



Original Research Article

A COMPREHENSIVE CADAVERIC STUDY OF THE BRANCHING PATTERN & VARIATIONS OF THE AXILLARY ARTERY IN NORTH COASTAL ANDHRA PRADESH

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ABSTRACT

Background: The axillary artery shows considerable variation in its branching pattern, which is clinically important during surgical and interventional procedures involving the axilla and upper limb. The aim is to study variations in the branching pattern of the axillary artery in human cadavers from North Coastal Andhra Pradesh.

Materials and Methods: A cadaveric study was conducted on 40 cadavers (80 upper limbs), comprising 34 male and 6 female cadavers. The axillary arteries were exposed by routine dissection and their branching patterns were documented.

Results: Variations in the branching pattern of the second part of the axillary artery were identified. A common trunk giving rise to the lateral thoracic, thoraco-dorsal, subscapular and posterior circumflex humeral arteries was observed in 22.5% of cases, while a trifurcating trunk occurred in 18.75%. Other variations included common origins of the lateral thoracic and thoraco-acromial arteries (12.5%), lateral thoracic, thoraco-acromial and subscapular arteries (7.5%) and lateral thoracic and subscapular arteries (5%).

Conclusion: The study demonstrates significant variations in the branching pattern of the axillary artery. Knowledge of these variations is important for safe and effective surgical, radiological, and vascular procedures involving the axillary region.

Keywords: Axillary artery, anatomical variation, branching pattern, cadaveric study

INTRODUCTION

The region of the upper chest, medial wall & posterior wall of the axilla presents several huge axio-appendicular link muscles which draw a large amount of blood from the axillary artery. Crucial in this region is the highly mobile shoulder articulation complex involving the clavicular strut, the scapula & the glenohumeral joint. In view of their wide range of movements which are responsible for prehensile movements considerable number of anastomotic channels are present viz circumscapular anastomosis, circumflex humeral, acromial & thoracic.^[1-6]

During its course the axillary artery as a continuation of subclavian artery from the outer border of the first rib to the lower border of teres major is covered by the pectoral muscles. Classically, axillary artery is described as having 3 parts with reference to the pectoralis minor muscle as the parts above, behind & below respectively,^[1-3] branches arise from them respectively. The branches are as follows Superior thoracic artery (1st part), Thoraco-acromial & lateral thoracic artery (2nd part) & Sub-scapular artery, posterior circumflex humeral artery & anterior circumflex humeral artery (3rd part).^[7-12]

The detailed knowledge of the normal branching pattern & their course is of great importance to the surgeons during surgery on the mammary gland which is supplied by the branches from the axillary artery. Sub-coracoid operations & explorative surgery in the region of coracoid process is a part of ortho-plastic surgeries in orthopedics. Since most of the branches arise in & around the coracoid process any deviation in the branching pattern can pose special difficulties. A pectoral muscle flap & facial graft are used in various plastic surgical procedures in which the vascular integrity of the flap decides the outcome of the surgical operation. Doppler study of the chest wall vessels especially the axillary artery is a part of radiological & anesthetic procedures in conditions like Reynaud's disease of upper limb & other vascular compression diseases.^[13-15]

This study performed in the north-coastal districts of Andhra Pradesh adds to the existent literature. Variations of the branching though described as very common in this study we found that such variations are limited. Here we described an unusual branching which appears to be rather distinctive if not unique. Such a study and recorded observation is of immense value in invasive diagnostic procedures employed in vascular surgery and transplant procedures.^[16-18]

MATERIALS AND METHODS

With approved from the Scientific Committee (SC:07/2026/01; 23/07/2026) and Institutional Ethics Committee (111/IEC GMC/AUG 2026; 11/08/2026) of Government Medical College, Vizianagaram. As a part of academic dissections for 1st phase MBBS medical graduates in the Department of Anatomy, Government Medical College, Vizianagaram, 40 embalmed cadavers (80 upper limbs) were dissected, comprising 34 male and 6 female cadavers. Pectoral region dissection was performed following the incisions as mentioned in Cunningham's dissection volume-1 G.J Romanes. The branches & its variations of the axillary artery were studied and relevant photographs documented.

RESULTS

We found following the variations in its branching pattern. In 18.75% of cases, a unique single trunk arose from 2nd part of axillary artery which is dividing into lateral thoracic artery, thoraco-dorsal artery and Sub-scapular artery which should have originated from the 3rd part of axillary artery(Image-1).

In 22.5% of cases, a common trunk arose from the 2nd part of axillary artery which divided into lateral thoracic artery, thoraco-dorsal artery and common branch which divided into Sub-scapular artery & posterior circumflex humeral artery. In this case the 3rd part of the axillary artery gave of only one artery

that is anterior circumflex humeral artery. The 2nd part has taken a major share by giving of 3 branches from a common trunk. The first part gave one artery i.e superior thoracic artery in all the cases without exception. High origin of sub-scapular artery, posterior circumflex humeral artery, thoraco-dorsal arteries from the 2nd part of axillary artery instead of its usual origin from the third part(Image-2).

In 12.5% of cases, lateral thoracic artery & thoraco-acromial artery arose from a common trunk instead of arising separately from the 2nd part of the axillary artery(Image-5). In 7.5% of cases, lateral thoracic artery, thoraco-acromial artery and sub-scapular artery arose from a common trunk instead of arising individually from the 2nd part of the axillary artery. The third part gave off only the anterior and posterior circumflex humeral arteries only(Image-4). In 5% of cases while the thoraco-acromial artery was originating normally, lateral thoracic artery & sub-scapular artery arose from a common trunk instead of arising separately from the 2nd part and 3rd part of the axillary artery(Image-3).

Statistical Analysis: The collected data were analysed using SPSS software version. The branching patterns of axillary artery were analyzed descriptively and presented as frequencies and percentages. The chi-square test was used to assess the association between the normal and variant branching pattern of axillary artery. All values will be considered statistically significant for a value of $P \leq 0.05$.

Image-1



Image-2



Image-3

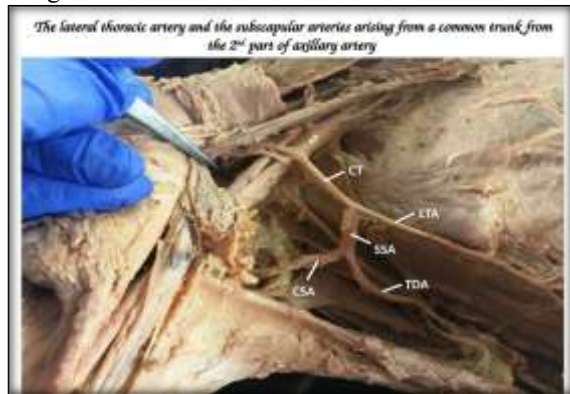


Image-4



Abbreviations: AA-Axillary artery, LTA – Lateral Thoracic Artery, TAA-Thoraco-acromial artery, SSA – Sub Scapular Artery, CSA – Circumflex Scapular Artery, TDA – Thoraco Dorsal Artery, PCHA – Posterior Circumflex Humoral Artery, CT-Common trunk.

Image-5



Table 1: Comparison of Axillary artery branching patterns with literature reports

Branching Variant / Common Trunk Pattern	Present Study (%)	Previous Authors	Percentage of variation
Single Trunk from 2nd Part (Giving LTA, TDA and SSA)	18.75%	Astik & Dave	17.5% 15.7%
Common Trunk from 2nd Part (Giving LTA, TDA & Common Trunk for SSA + PCHA)	22.5%	Konarik et al. Saeed et al.	22.93% 22.9%
Common Trunk for LTA & TAA	12.5%	Loukas et al. Huelke	13.5% 11.2%
Common Trunk for LTA, TAA & SSA	7.5%	Tiwari & Afroze Ramesh et al.	8% 6.8%
Common Trunk for LTA & SSA (Normal TAA origin)	5%	Farhan et al. Olinger & Benninger	5% 4.2%
Constant Origin of 1st Part Branch (STA)	100%	Gaur et al. Chakraborty et al.	100% 100%

DISCUSSION

Upper-limb vascular variations are common and usually asymptomatic. They result from abnormal persistence, regression or reappearance of embryonic vascular channels leading to variations in arterial origin and course. These anatomical variations are primarily attributed to the persistence of embryonic vessels, with genetic factors considered predominant. However, intrauterine fetal position, early limb movement and muscular variation may also contribute.^[19]

In the present study, we found thoraco-acromial artery and lateral thoracic artery arising from the common trunk instead of arising separately from the

2nd part of axillary artery our finding is correlates with that of George, Yang, Tanicescu, Samuel et al in 5-15%.^[20]

In the current study, we found a unique single trunk from 2nd part of axillary artery which is trifurcates into lateral thoracic artery, thoraco-dorsal artery and sub-scapular artery which should have originated from the 3rd part of axillary artery. A similar variation was described by Astik & Dave, Gaur et al., emphasizing the variability of axillary artery branching patterns.^[21]

Several studies have reported anatomical variations in the origin of the subscapular artery. The present study investigation showed variation in the origin of the subscapular artery, arising from the second part

of the axillary artery through a common trunk with the lateral thoracic artery. Similar variations have been reported by Agrawal and Majumdar et al. with varying frequencies. Such anatomical variations are important to recognize during surgical and interventional procedures involving the axillary region.^[22]

Bergman, Ramesh, saeed et al. reported an uncommon common trunk arising from the second part of the axillary artery. In the present study, a rare arterial pattern was observed in which a single trunk from the second part of the axillary artery divided into the thoraco-acromial, lateral thoracic, and subscapular arteries.^[23]

In our present study, we observed a common trunk from the 2nd part of axillary artery which divided into lateral thoracic artery, thoraco-dorsal artery and common branch which divided into Sub-scapular artery & posterior circumflex humeral artery. In this case the 3rd part of the axillary artery gave of only one artery that is anterior circumflex humeral artery. This kind of multipolar branching is singular in this study. Previous anatomical studies have documented variations in the origin of the sub-scapular artery.^[24] Arteriogenesis is a remodeling of pre-existing vessel and is a biomechanical response. It occurs due to genetic programming during embryological development. An error in the molecular signaling processes can lead to a variant branching pattern which may not necessarily be abnormal.

CONCLUSION

The study is useful for surgeons, radiologists and plastic surgeons while planning elective operative procedures like muscle flaps and grafts in cases of reconstructive surgeries involving the breast & metastatic carcinomas necessitating block dissections knowledge of the vascular pattern is of immense value & decides the outcome of the procedure. Knowledge of abnormal vascular pattern is necessary for a better surgical repair of cases of recurrent dislocation of the shoulder. Abnormal branches of axillary artery are of relevance for anesthetists in brachial plexus block.

While several studies revealed a highly variable branching pattern this study under taken in the North costal Andhra Pradesh a significant deviation from the normal and compliments the existing literature.

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