International Journal of Anatomy and Research,
Int J Anat Res 2019, Vol 7(3.3):6934-38. ISSN 2321-4287
DOI: https://dx.doi.org/10.16965/ijar.2019.260

Original Research Article

AN ANATOMICAL STUDY OF VARIATIONS IN THE BRANCHING PATTERN OF AXILLARY ARTERY AND ITS CLINICAL SIGNIFICANCE

Puloma Chakraborty [1], Amita Sarkar *[2].

[1] Demonstrator, Department Of Anatomy, K.P.C. Medical College and Hospital, 1F, Raja S. C. Mullick Road, Jadavpur, Kolkata, India.

*[2] Assistant Professor, Department Of Anatomy, K.P.C. Medical College and Hospital 1F, Raja S. C. Mullick Road , Jadavpur, Kolkata, India.

ABSTRACT

Introduction: Variation in the branching pattern of axillary artery is quite common. Accurate knowledge of the normal and variant arterial anatomy of the axillary artery is important for clinical procedures in axillary and pectoral region. The aim of this study is to find out the incidence and types of variation in the branching pattern of axillary artery.

Materials and Methods: Dissection of axillary and pectoral region was done on both sides in 25 cadavers in the department of Anatomy, K.P.C. Medical College and Hospital, Kolkata to study the branching pattern of axillary artery.

Results: Variation was present in 16% cases. Among these, 6% variation was present in the second part and 10% variation was present in the third part of axillary artery. Most common variation found was the origin of subscapular artery from the second part of axillary artery.

Conclusion: Proper knowledge of variations of branching pattern of axillary artery is important for orthopaedic, reconstructive and vascular surgeons to avoid complications during various surgical procedures in axillary regions and angiographies.

KEY WORDS: Axillary artery, Subscapular artery, Lateral thoracic artery, Circumflex scapular artery.

Address for Correspondence: Dr. Amita Sarkar, Assistant Professor, Department Of Anatomy, K.P.C. Medical College and Hospital 1F, Raja S.C. Mullick Road, Jadavpur, Kolkata – 700032, India.
Contact no: 9088383680 **E-Mail:** amita_sarkar@yahoo.com, dramitasarkar3@gmail.com

Access this Article online	Journal Information
Quick Response code	**International Journal of Anatomy and Research**
	ICV for 2016 90.30
	ISSN (E) 2321-4287 | ISSN (P) 2321-8967
	https://www.ijmhr.org/ijar.htm
	DOI-Prefix: https://dx.doi.org/10.16965/ijar
DOI: 10.16965/ijar.2019.260	**Article Information**
	Received: 22 Jun 2019 Accepted: 05 Aug 2019
	Peer Review: 24 Jun 2019 Published (O): 05 Sep 2019
	Revised: None Published (P): 05 Sep 2019

INTRODUCTION

The axillary artery is the continuation of the subclavian artery, extending from the outer border of first rib to the lower border of teres major muscle where it becomes the brachial artery. Pectoralis minor muscle divides it into three parts – first part proximal to the muscle, second part posterior to the muscle and third part distal to the muscle. The axillary artery normally gives off one branch from it's first part, i.e., superior thoracic artery, two branches from second part, i.e., lateral thoracic and thoracoacromial arteries, and three branches from third part, i.e., subscapular, anterior circumflex humeral, and posterior circumflex humeral arteries. The subscapular artery divides into circumflex scapular and thoracodorsal arteries. Sometimes an alar thoracic artery arise from the second part of axillary artery, supply fat and lymph nodes in the axilla [1].

There are considerable variations found in number of branches that arise from the axillary artery: Two or more of usual branches may arise by a common trunk or sub-branches of a branch may arise directly from axillary artery [2].

When this kind of variation is present surgeons must be careful to avoid complications during surgeries.

The variation in the branching pattern observed considerably; the most common is the origin of subscapular artery from a common trunk with the posterior circumflex humeral artery [2, 3].

The variations in the origin of the anterior circumflex humeral, posterior circumflex humeral are occasional, whereas anomalous origin is common for profunda brachial artery. The posterior circumflex humeral artery may arise from the profunda brachial artery, and pass back below the teres major to enter the quadrangular space [1]. Occasionally the subscapular, circumflex humeral and profunda brachii arteries arise in common, in which case branches of the brachial plexus surround this common vessel instead of axillary artery.

The branches of the third part are subject to great variations. The two circumflex arteries may arise from a common trunk, usually alone or rarely together with profunda brachii and muscular branches. Very rarely it may give rise to a common trunk, from which may arises the subscapular, anterior and posterior circumflex humeral, profunda brachii and ulnar collateral arteries [4].

A rare but striking anomaly of the axillary artery is it's division into two branches that proceed down the arm. One of the arterial stems in the arm runs more superficially than the other, and they are distinguished as brachial artery and superficial brachial artery. This apparent doubling of the brachial artery more commonly occurs in the arm than in the axilla [5].

Variation in the origin, course and branching pattern of the axillary artery have received much importance to anatomists, radiologists and surgeons particularly vascular surgeons. Knowledge about variations of axillary artery is essential in surgeries for lymph node resection in the axilla and pectoral region, in mastectomy and reconstructive surgeries of breast, surgical repair of shoulder joint and vascular procedures like antegrade cerebral perfusion in aortic surgery.

MATERIALS AND METHODS

The present study was done in 25 formalin preserved cadavers (22 males and 3 females) in the department of Anatomy, K.P.C. Medical College and Hospital, Kolkata to observe the variations in the branching pattern of axillary artery of both sides. Dissection of pectoral, axillary region, arm and forearm was done according to the steps described in Cunningham's manual of practi-cal anatomy. Skin and superficial fascia were removed. pectoralis major and pectoralis minor with clavi-pectoral fascia were studied and separated. Traumatized or deformed upper limbs with any pathological lesion or surgical procedures were excluded from the study. During dis-section of axilla, axillary artery and brachial plexus were cleaned and studied. All the branches of three parts of axil-lary artery were carefully dissected and their relations with brachial plexus were studied. Variations in the branching pattern arising from three parts of axillary ar-tery were recorded and photographed.

RESULTS

The present study showed variation in the branching pattern of axillary artery in 8 cases (16%). Among these, no variation was found in first part of axillary artery (**Table 1)**.

Variation in the second part was present in 3 cases (6%). Third part of the axillary artery showed variation in 5 cases (10%).

1) Variations in first part of the axillary artery – first part of the axillary artery showed normal branching pattern in all cases.

2) Variations in second part of the axillary artery –

i) subscapular artery took origin from second part of axillary artery **(Fig 3)** in 2 cases (4%).

ii) A common trunk gave rise to subscapular artery and lateral thoracic artery **(Fig 1)** in 1 case (2%).

3) Variations in third part of axillary artery –

i) subscapular artery and lateral thoracic artery arising as a common trunk in 1 cases (2%)

ii) Circumflex scapular artery arising as a

separate branch from third part of axillary artery **(Fig 2)** instead of a branch of subscapular artery in 2 cases (4%).

Third part of axillary artery divided into superficial and deep brachial artery which continued as radial artery and ulnar artery respectively **(Fig 4)** in 2 cases (4%).

Fig. 1: Origin of subscapular artery and lateral thoracic artery as a common trunk from second part of axillary artery. AA – Axillary artery , SCA – Subscapular artery, LTA – Lateral thoracic artery , AV – Axillary vein , MN – Median nerve , P MIN – Pectoralis minor

Fig. 2: Origin of circumflex scapular artery directly from third part of axillary artery. AA – Axillary artery , CSA – Circumflex scapular artery , AV – Axillary vein , MN – Median nerve , SS - Subscapularis

Fig. 3: Origin of subscapular artery from second part of axillary artery. AA – Axillary artery , SCA – Subscapular artery.

Fig. 4: Third part of axillary artery divides into superficial and deep brachial artery that continue as radial and ulnar arteries respectively. AA – Axillary artery , DBA – Deep brachial artery , SBA – Superficial brachial artery.

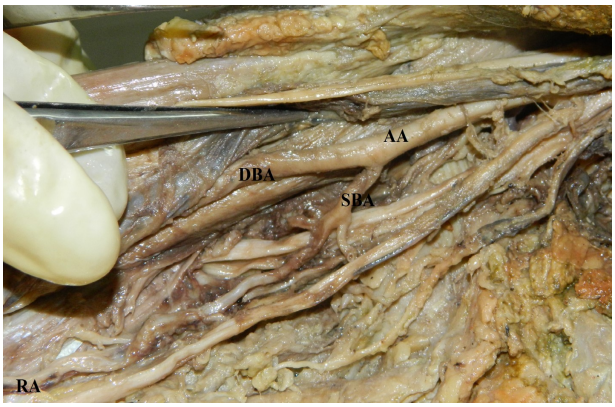

Table 1: Incidence of variation in the branching pattern of axillary artery.

Variation in	No. of cases	Percentage
First part	0	0%
Second part	3	6%
Third part	5	10%
Total (50)	8	16%

DISCUSSION

The axillary artery is usually described as giving off six branches although the number of branches may vary because two or more arteries often arise together instead of their separate origin or there may be some extra branches. Thus instead of six there may be 5-11 branches.

A rare but striking anomaly arises when instead of continuing as a single brachial artery, the axiliary artery divides in the axilla into two branches. On entering the arm, one of the branches usualy runs more superficially and may represent the radial or ulnar arteries, the deeper branch usually correspond to the brachial artery proper. In our observation also in two cases, axillary artery has divided into two branches in axilla. Superficial one is continuing as Radial Artery and deeper one continued as brachial artery proper and then ulnar artery.

Numerous type of variations in branching pattern of axil-lary artery are reported by various workers .Gaur S et al have reported that variations in branching pat-tern are found in about 28% of cases [6].

Saeed et al reported origin of a common subscapular circumflex humeral trunk from 3rd part of axillary artery divided into subscapular,

anterior circumflex humeral and posterior circumflex humeral arteries in 3.8% cases [7].

Ramesh et al reported a case in which a common trunk gave rise to many branches such as the thoracoacromial artery, lateral thoracic artery, posterior circumflex humeral artery and subscapular artery while the anterior circumflex humeral artery was found to arise from the 3rd part [3].

Konarik et al reported a case of coincidental variation of the axillary artery with a brachioradial artery and an aberrant posterior humeral circumflex artery passing under the tendon of the latissimus dorsi muscle [8].

According to Huelke's study, the subscapular artery arises from the first part of axillary artery in 0.6% cases, from the second part in 15.7% cases, and from the third part in 79.2% cases. Lateral thoracic artery arises from the first part of Axillary artery in 10.7% cases, from the second part in 52.2% cases, and from the third part in 1.7% cases. The posterior circumflex humeral artery arises from the third part of axillary artery in 67.5% cases and from the subscapular artery in 15.2% cases [2]. In our study, subscapular artery took origin from the second part of axillary artery in 4% cases, as a common trunk along with lateral thoracic artery in 2% cases.

De Garis and Swartley, in their study, found 5-11 branches arising directly from the axillary artery the most common number was 8 [10]. Heulke, in his study, found two to seven branches arose from the axillary artery [2].

Pandey and Shukla studied thoracoacromial trunk variations particularly at the level of origin of its branches and divided these variations into three groups. In the first group, the common trunk was absent but deltoacromial and clavipectoral sub-trunks arose directly from the second part of the axillary artery. In the second group, only one branch, i.e., a clavicular branch took origin from the second part of axillary artery and the remaining three were arising from thoracoacromial trunk. In the third group, all classical branches of thoracoacromial trunk arose directly from the second part of the axillary artery, and the common trunk was absent.

In 5% of the limbs, thoracoacromial trunk divided 1.2 cm after its origin into deltoacromialand clavipectoral sub-trunks, which were divided into deltoid and acromial, clavicular and pectoral branches, respectively [10]. .

Vijaya *et al*. reported a common trunk from the third part of the axillary artery, which gave origin to anterior circumflex humeral, posterior circumflex humeral, subscapular, radial collateral, middle collateral, and superior ulnar collateral arteries with absent profunda brachial artery [11].

Cavdar *et al*. mentioned the third part of axillary artery variation and its division into superficial and deep brachial arteries: The superficial brachial artery divided into radial and ulnar arteries in cubital fossa; and deep brachial artery divided into anterior circumflex humeral, posterior circumflex humeral, subscapular, and profunda brachial arteries [12].

Daimi *et al*. found duplex origin in the posterior circumflex humeral arteries arising from the third part of the axillary artery as two trunks: One artery continued laterally together with axillary nerve and appeared in the quadrangular space; the other one passed medially piercing teres minor muscle and appeared on the dorsal surface of scapula [13].

The anomalous branching pattern of axillary artery can be correlated to different modes of transformations of the primary vessels during embryonic life. The variations are due to defects in embryonic development of the vascular plexus of upper limb bud. During various stages of arterial development, arrest can occur anywhere along its course. Defects in embryonic development of vascular plexus of upper limb occur due to arrest at any stage followed by regression, retention or reappearance [14].

The axis artery of upper limb is derived from lateral branch of 7th cervical intersegmental artery and proximal part of it forms the axillary artery and brachial artery [5].

Variations can occur due to arrest at any stage of development of vessels of upper limb. According to Arrey, unusual blood vessels were due to either choice of unusual path in the primitive vascular plexus or persistence of vessels, which are normally obliterated and disappearance of vessels, which are normally retained or

incomplete development and fusion of the parts [15].

Accurate knowledge of the normal and variations of arterial anatomy is important for operating surgeons, cardiologists and interventional radiologists to avoid undesirable complications during the interventional surgical procedures in the upper limb region.

Branches of axillary artery are used for coronary bypass and flap for reconstructive surgery. A sound knowledge is essential for surgical attempt to reduce old shoulder dislocations especially if the artery is adherent to the arterial capsule.

Variations in branching pattern of axillary artery should be kept in mind while performing bypass between axillary artery and subclavian artery in subclavian artery occlusion. The common trunk, subscapular artery and lateral thoracic artery may be used for bypass.

The knowledge of branching pattern is very essential while treating the cases of axillary artery thrombosis using medial arm skin flap reconstruction procedures. In the surgical intervention of fracture, upper end of humerus and shoulder dislocation, the variation of the regional arteries including the axillary artery should be considered.

CONCLUSION

Anomalies in the origin and course of principal arteries are having practical importance. Knowledge of branching pattern of axillary artery is necessary during antegrade cerebral perfusion in aortic surgery, while treating the axillary artery thrombosis, using the medial arm skin flap, 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, knowledge of both the normal and abnormal anatomies of the axillary artery is essential for accurate diagnostic interpretation and surgical intervention.

Conflicts of Interests: None

REFERENCES

[1]. Standring, S.; Borley, N. R.; Collins, P.; Crossman, A. R.; Gatzoulis, M. A., Healy, J. C.; Johnson, D.; Mahadevan, V.; Newell, R. L. M. & Wigley, C. B. Gray's anatomy. The anatomical basis of clinical practice. Edinburgh, Elsevier, 2008.

[2]. Huelke DF. Variation in the origins of the branches of the axillary artery. Anat Rec 1959;135:33-41.

[3]. Ramesh TR, Prakashchandra S, Suresh R. Abnormal branching pattern of the axillary artery and its clinical signifi cance. Int J Morphol 2008;26:389-92.

[4]. Bergman, R. A.; Thomson, S. A.; Afifi, A. K. & Saadeh, F. A. Compendium of Anatomic Variation. In: Cardiovascular system. Baltimore, Urban and Schwarzenber, 1988;72-73.

[5]. Hollinshead, W. H. & Rosse, C. Text Book of Anatomy. 4th Ed. Harper & Row, Philadelphia, 1985;187-189.

[6]. Gaur S, Katariya S, Vaishnani H, Wani NI, Bondre KV, Shah G V. A Cadaveric Study of Branching Pattern of the Axillary Artery Int J Biol Med Res. 2012; 3(1):1388-1391.

[7]. Saeed M, Rufai AA, Elsayed SE, Sadiq MS. Variations in the subclavianaxillary arterial system. Saudi Med J 2002;22:206-212.

[8]. Konarik M, Katchlik D, Baca V. A coincidental variation of the axillary artery: the brachioradial artery and the aberrant posterior humeral circumflex artery passing under the tendon of the latissimus dorsi muscle. Bosn J Basic Med Sci 2014;14(4):239-243.

[9]. De Garis CF, Swartley WB. The axillary artery in white and negro stocks. Am J Anat 1928;41:353-97.

[10]. Pandey SK, Shukla VK. Anatomical variations of the cords of brachial plexus and the median nerve. Clin Anat 2007;20:150-6.

[11]. Vijaya PS, Venkata RV, Satheesha N, Mohandas R, Sreenivasa RB, Narendra P. A rare variation in the branching pattern of the axillary artery. Indian J Plast Surg 2006;39:222-3.

[12]. Cavdar S, Zeybek A, Bayramiçli M. Rare variation of the axillary artery. Clin Anat 2000;13:66-8.

[13]. Daimi SR, Siddiqui AU, Wabale RN. Variations in the branching pattern of axillary artery with high origin of radial artery. Int J Anat Var 2010;3:76-7.

[14]. Astik R, Dave U. Variations in branching pattern of the axillary artery: a study in 40 human cadavers. J Vasc Bras 2012;11(1):12-17.

[15].Arey, L.B. In Development of the Arteries, Developmental Anatomy, 6th Edn, W.B.Saunders'co. Philadelphia 1957;pp.375-375.

How to cite this article: Puloma Chakraborty, Amita Sarkar. AN ANATOMICAL STUDY OF VARIATIONS IN THE BRANCHING PATTERN OF AXILLARY ARTERY AND ITS CLINICAL SIGNIFICANCE. Int J Anat Res 2019;7(3.3):6934-6938. **DOI:** 10.16965/ijar.2019.260