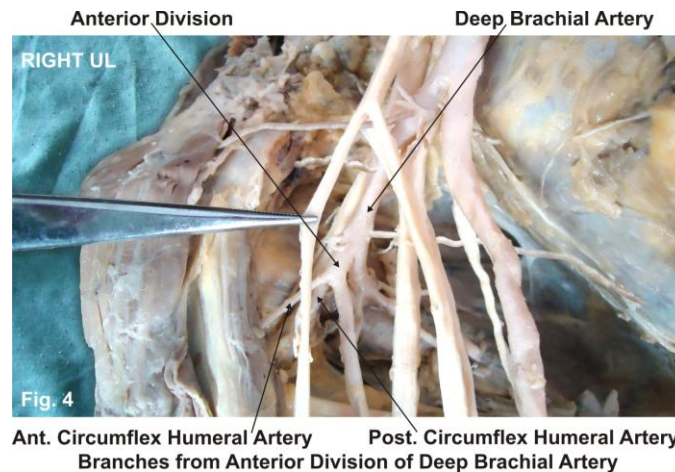


Figure 4: Photograph representation of the anterior division of deep brachial artery gave rise to anterior circumflex humeral, posterior circumflex humeral and profunda brachii artery.

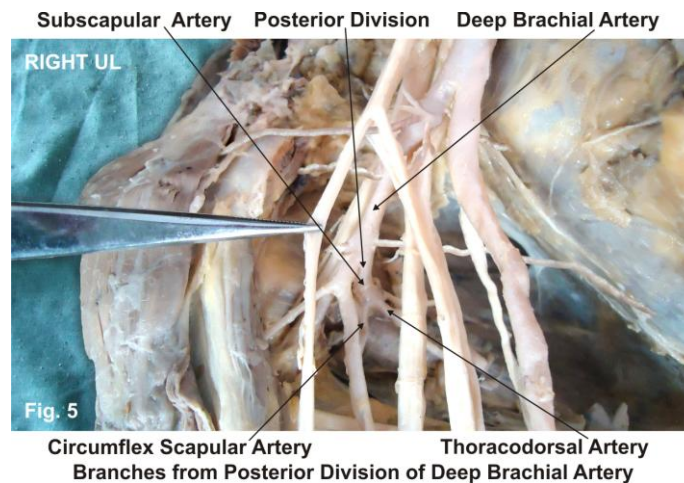


Figure 5: Photograph representation of the posterior division of deep brachial artery continued as subscapular artery gave rise to circumflex scapular and thoracodorsal artery.

4. Discussion

The arterial system of the upper limb has variations which are well documented (4, 5, 6). On the basis of embryologic development of the vascular plexuses of the limb buds, the variations and anomalies of the arterial system to the upper limb can be explained best (7). A model has been proposed which demonstrates the development of the arteries of upper limb in 5 stages (8, 9). This model explains the development of an axial system appears first and other branches develop later from this axial system. Consequently the axillary artery, brachial artery and anterior interosseous artery contains in the axial system of the adult.

In stage 2 the median artery branches from the last one afterwards in stage 3 the ulnar artery branches from the brachial artery. In stage 4 the development of superficial brachial artery consequences from the axillary and it continue being a radial artery. Rising of definitive radial artery is consequence of the regression of the median artery and an anastomosis between the brachial artery and the superficial brachial artery with regression of the proximal segment of the latter. Axillary Artery has variations in the origin, course and also in the distribution which are not common (10). The upper limb has axillary artery which is axial artery and it is derived from the lateral branch of the seventh

cervical intersegmental artery (11). The defects in the embryonic development of the vascular plexus of the upper limb bud results to the arterial variations. These results may be due to the detain at any stage of development and also because of showing regression, retention or reappearance which may lead to variations in the origins of arterial and in the major upper limb vessel's courses (12).

Two distinct variations are shown by the axillary artery, one is the high origin of the superficial brachial artery emerging from the axillary or brachial artery continues as the radial artery in the forearm. In the context of radial and ulnar arteries' creation, the superficial brachial artery may or may not be a brachial artery (13). During the course of the superficial brachial artery in the arm has not given any branches in the present case resulting in the absence of variations in the vascular arches of the hand. The literature shows that the incidence of such superficial brachial artery is around 0.1% to 3.2% (13). The axillary artery is divided in to superficial and deep stem which was found to be more common in A black person that is 13.4% and it is 4.6% in white persons (14). The all branches which are due to the deep brachial artery are normally given by the axillary artery is very rare but the literature does not show the availability of such case report. Superior thoracic, thoracoacromial, lateral thoracic artery and articular branch are firstly given by the deep brachial artery to the shoulder point results into anterior and posterior divisions.

The first division known as anterior division creates anterior circumflex humeral, posterior circumflex humeral and profunda brachii artery on other side second division (posterior division) generally known as subscapular artery creates to circumflex scapular and thoracodorsal artery. Charles et al, year 1931 specify 7 Types of origins for this artery where the origin of arteria profunda brachii is quite variable in 54.7% cases the branch of brachial artery comes under Type 1 as compare to 55% cases by Anson in 1966. Type 1 has again two sub types which are origin of arteria profunda brachii by 2 separate branches as seen in 0.7% dissections and origin of arteria profunda brachii by 3 separate branches as seen in 0.3% dissections.

In Type 2 under 22.3% cases, arising as a common trunk with superior ulnar collateral as compare with 22% cases by Anson in 1966. Type 3 states that arising at lower border of teres major can be considered to be arising from axillary or brachial in 8% cases where Type 4 explains that in the 8.7% cases has the branch of 3rd part of axillary artery which is compare with 16.0% by Anson in 1966. Type 5 shows the arising as a common trunk with posterior circumflex humeral accounts in 4% cases which was in 13% cases by Keen in 1961 and 7% by Anson in 1966. 4% cases include 6% before entry of posterior circumflex humeral into quadrangular space and 7% after its entry into quadrangular space. Type 6 shows the arising as a common trunk with subscapular and both circumflex humerals from axillary artery which accounts in 0.7% cases where Type 7 explains about the absent arteria profunda brachii in 0.7% cases.

In present case along with anterior circumflex humeral and posterior circumflex humeral arteries the profunda brachii artery starts from the anterior division of the deep brachial artery. In the axillary approach to chronic dislocation of the shoulder joint where knowledge of such variations maintain the importance. There are few precautions which must be taken during transverse incision in order to avoid injury to the deep brachial artery and its branches (16). In case of reparative surgery and angiography, the perfect knowledge of the normal and variant arterial pattern of the human upper extremities plays an important role (17). In order to prevent bleeding during surgical repair of brachial Plexus injury it becomes important in mind the presence of deep brachial artery and its branches (18). In case of surgeons the sound knowledge of axillary artery variation plays important role because the maxillary artery is more common lacerated by violence. In case of neurosurgeons and specialists the anatomical knowledge of axillary region plays critical role when using radio diagnostic techniques in traumatic injuries. Ultimately the enhanced knowledge would results in more accurate diagnostic interpretations and surgical treatment.

5. Conclusion

The arterial variations of the upper limb have been implicated in different clinical situations. The variations in the origin and course of principal arteries are clinically important for surgeons, orthopaedicians and radiologists performing angiographic studies on the upper limb. These variations are compared with the earlier data & it is concluded that variations in branching pattern of axillary artery are a rule rather than exception. Therefore both the normal and abnormal anatomy of the region should be well known for accurate diagnostic interpretation and therapeutic intervention.

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