

Frequency of Variations in Axillary Artery Branches and its Surgical Importance

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Abstract

Introduction: Variation in the branching pattern of axillary artery is not uncommon. Awareness of variation of the axillary artery and its branching pattern is very much necessary for both radiologists and vascular surgeons. Knowledge about any variations in branching pattern is kept in mind during surgeries for lymph nodes in the axilla and pectoral region.

Materials and Methods: Axillary artery and its branches in 30 cadavers, on both right and the left sides of males and females, aged 26-70 years, through routine dissection on the axillary regions on both sides were taken for study.

Results: Most common variation found was the origin of posterior circumflex humeral artery from subscapular artery (30%) and duplex origin of subscapular artery from third part as usual and anomalous origin from second part along with thoracoacromial trunk (20%).

Conclusion: Accurate knowledge of the normal and variant arterial anatomy of the axillary artery is important for clinical procedures in this region. Branches of the axillary artery are used for flaps in reconstructive surgeries in the pectoral region. Orthopedic surgeons, also need to know about any variation in branching pattern while attempting to reduce old dislocations, especially when the artery is adherent to the articular capsule.

Key words: Axillary artery, Origin, Subscapular artery, Variation

INTRODUCTION

Variation in the origin, branching, course, branches of the axillary artery have received much importance of anatomists, surgeons, and particularly vascular surgeons. The axillary artery is a continuation of the subclavian artery, extending from the outer border of first rib to the lower border of teres major muscle. The axillary artery normally gives off one branch from its first part, i.e., superior thoracic, 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. It continues as the brachial artery, which divides into the radial and the ulnar artery in the forearm at the level of neck of the radius.¹⁻³ The variation in the branching pattern of axillary artery is not uncommon. Any deviation in the development of the vascular plexus of the limb bud may be responsible for variations in the branching pattern of the axillary artery. Normal anatomy and variations of the axillary artery have received great attention by radiologists and vascular surgeons. Knowledge about variations of axillary artery is used during surgeries for lymph nodes in the axilla and pectoral region.

The variation in the branching pattern observed considerably; the common known is the subscapular artery origination from a common trunk with the posterior circumflex humeral artery.^{4,5} The variations in the origin of the anterior circumflex humeral, posterior circumflex

Access this article online



www.ijss-sn.com

Month of Submission : 07-2015
Month of Peer Review : 08-2015
Month of Acceptance : 08-2015
Month of Publishing : 09-2015

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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.

There are considerable variations found in a number of branches that arose from the axillary artery: Two or more of usual branches may arise by a common trunk or named artery *viz.* deltoid, acromial, clavicular, or pectoral branch may arise directly from axillary artery.⁵

MATERIALS AND METHODS

In present study, the axillary artery and its branches in 30 cadavers, on right and the left sides of both males and females, aged 26-70 years, was studied through routine dissection for undergraduate medical students at Viswabharathi Medical College, Kurnool, Andhra Pradesh (state). The dissections were performed on the axillary regions on both sides, 60 axillary arteries in all. We have studied the total number of branches arising from three parts of axillary artery and variations in branching pattern which includes variation in the origin from anomalous location, along with other branches as a common trunk, duplex origin, and absence of origin found in main branches and sub-branches.

OBSERVATIONS AND RESULTS

In the present study, it was found that most common variation observed was the origin of posterior circumflex humeral artery from subscapular artery (30%) (Figure 1 and Table 1) and origin of subscapular artery from the third part as usual and anomalous origin of subscapular from the second part along with thoracoacromial trunk, i.e., duplex origin (20%) (Figure 2 and Table 2), least common were absence of superior thoracic artery. No significant correlation was observed in relation with nerves and preference of variation to right or left side.

DISCUSSION

Many reports of variations in the branching pattern of the axillary artery are available. 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



Figure 1: Anomalous origin of posterior circumflex humeral artery from subscapular artery



Figure 2: Thoracoacromial trunk and subscapular artery arising as common trunk from second part and accessory subscapular artery from third part (duplex origin)

Table 1: Percentage of variations of axillary artery branches

Branches	Percentage of variation	
	More common	Less common
Name of the main branch		
Superior thoracic		5
Lateral thoracic		5
Thoracoacromial		10
Subscapular	15	
Ant circumflex humeral		4
Post circumflex humeral	25	
Name of sub branch		
Circumflex scapular	15	
Thoracodorsal	15	

circumflex humeral artery arises from the third part of axillary artery in 67.5% cases and from the subscapular artery in 15.2% cases.⁶

De Garis and Swartley, in their study, found 5-11 branches arising directly from the axillary artery the most common number the 8. Heulke, in his study, found two to seven branches that arose from the axillary artery.⁷ In the present study, it was found 5-8 branches from an axillary artery (Table 3).

Pandey and Shukla studied about, thoracoacromial trunk variations particularly at the level of origin of its branches, more on the right side, 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 of from the second part of an 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 deltoacromial and clavipectoral sub-trunks, which were divided into deltoid and acromial, clavicular and pectoral branches, respectively.⁸ In the present study, it was found the pattern of division of thoracoacromial trunk according to the first group in the majority of cases.

Saeed *et al.* has reported a common subscapular-circumflex humeral trunk from the third part of axillary artery, which divided into subscapular, anterior circumflex humeral, and posterior circumflex humeral arteries in 3.8% of cases.⁹ Ramesh *et al.* also reported a common trunk from the third part of the left axillary artery, which gave origin to subscapular, anterior circumflex humeral, posterior circumflex humeral, profunda brachial, and ulnar collateral arteries.⁴ 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.¹⁰ Cavdar *et al.* mentioned the third part of axillary artery variation as its division into superficial and deep brachial arteries: The superficial brachial artery was 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, so it may be similar to common trunk as it was found in present study.¹¹ Furthermore in current study, it was found a common trunk from the third part of axillary artery in 20% of the limbs; Bhargava considered this common trunk as an original axillary brachial trunk, which failed to develop in early fetal life and became obstructed. Subsequently, an apparent axillary brachial trunk developed for supplying the distal part of the limb. This was probably a vasa aberration, which sometimes arose from the brachial artery. This type of arrangement would give a good blood supply to the limb through profunda brachial if axillary artery or brachial artery was connected distally to the origin of this common trunk.

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.¹² We found posterior circumflex humeral arteries arising from subscapular artery in 25% of the limbs: In the present study, it was found the origin of posterior circumflex humeral artery from subscapular artery in 25% of cases and common trunk of subscapular and thoracoacromial trunk from the second part of axillary artery in 15% of cases (Figures 1 and 2, Tables 1 and 2).

Any deviation in the embryonic development of the vascular plexus of the upper limb bud may cause variations in the branching pattern of the axillary artery. The manner of deviation may be 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. Anomalous branching pattern may represent persisting branches of the capillary plexus of the developing limb buds and their unusual course, it may be a cause for concern to the radiologists and vascular surgeons, and may lead to complications in surgeries that involve the axilla and pectoral regions.

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

Table 2: Types of variations and its distribution-axillary artery branches

Type of variation	Name of artery	Percentage of variation
Common stem	Lateral thoracic, thoracoacromial and subscapular	10
Duplex origin	Subscapular	15
Absence	Superior thoracic	5
Abnormal site of origin	Post circumflex humeral	25

Table 3: Average number of branches arising from axillary artery

Number of branches	Author's name
6-11	DeGaris and Swartley
4-7	Heulke
5-8	Present study

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.

CONCLUSION

Common variations need to be observed in axillary artery dissection are i) origin of posterior circumflex humeral from subscapular artery in 25% of limbs, ii) subscapular artery arising from the second part along with thoracoacromial trunk (15%) iii) accessory subscapular artery from the third part, i.e., duplex origin (15%).

Any clinical procedures in pectoral and axillary regions require accurate knowledge of the normal and variant arterial anatomy of the axillary artery.¹¹ The importance of axillary artery and its branches lies in the usage for coronary bypass and flaps in reconstructive surgeries. All vascular surgeons need thorough knowledge of variation in branching pattern while attempting to reduce old

dislocations, especially when the artery is adherent to the articular capsule.^{4,5,13,14}

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How to cite this article: Kanaka S, Eluru RT, Basha MA, Somasekhar R, Kanchanalatha G, Haniman KS. Frequency of Variations in Axillary Artery Branches and its Surgical Importance. *Int J Sci Stud* 2015;3(6):1-4.

Source of Support: Nil, **Conflict of Interest:** None declared.