

Cadaveric Morphometric Study to Evaluate the Variations in Branching Pattern of Axillary Artery

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Received: 20-10-2022 / Revised: 05-11-2022 / Accepted: 08-12-2022

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Conflict of interest: Nil

Abstract

Aim: The aim of the present study was to contribute to the existing knowledge of the variations in the branching pattern of the Axillary artery, explaining its embryological basis and also its morphological and clinical significance.

Methods: 20 cadavers (40 upper limbs) - 15 male and 5 females embalmed with 10% formalin were dissected for this study. The study was conducted in the Department of Anatomy, Government medical College, Bettiah, Bihar, India. Variations in the origin and branching pattern of axillary artery were noted.

Results: Variable branching pattern was observed in 7% of the cases on right side and 8% of the cases on left side in first part of Axillary artery, 43% of the cases on right side and 52% of the cases on left side in second part and 50% of the cases on right side and 25% of the cases on left side in third part.

Conclusion: Accurate and detailed knowledge of the normal and variant anatomy of the axillary artery is of importance for anatomists, surgeons, radiologists and clinicians during various interventional, diagnostic, therapeutic and surgical procedures on pectoral and axillary regions.

Keywords: Axillary artery, Branching pattern, Cadavers, Upper limbs

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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 muscle. [1] 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 artery. [2] It is very common to find the variations in the branching pattern of axillary artery.

Axillary artery extends from the outer border of the 1st rib to the lower border of

Teres major. It is a direct continuation of the subclavian artery and continues as the brachial artery. [4] The Pectoralis minor passes over to divide the artery into 3 parts. Conventionally, six branches arise from the axillary artery. Superior thoracic artery from the 1st part, thoracoacromial and lateral thoracic arteries from the 2nd part and subscapular, anterior circumflex humeral and posterior circumflex humeral arteries from the 3rd part. [3] Twenty three different types of axillary artery on the basis of origin of branches have been described. [5]

The axillary artery is a continuation of the subclavian one from outer border of the first rib to lower border of teres major muscle that continues further distally as brachial artery. It is classically divided into three parts by the pectoralis minor muscle. It is conventionally described as giving of six branches. The branches vary considerably, in up to 30% of the cases, the subscapular artery can arise from a common trunk with the posterior circumflex humeral artery. Occasionally, the subscapular, anterior circumflex humeral, posterior circumflex humeral, and profunda brachii arteries arise in common. The posterior circumflex humeral artery may arise from the profunda brachii artery, and pass back below the teres major to enter the quadrangular space. [6] The number of branches that arose from the axillary artery showed considerable variations: 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. [7] Accurate knowledge of the normal and variant arterial anatomy of the

axillary artery is important for clinical procedures in this region. Branches of axillary artery are used for coronary bypass and flaps in reconstructive surgeries. Sound knowledge of variation in branching pattern is important for surgeons' attempting to reduce old dislocations, especially when the artery is adherent to the articular capsule.

The aim of the present study was to contribute to the existing knowledge of the variations in the branching pattern of the Axillary artery, explaining its embryological basis and also its morphological and clinical significance.

Materials and Methods

20 cadavers (40 upper limbs) - 15 male and 5 females embalmed with 10% formalin were dissected for this study. The study was conducted in the Department of Anatomy, Government medical College, Bettiah, Bihar, India for two years. Variations in the origin and branching pattern of axillary artery were noted.

The branching pattern of the axillary artery was studied under the following headings: origin of all branches, their courses and variations if present, and photographs were taken for recording.

Statistical comparisons between percentages were performed by the χ^2 test; $p < 0.05$ was regarded as statistically significant. For the dissection of the cadavers, investigations and materials were used in the study, the required permissions were taken from appropriate firms within the institute, and all the methods were followed in-line with international ethics and values.

Results

Table 1: Variations in Axillary Artery

Parts	Variations in Axillary Artery	
	Right	Left
First part	7%	8%
Second part	43%	52%
Third part	50	25%

Variable branching pattern was observed in 7% of the cases on right side and 8% of the cases on left side in first part of Axillary artery, 43% of the cases on right side and 52% of the cases on left side in second part and 50% of the cases on right side and 25% of the cases on left side in third part.

We found variant branching pattern of the axillary artery in 13 out of 20 limbs (65% limbs) in males and 10 limbs out of 20 limbs (50% limbs) in females. The variant branching pattern was found in 10 male cadavers, unilaterally in 3 cases and bilaterally in 2. It was found in four female cadavers, with one unilateral case on the right side and three bilateral.

We found the origin of lateral thoracic artery from subscapular artery in six male cadavers, unilaterally in two cases on the right side and bilaterally in four. Lateral thoracic artery arose from subscapular artery in one female cadaver bilaterally. The χ^2 test did not show any statistically.

Some of the important variations observed are as follows:

1. A common trunk of lateral thoracic artery (LTA) and acromio - thoracic artery (ATA), suprascapular artery (SSA) and pectoral branches (PB) arising independently from 2nd part of left axillary artery.
2. A suprascapular artery arising from 1st part of right axillary artery.
3. Two acromiothoracic arteries arising independently from 2nd part of left axillary artery.
4. A subscapular artery (SSA) and thoracodorsal artery arising independently from 2nd part of right axillary artery.
5. A superior thoracic artery, 2 lateral thoracic arteries, subscapular artery, 2 accessory muscular branches arising from 2nd part of left axillary artery and a common trunk of lateral thoracic artery (LTA) and acromio - thoracic artery (ATA).
6. A common trunk of lateral thoracic artery and subscapular artery arising from 2nd part of left axillary artery.
7. Accessory muscular branches arising from 2nd part of left axillary artery.
8. A common trunk of anterior circumflex humeral artery (ACHA) and posterior circumflex humeral artery (PCHA) arising from 3rd part of right axillary artery.
9. 2 anterior circumflex humeral arteries and posterior circumflex humeral artery arising from 3rd part of left axillary artery.
10. A common trunk of posterior circumflex humeral artery and subscapular artery arising from 3rd part of left axillary artery.
11. A common trunk of anterior circumflex humeral artery, posterior circumflex humeral artery and subscapular artery and an accessory muscular branch arising from 3rd part of left axillary artery.

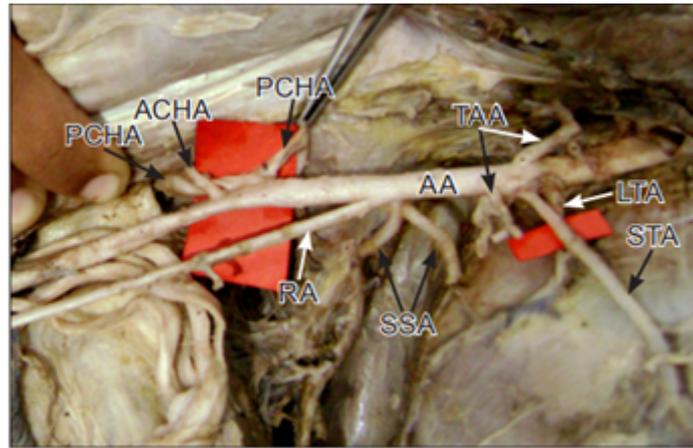


Figure 1: Branching pattern of the axillary artery (AA) of right side. The first part giving rise to lateral thoracic artery (LTA) as the first branch, superior thoracic artery (STA) and one trunk of thoracoacromial artery (TAA). The second part giving origin to the other trunk of thoracoacromial artery, subscapular artery (SSA) and high origin of radial artery (RA). The anterior circumflex humeral artery (ACHA) and two trunks of posterior circumflex humeral artery (PCHA) arise from third part

Discussion

Due to clinical importance of axillary artery and its branches, a more definitive study seemed appropriate and necessary to provide additional data to coeval anatomical literature. Axillary artery extends from the outer border of the 1st rib to the lower border of Teres major. It is a direct continuation of the subclavian artery and continues as the brachial artery. [10] The Pectoralis minor passes over to divide the artery into 3 parts. Conventionally, six branches arise from the axillary artery. Superior thoracic artery from the 1st part, thoracoacromial and lateral thoracic arteries from the 2nd part and subscapular, anterior circumflex humeral and posterior circumflex humeral arteries from the 3rd part. [8] Twenty three different types of axillary artery on the basis of origin of branches have been described. Literature suggests 5-11 branches arising from the axillary artery. [10] A study by Huelke DF documents 2-7 direct branches of the axillary artery while Kanaka S et al., reported 5-8 branches originating from axillary artery. [11,12]

Rajesh Astik et al. (2012) found variant branching pattern of the axillary artery in

43 out of 68 limbs (63% limbs) in males and 7 limbs out of 12 limbs (58% limbs) in females. The variant branching pattern was found in 26 male cadavers (76.4%), unilaterally in 9 cases (five right, four left) and bilaterally in 17. It was found in four female cadavers (66.7%), with one unilateral case on the right side and three bilateral. In their study, the total incidence of variant branching pattern of the axillary artery was 30 out of 40 cadavers (75%) or 50 out of 80 upper limbs (62.5%). [1]

But in present study, a variable branching pattern was observed in 7% of the cases on right side and 8% of the cases on left side in first part of Axillary artery, 43% of the cases on right side and 52% of the cases on left side in second part and 50% of the cases on right side and 25% of the cases on left side in third part.

Samuel et al. (2006) documented a variation of an abnormal trunk of anterior and posterior circumflex humeral, subscapular, radial collateral, middle collateral and superior ulnar collateral arteries (third part) on left side in 50 years old male cadaver. [13] Ramesh Rao et al. (2008) found a rare case of origin of subscapular, anterior and posterior

circumflex humeral, profunda brachii artery and ulnar collateral arteries from a common trunk (third part- left side). [14]

In present study a common trunk of anterior circumflex humeral artery, posterior circumflex humeral artery and subscapular artery and an accessory muscular branch were found to be arising from 3rd part of left axillary artery. Also 2 anterior circumflex humeral arteries and posterior circumflex humeral artery are seen to be arising from 3rd part of left axillary artery (Figure 10). A common trunk of lateral thoracic artery (LTA) and acromio – thoracic artery (ATA), suprascapular artery (SSA) and pectoral branches (PB) were seen to be arising independently from 2nd part of left axillary artery. Baral et al (2009) recorded a variable pattern of a common trunk of lateral thoracic, thoracodorsal, subscapular, posterior circumflex scapular which continued as posterior circumflex humeral artery (second part). [15] T. Srimathi et al (2011) found a common trunk of lateral thoracic artery, thoracoacromial artery, subscapular artery and posterior circumflex humeral artery (third part). [16]

Knowledge of branching pattern of axillary artery is useful during antegrade cerebral perfusion in aortic surgery [17], 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 patients 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 angiography.

Conclusion

Accurate and detailed knowledge of the normal and variant anatomy of the axillary artery is of importance for anatomists, surgeons, radiologists and clinicians

during various interventional, diagnostic, therapeutic and surgical procedures on pectoral and axillary regions. Variations in branching pattern of axillary artery are found frequently. 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 orthopedic and vascular surgeons to avoid complications during various surgical procedures in axillary regions and during angiographies respectively.

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