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

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ABSTRACT

BACKGROUND
To study the anatomical variations in the branching pattern of axillary artery and its clinical significance.

MATERIALS & METHODS
The present study was done on 60 upper limbs of 30 embalmed cadavers of both sexes (24 male and 6 female) of age ranging from 35-60 years at the Department of Anatomy, NRIIMS, Visakhapatnam. 60 upper limbs were dissected and the branching pattern of axillary artery was examined.

RESULTS
Out of 60 upper limbs, 39 limbs (65%) had classical branching pattern and 21 limbs (35%) had variations in the branching pattern of axillary artery.

CONCLUSIONS
Variations in the branching pattern of axillary artery is not uncommon. Knowledge of these variations is useful for the orthopaedic, vascular and plastic surgeons to avoid complications during various surgical and interventional procedures.

KEYWORDS
Axillary Artery, Common Trunk, Subscapular Artery, Posterior Circumflex Humeral Artery.

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BACKGROUND

Axillary artery is a continuation of subclavian artery at the outer border of first rib and at the inferior border of teres major, continues as brachial artery. Pectoralis minor crosses anterior to it and divides the artery into 3 parts which are proximal, posterior and distal to the artery. It gives six branches. The first part gives superior thoracic, the second part gives thoracoacromial and lateral thoracic arteries and the third part gives rise to subscapular, anterior circumflex humeral and posterior circumflex humeral arteries.[1] The cords of brachial plexus lie posterior to the first part, are arranged around the second part according to their names while the main nerves arising from the cords surround the third part.[2]

The knowledge of variations in the branching pattern of axillary artery is useful for surgeons and anaesthesiologist to do any surgical procedures or interventions in the region of axilla. The branches of the subclavian and axillary arteries form an extensive collateral anastomosis around the scapula.[3] Hollinshead WH[4] stated that sometimes branches of the axillary artery may arise from a common trunk or stem or may arise separately.

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MATERIALS & METHODS

The present study was done on 60 upper limbs of 30 embalmed cadavers of both sexes (24 male and 6 female) of age ranging from 35-60 years at the Department of Anatomy, NRIIMS, Visakhapatnam. Axilla was dissected according to the methods described by Romanees GJ[2], and axillary artery was exposed, cleaned and observed for its branching pattern.

Observations

In the present study, we observed the total number of branches arising from the axillary artery was varying from 5-10 branches and the most common number was 7 branches. Out of 60 axillae, 21 (35%) showed variations in the branching pattern of axillary artery (Table 1).

Part of AA	Number of Variations	Percentage
1	1	1.7%
2	7	11.7%
3	13	21.6%
Total	**21**	**35%**

Table 1. Variations in the Branching Pattern of Axillary Artery

Variations in the Branching Pattern of 1st part of Axillary Artery

In one axilla, a common trunk was arising from the first part of axillary artery and no other separate branches (Figure 1). This common trunk was divided into superior thoracic, lateral thoracic and pectoral branch of thoracoacromial arteries.

Sl. No.	Branches Arising from 2nd part of AA	Number of Variations	%
1	Thoracoacromial	1	1.7 %
2	Thoracodorsal Artery	1	1.7 %
3	Alar Thoracic Branches	5	8.3 %
	Total	**7**	**11.7 %**

Table 2. Variations in the Branching Pattern of 2nd part of Axillary Artery

Variations in the Branching Pattern of 2nd Part of Axillary Artery

In 1.7% of cases, thoracodorsal artery instead of arising from subscapular artery, was arising directly from 2nd part of axillary artery (Figure 2) and was accompanied by thoracodorsal nerve. In 1.7% of cases, thoracoacromial artery, pectoral branch was separately arising from the 2nd part of axillary artery (Figure 3). In 8% of cases, alar thoracic branches were arising from the 2nd part of axillary artery (Figure 3 & 4) (Table 2).

Branches from 3rd Part of AA	Number of Variations	%
Common Trunks for SSA & PCHA	7	11.6 %
PCHA Arising as a Branch from SSA	4	6.6%
Alar Branches from SSA	2	3.2 %
Total	**13**	**21.8 %**

Table 3. Variations in the Branching Pattern of 3rd part of Axillary Artery

Variations from the third part of axillary artery were most common and in the form of common trunk for posterior circumflex humeral and subscapular arteries (Figure 2) in 11.6% cases, and in two cases (3.2%) alar branches were arising from subscapular artery (Figure 4). In four (6.6%) axillae, posterior circumflex humeral artery was arising as a branch from subscapular artery (Table 3). In that condition it was less in diameter.

Figure 1. Showing Common Trunk directly arising from First Part of Axillary Artery

(CT-Common Trunk, TAA-Thoracoacromial Artery, STA-Superior Thoracic Artery, LTA-Lateral Thoracic Artery, PMi-Pectoralis Minor Muscle).

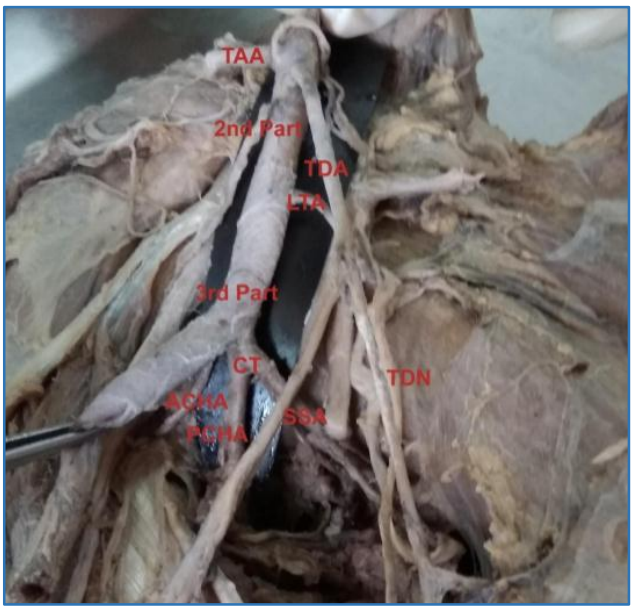

Figure 2. Showing Thoracodorsal Artery directly arising from Second Part of Axillary Artery

(TAA-Thoracoacromial Artery, TDA-Thoracodorsal Artery, LTA–Lateral Thoracic Artery, TDN–Thoracodorsal Nerve, CT-Common Trunk, ACHA-Anterior Circumflex Humeral Artery, PCHA-Posterior Circumflex Humeral Artery, SSA-Subscapular Artery).

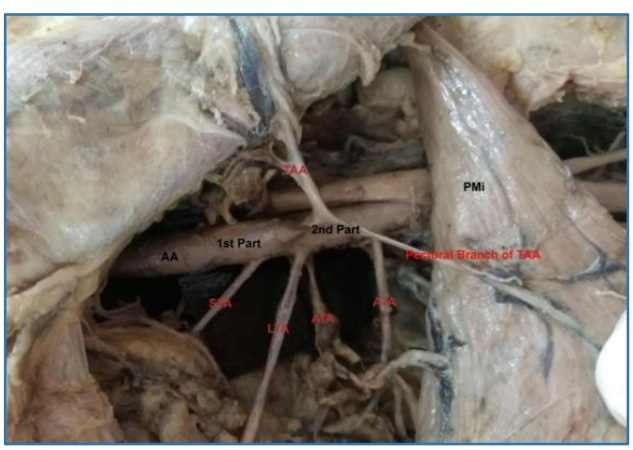

Figure 3. Showing First & Second Parts of Axillary Artery

(TAA-Thoracoacromial artery, LTA-Lateral thoracic artery, STA-Superior thoracic artery, LTA-Lateral thoracic artery, ATA-Alar thoracic artery, PMi-Pectoralis minor muscle).

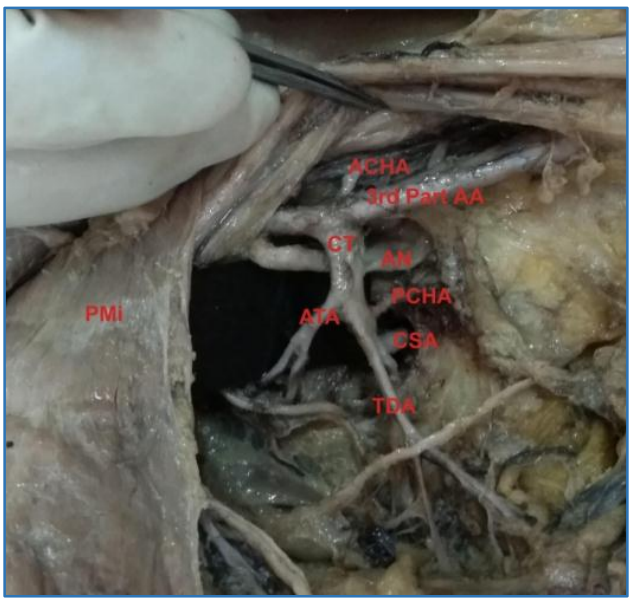

Figure 4. Showing Third Part of Axillary Artery

(AA-Axillary Artery, ATA-Alar Thoracic Artery, PMi-Pectoralis Minor Muscle, TDA-Thoracodorsal Artery, CT–Common Trunk, ACHA–Anterior Circumflex Humeral Artery, PCHA-Posterior Circumflex Humeral Artery, CSA–Circumflex Scapular Artery, AN–Axillary Nerve).

DISCUSSION

Embryogenesis

During embryogenesis the lateral branch of the seventh intersegmental artery becomes enlarged to form the axis artery of the upper limb. Later, it persists as the axillary, brachial and anterior interosseous arteries and deep palmar arch.[5] The arterial anomalies in the upper limb are due to defects in the embryonic development of the vascular plexus of upper limb bud. This may be due to arrest at any stage of development, showing regression, retention or reappearance and may lead to variations in the arterial origins and courses of the major upper limb vessels.[6]

De Garis and Swartley,[7] in their study on 512 cases about the axillary artery among White & Negro stocks, documented 5-11 branches were arising from the axillary artery, though the commonest number was 8 branches. In the present study, the total number of branches was varying from 5-10 and the commonest number was 7. According to Hollinshead & Rosse,[8] the axillary artery usually gives off six branches. But the number varies from 5 to 11 branches because two or more arteries often arise together instead of separately to form a common trunk.

In the present study, 1.7% of cases showed one common trunk that was arising from the first part of axillary artery and giving off superior thoracic, lateral thoracic arteries and pectoral branch of thoracoacromial arteries. Bashir AJ et al[9] observed in one limb that the common thoracic trunk got origin from the 1st part of axillary artery and was divided into highest thoracic and lateral thoracic arteries.

From the second part of axillary artery, thoracodorsal artery was directly arising instead of from the subscapular artery and was accompanying thoracodorsal nerve. Alar thoracic branches were arising directly from 2nd part of axillary artery in 8% of cases and from the 3rd part of axillary artery as a branch of common trunk in 3.2% cases. Samta Gaur et al[10] observed that two or three alar branches were arising from the second part of axillary artery in 6% of cases.

In the present study, 15.6% cases showed that posterior circumflex humeral artery was arising from the subscapular artery which was thin in diameter and in 3% both are arising as a common trunk from the third part of AA. According to Sudeshna M et al,[11] Sreenivasulu K et al[12] in 30% of cases, posterior circumflex humeral artery was arising from the subscapular artery, which is from 3rd part of AA. In the study done by Ojha et al[13] in 13% of limbs, a common trunk for anterior, posterior circumflex humeral and subscapular arteries was arising from the 3rd part of axillary artery. According to Vanisree SK et al,[14] the third part of axillary artery had given posterior circumflex humeral and subscapular arteries as a common trunk in 60% of cases.

In the present study, 35% of variations were observed in the branching pattern of AA and these are more frequent in 3rd part of AA around 22% of cases. According to Samta Gaur et al,[10] these variations were found in about 28% of limbs.

This anomalous branching pattern of AA was important to know because except for the popliteal, the axillary artery is more frequently lacerated by violence than any other, being most susceptible when diseased. Axillary artery compression is more effective against humerus. It has been ruptured in attempts to reduce old dislocations, especially when the artery is adherent to the articular capsule.[15]

CONCLUSIONS

Anatomical variations in the branching pattern of axillary artery are not uncommon. In the present study, we observed variations in the branching pattern of axillary artery in 35% of limbs. These are most common in 3rd part of axillary artery. Knowledge of these variations is useful for orthopaedic, plastic and general surgeons to avoid various complications during angiographies and surgical procedures in the axillary region.

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