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Case report

A rare variation in the branching pattern of the axillary artery: a case report

Preethi Umanath*, Sutha Selvaraj

KMCH Institute of Health Science and Research, Coimbatore, India

Abstract

This report presents a rare anatomical variation that was observed during the routine dissection of a male cadaver. The third part of the left axillary artery revealed a complete absence of the anterior and posterior circumflex humeral arteries. An unusual ascending branch originated from the arteria profunda brachii, a branch of the brachial artery. This aberrant branch divided further into a deltoid branch, which accompanied the axillary nerve through the quadrangular space to supply the deltoid muscle and terminated at the shoulder joint, and a nutrient branch, which supplied the head of the humerus. To the best of our knowledge, this variation has not been previously reported. Recognition of such vascular anomalies is important for surgeons, radiologists, and anatomists to prevent intraoperative complications and ensure the accurate interpretation of imaging.

Keywords: Anatomical variation, arteria profunda brachii, axillary artery, circumflex humeral arteries.

The axillary artery is a continuation of the subclavian artery and serves as the main arterial supply for the upper extremity. This artery extends from the outer border of the first rib to the lower border of the teres major muscle. The pectoralis minor muscle divides the axillary artery into three parts: the first runs proximal to the muscle, the second lies behind the muscle, and the third is distal to the muscle. The first part gives rise to the superior thoracic artery. The second part branches into the lateral thoracic and thoraco-acromial arteries. The third part gives rise to the subscapular artery as well as the anterior and posterior circumflex humeral arteries. The branching pattern of the axillary artery exhibits considerable variability. This case report details an anomalous branching pattern of the third part of the axillary artery and an unusual ascending branch from the arteria profunda brachii that was identified in a male cadaver used for teaching purposes. The report also explores the embryological and clinical significance of these variations. Understanding these variations is crucial for orthopedic and vascular surgeons to prevent complications during surgical procedures in the axilla.

***Correspondence to:** Preethi Umanath,* Assistant Professor, KMCH Institute of Health Science and Research, Coimbatore, India.

E-mail: preethiumanath22@gmail.com

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Case report

During a teaching cadaveric dissection of the left upper limb of a 50-year-old male, a unilateral variation was observed in the branching pattern of the third part of the axillary artery. According to the Essentials of Human Anatomy textbook by A.K. Datta and Gray's Anatomy, Standring edition, the anterior and posterior circumflex humeral arteries, as well as the subscapular artery, typically arise from the third part of the axillary artery.[1, 2] **Figure 1** illustrates the normal branching pattern of the axillary artery.

In this instance, the first and second parts of the axillary artery followed the usual anatomical course and distribution.[2] However, a rare variation was noted in the third part, where the anterior and posterior circumflex humeral arteries were completely absent while the subscapular artery exhibited a normal origin **(Figure 2).** Moreover, an unusual ascending branch was observed emerging from the arteria profunda brachii (a branch of the brachial artery). This

ascending branch is then divided into two branches. One of the branches, termed the deltoid branch, accompanied the axillary nerve in the quadrangular space (compensating for the absent posterior circumflex humeral artery) and supplied the deltoid muscle. The other branch, termed the nutrient branch, supplied the head of the humerus **(Figure 3).** The graphical abstract represents the variations noted in the case report **(Figure 4).**

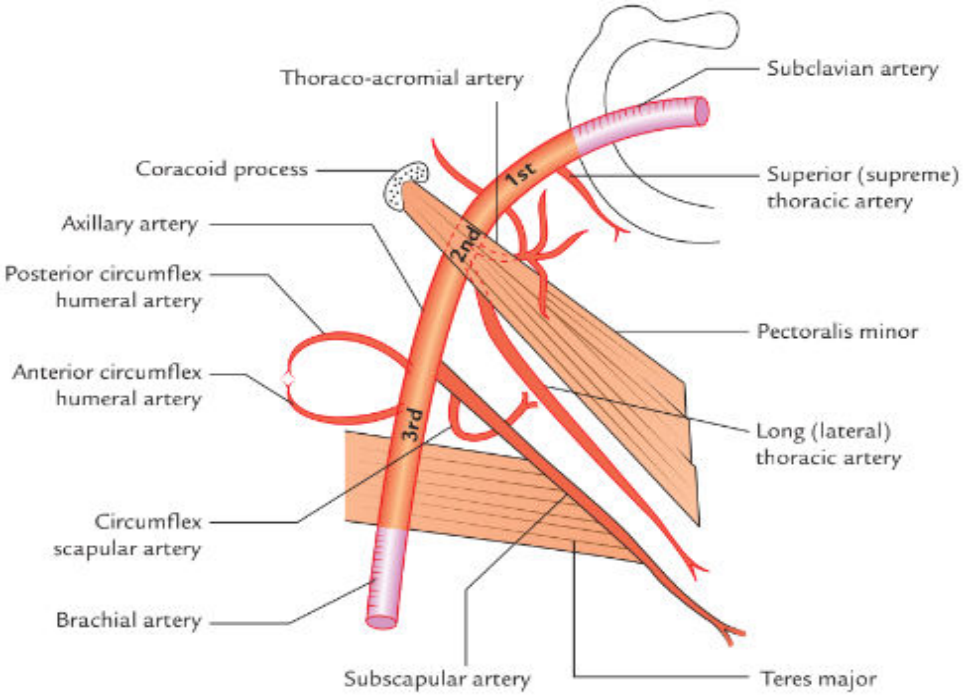

Figure 1. Course and branches of axillary artery.

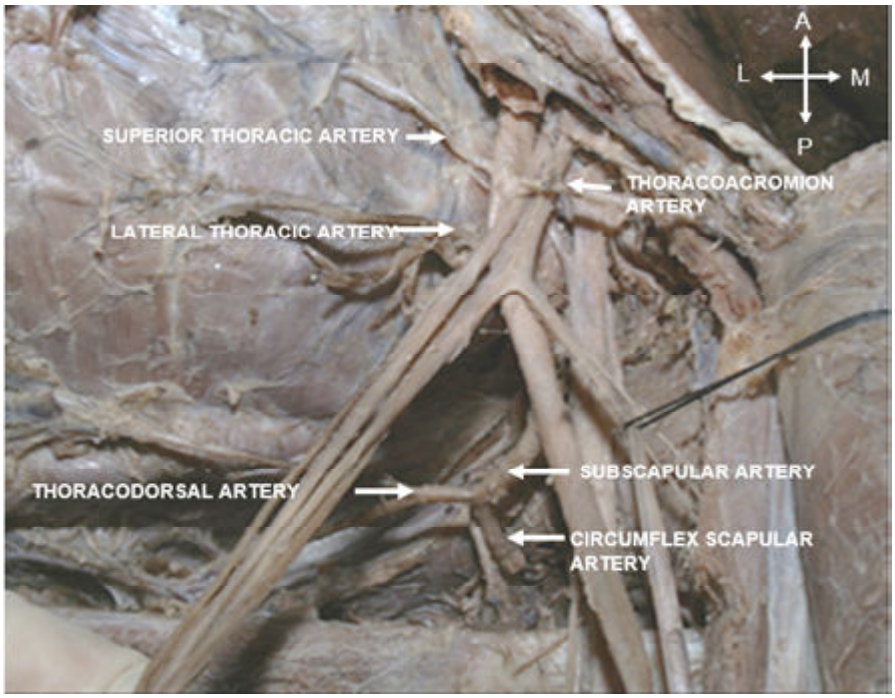

Figure 2. Branches of axillary artery without anterior and posterior circumflex humeral artery.

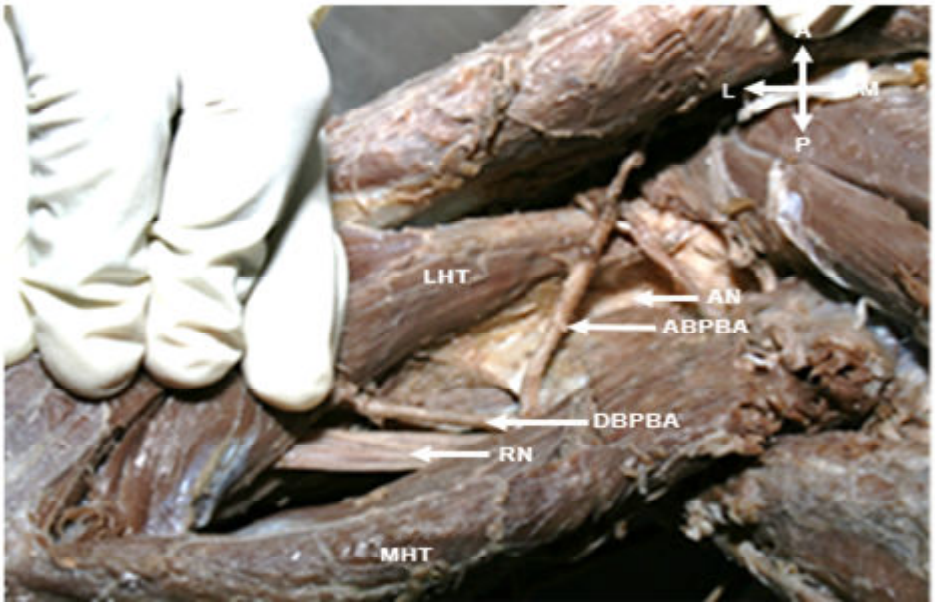

Figure 3. Lower triangular space showing ascending branch of profunda brachii artery accompanying axillary nerve in quadrangular space. ABPBA, Ascending branch of profunda brachii; AN, Axillary nerve; DBPBA, descending branch of profunda brachii; LHT, lateral head of triceps; MHT, medial head of triceps; RN, radial nerve.

Normal Anatomy

- 1st part: Superior thoracic artery
- 2nd part: Thoraco-acromion artery
  Lateral thoracic artery
- 3rd part: Anterior circumflex humeral artery
  Posterior circumflex humeral artery
  Subscapualr artery

Variation Anatomy

- 1st part & 2nd part are same as normal anatomy
- 3rd part :anterior and posterior circumflex humeral artery are absent
- Common trunk arises from arteria profuda brachii artery in addition to its usual branches
- Common trunk divides in to ascending and descending branches
- Ascending branch replaces posterior circumflex artery and accompanied axillary nerve in quadrangular space
- Descending branch supplies humerus as the nutrient artery.

Figure 4. Variation in the branching pattern of third part of axillary artery.

Discussion

Numerous variations have been reported in the arterial anatomy of the axillary artery. [3] Notably, the branches of the third part of the axillary artery exhibit a higher degree of variability. However, a rare variation was noted in the branching pattern of the axillary artery, which has not been previously documented. The picture illustrates that the axillary artery in the axilla has normal branches in the first and second parts, namely the superior thoracic artery (1st part), lateral thoracic artery, thoraco-acromial artery (2nd part), and subscapular artery (3rd part), with its terminal branches the thoracodorsal and circumflex scapular arteries. Interestingly, the other two branches of the third part of the anterior and posterior circumflex humeral arteries are absent; instead, an unusual ascending branch was observed. This branch emerged from the arteria profunda brachii and divided into two branches. The first branch, termed the deltoid branch (ABPBA–ascending branch of profunda brachii artery), accompanied the axillary nerve in the quadrangular space (compensating for the absent posterior circumflex humeral artery) and supplied the deltoid

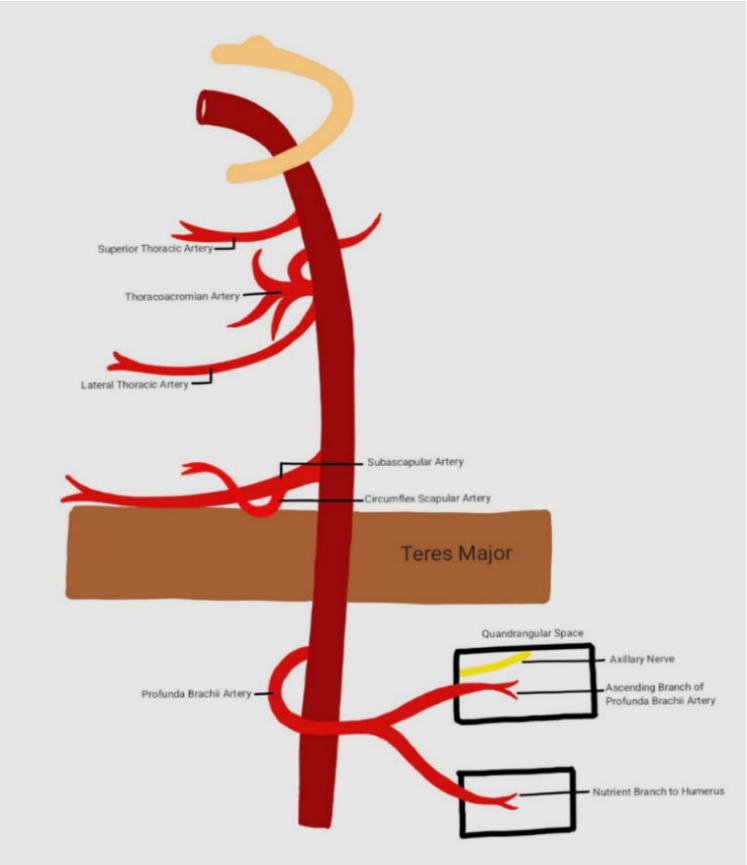

Figure 5. Schematic representation of variations in the branching pattern of axillary artery observed in the present case.
a) Absence of anterior and posterior circumflex humeral artery
b) A common trunk arises from arteria profuda brachii artery in addition to its usual branches
c) Common trunk divides in to ascending and descending branches
d) Ascending branch replaces posterior circumflex artery and accompanied axillary nerve in quadrangular space
e) Descending branch supplies humerus as the nutrient artery

muscle. The other branch, termed the nutrient branch (DBPBA–descending branch of profunda brachii artery), supplied the head of the humerus by accompanying the radial nerve (RN) in the lower triangular space **(Figure 5).**

Huelke DF. reported that the anterior circumflex humeral artery arose in common with the profunda brachii artery.[4] On the other hand, Patnaik VVG, *et al*. observed that in 4.0% of cases, the anterior and posterior circumflex humeral arteries arose in common with the subscapular and lateral thoracic arteries.[5] Samuel VP, *et al*. presented a report in which an abnormal trunk was observed from the third part of the axillary artery. From the abnormal trunk, the anterior and posterior circumflex humeral arteries originated together with the subscapular, radial collateral, middle collateral, and ulnar collateral arteries.[3]

VijayaBhaskar P, *et al.* described the axillary artery as dividing into a superficial brachial artery and a deep brachial artery, and from the latter, the subscapular, profunda brachii, articular branch to the shoulder joint, anterior circumflex, and posterior circumflex humeral arteries arose.[6] Vasudha S, *et al.* reported that a collateral branch (subscapular common trunk) arose from the first part of the axillary artery and gave rise to the circumflex scapular, thoracodorsal, posterior circumflex humeral, thoracic-acromion, and lateral thoracic arteries.[7]

Pellegerini A, *et al.* indicated that the origin of the posterior circumflex humeral artery was statistically different between nationalities.[8] Ramesh RT, *et al.* presented that the anterior and posterior circumflex humeral arteries originated from a common trunk along with the subscapular, profunda brachii, and ulnar collateral arteries from the third part of the axillary artery.[9] Lee JH, *et al.* found that the division

of the axillary artery into medial and lateral stems, from the lateral stem, five branches arose: two anterior circumflex humeral, a posterior circumflex humeral, and the profunda brachii arteries.[10] Daimi SR, *et al.* reported the presence of two trunks of the posterior circumflex humeral arteries. The first artery continued with the axillary nerve, and the second pierced the teres minor muscle and appeared on the dorsal surface of the scapula.[11]

In the present case, the branches of the third part of the axillary artery, i.e., the anterior and posterior circumflex humeral arteries, were absent, and an ascending branch from the arteria profunda brachii gave rise to two branches. One of the branches (the deltoid branch) accompanied the axillary nerve and supplied the deltoid muscle and the shoulder joint, and the other branch (the nutrient branch) supplied the head of the humerus. This branching pattern variation has not been observed in previous references.

Wheeless' Textbook of Orthopedics described that brachial artery injuries may result in the amputation of the limb below the elbow, as the latter is the sole source of blood supply to the forearm.[12] In this report, the branch of the brachial artery supplied the shoulder joint as well as the head of the humerus. Brachial artery injuries in such cases may cause avascular necrosis of the humerus and result in total amputation of the upper limb. Anatomical variations of the brachial and axillary arteries should be considered in upper limb injuries.[12]

Embryologically, the axis artery of the upper limb originates from the seventh cervical intersegmental (subclavian) artery. This artery grows distally along the ventral axial line and terminates as the palmar capillary plexus in the hand. The main trunk of the axis artery forms the axillary, brachial, and anterior interosseous arteries, as well as the deep palmar arch.[13]

Variations in the axillary artery branching pattern are due to defects in the embryonic development of the vascular plexus of the upper limb bud. This may be due to an arrest at any stage of the development of vessels, followed by regression, retention, or reappearance, which leads to variations in the arterial origin and the course of the major upper limb vessels.[14]

Conclusion

In this report, we highlight a rare variation in the arterial tree of the axillary artery where branches of the third part of the axillary artery were absent. An unusual ascending branch of the arteria profunda brachii then divided into two branches. These branches supplied the shoulder joint, the deltoid muscle, and the head of the humerus. This study provides potential information for anatomists, radiologists, and vascular surgeons. Details of arterial pattern variations of the axillary artery may be essential for patients undergoing dialysis and arteriography, for antegrade cerebral perfusion in aortic surgery, and for catheterization or cannulation of the axillary artery for several procedures.

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Conflict of interest statement

Each of the author has completed an ICMJE disclosure form. The authors declare that they do not have any potential or actual relationship, activity, or conflict of interest related to the content of this article.

Data sharing statement

Data generated or analyzed for the present report is included in this published article. Further details are available from the corresponding author on reasonable request after the deidentification of the patient whose data is included in the report.

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