



A CADAVERIC STUDY OF THE AXILLARY ARTERY.

HUMBERTO FERREIRA ARQUEZ*

*Professor of Human Morphology, Medicine Program, Morphology Laboratory Coordinator,
University of Pamplona. Pamplona, Norte de Santander, Colombia, South America.*

ABSTRACT

The axillary artery is classically divided into three parts by pectoralis minor muscle and usually described as giving off six major branches. Anatomical variations in the branching pattern of axillary artery include: subscapular, lateral thoracic and the circumflex humeral. A total of 13 cadavers (26 embalmed axillae) were used for the study. In 92,4 % of the cases the axillary artery having a classic pattern of branching and in 7,6% of the cases the axillary artery showed variations in pattern of branching: First part did not give any branch, the second part gave off only three branches: lateral thoracic, thoracoacromial and large common trunk which later gave off thoracodorsal, circumflex scapular, subscapular, posterior circumflex humeral. The third part gave off only anterior circumflex humeral. Vascular variations in the axillary artery should be considered seriously as will implicate risk of bleeding during surgery also the difficulty in interpretation of the angiography.

KEYWORDS: Subclavian artery, axillary artery, anatomical variation, common trunk, vascular variation.



HUMBERTO FERREIRA ARQUEZ

Professor of Human Morphology, Medicine Program, Morphology Laboratory
Coordinator, University of Pamplona. Pamplona, Norte de Santander,
Colombia, South America.

*Corresponding author

INTRODUCTION

The arterial system of upper limb begins with the axillary artery, a continuation of subclavian artery from the outer border of first rib to the lower border of teres major. The artery is divisible into three parts. The first part begins at the lateral border of the first rib and extends to the superomedial border of the pectoralis minor muscle. The first part is enclosed within the axillary sheath along with the axillary vein and brachial plexus. The second part lies deep to the pectoralis minor muscle and the third part lies between the inferolateral border of the pectoralis minor and the inferior border of the teres major muscle as it crosses the artery anteriorly. The first part gives superior thoracic artery (STA). The second part gives lateral thoracic artery (LTA) and thoraco-acromial arteries (TAA). The third part gives three, subscapular artery (SSA), anterior circumflex humeral artery (ACHA) and posterior circumflex humeral artery (PCHA). The axillary artery continues as brachial artery distal to the lower border of teres major muscle^{1,2}. There is an extensive collateral circulation associated with the branches of subclavian and axillary artery, particularly around the scapula. This clearly becomes of clinical significance during injury of the axillary artery. It is common to find variations in the branching pattern of axillary artery. Many of its branches may arise by a common trunk or a branch of the named artery may arise separately. The variations of the axillary artery branching pattern has anatomical as well as clinical and surgical relevance given the proximity to the shoulder joint and humerus as well as the neurovascular supply to the deltoid muscle, important for surgeons who remove the axillary lymph nodes, to anesthesiologist and orthopedic surgeons considering the frequency of procedures done in this region and may serve as a useful guide for both radiologist and vascular surgeons. It may help to prevent diagnostic errors, interventional procedures and avoid complications during any surgery of the axillary region³⁻⁹. Aims and objective of present study is to observe and describe variations in axillary artery branches in human cadavers.

MATERIALS AND METHODS

A total of 13 cadavers of both sexes (12 men and 1 women-26 embalmed axillae) with different age group were used for the study. Bilateral axilla were carefully dissected as per the standard dissection procedure in the Morphology Laboratory at the University of Pamplona and was conducted to allow examination of the axillary artery and its branches. The topographic details were examined and the variations were recorded and photographed. The history of the individual and the cause of death are not known.

RESULTS

One specimen (7,6%) showed bilateral anatomical variations in patterns of branching of the axillary artery which result in: The first part of axillary artery did not give any branch. The superior thoracic artery was absent. The second part of artery gave three branches: (a). Thoracoacromial artery that showed usual pattern. It emerged at the upper border of pectoralis minor muscle and was divided into four branches namely acromial, deltoid, clavicular and pectoral, all followed usual course. (b). Lateral Thoracic artery (c). A large common trunk that down and laterally. This common trunk gave following branches:

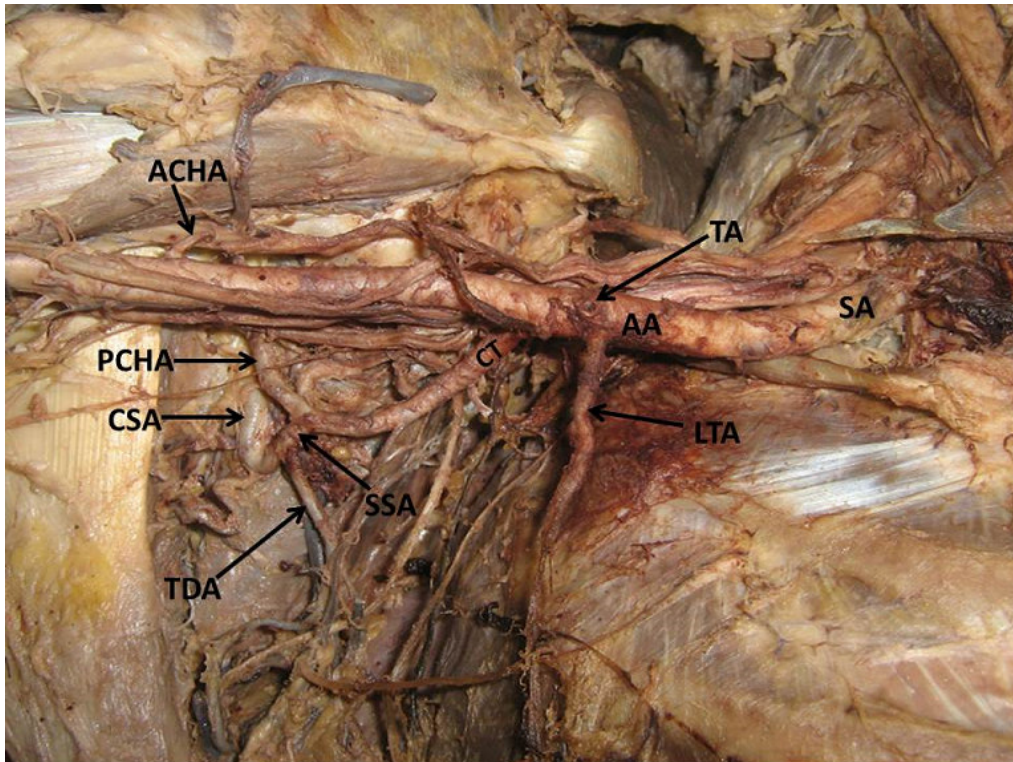
- 1- Thoracodorsal artery
- 2- Subscapular artery
- 3- Posterior circumflex humeral artery
- 4- Circumflex Scapular artery

The third part of axillary artery had only one branch i.e. Anterior circumflex humeral artery. This artery wound around the humerus anteriorly and ended intertubercular sulcus of humerus by dividing into ascending and descending branches without anastomosing with posterior circumflex humeral artery. The posterior circumflex humeral artery, which was a continuation of the common trunk from the second part of axillary artery along with axillary nerve entered quadrangular space and wound

around the humerus posteriorly, then it was divided into upper and lower branches deep to the deltoid muscle and ended by supplying shoulder joint and deltoid muscle. This arterial

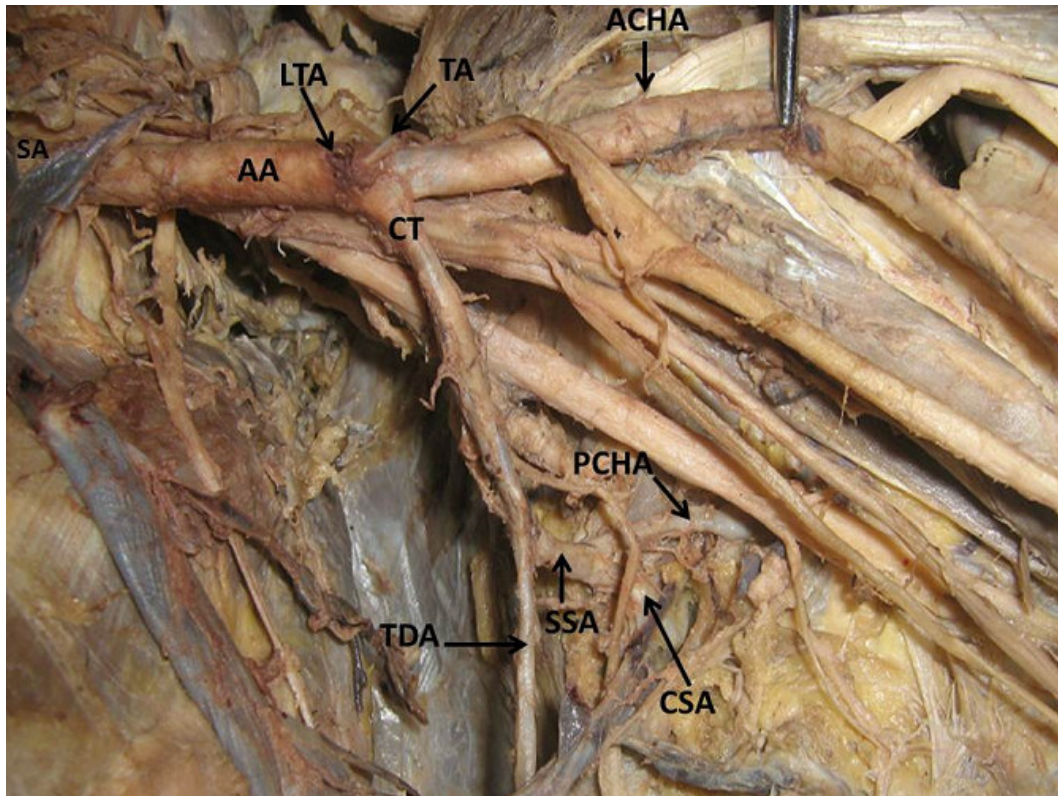
distribution described anatomical variables were observed in both armpits (figures 1 and 2).

Figure 1
Axillary artery in right upper limb.



SA: Subclavian artery, AA: Axillary artery, TA: Thoracoacromial artery, LTA: Lateral Thoracic artery, CT: Common trunk, SSA: Subscapular artery, TDA: Thoracodorsal artery, CSA: Circumflex Scapular artery, PCHA: Posterior circumflex humeral artery, ACHA: Anterior circumflex humeral artery.

Figure 2
Axillary artery in left upper limb.



SA: Subclavian artery, AA: Axillary artery, TA: Thoracoacromial artery, LTA: Lateral Thoracic artery, CT: Common trunk, SSA: Subscapular artery, TDA: Thoracodorsal artery, CSA: Circumflex Scapular artery, PCHA: Posterior circumflex humeral artery, ACHA: Anterior circumflex humeral artery. In the remaining 92,4% limbs (24 axillae) the course and branching patterns of the axillary artery was normal as per described in the standard text book of anatomy.

DISCUSSION

Anatomic variations in the major arteries of the upper limb have been reported. It is not uncommon to find the variation in the branching pattern of axillary artery^{2,8-15}. Such anomalous branching pattern may represent persisting branches of the capillary plexus of the developing limb buds and their unusual course may be a cause for concern to the vascular radiologists and surgeons and may lead to complications in surgeries involving the axilla and the pectoral regions. Presence of a large common trunk as a branch of the axillary artery is worth considering: a) during antegrade cerebral perfusion in aortic surgery, b) while creating the bypass between axillary and subclavian artery in case of subclavian artery occlusion, c) while treating the aneurysm of axillary artery, d) while reconstruction of axillary artery after trauma, e) while treating the axillary hematoma and brachial plexus palsy, f) while

considering the branches of the axillary artery for the use of microvascular graft to replace the damaged arteries, g) while creating the axillary-coronary bypass shunt in high risk patient, h) during surgeries involved in breast augmentation, i) radical mastectomy, j) catheterization/ cannulation of axillary artery for various purposes, k) while treating the axillary artery thrombosis, l) while analyzing the axillary region using imaging system or ultrasonography, j) while using the medial arm skin as free flap, k) during surgical intervention of fractured upper end of humerus and shoulder dislocations¹³. Anomalies in axillary artery with regard to origin, course and branching patterns are not frequent. During embryogenesis the lateral branch of seventh cervical inter segmental artery becomes enlarged to form the axial artery of upper limb which on further development becomes axillary, brachial, its bud

gives rise to radial and ulnar arteries^{14,15}. The arterial anomalies in the upper limb are due to defects in embryonic development of the vascular plexus in the upper limb buds. This may be due to arrest at any stage of development of the vascular plexus showing regression, retention or reappearance and may lead to variations in the arterial origins and courses of the major upper limb vessels¹⁷. A model has been proposed which demonstrates the development of the arteries of upper limb in 5 stages. This model explains the development of an axial system appears first and other branches develop later from this axial system. Consequently the axillary artery, brachial artery and anterior interosseous artery are contained in the axial system of the adult. In stage 2 the median artery branches from the last one afterwards in stage 3 the ulnar artery branches from the brachial artery. In stage 4 the development of superficial brachial artery consequences from the axillary and it continue being a radial artery. Rising of definitive radial artery is a consequence of the regression of the median artery and an anastomosis between the brachial artery and the superficial brachial artery with regression of the proximal segment of the latter^{18,19}. According to Arey²⁰, the unusual blood vessels may be due to:

- The choice of unusual paths in the primitive vascular plexuses.
- The persistence of vessels normally obliterated.
- The disappearance of vessels normally retained

- Incomplete development and fusions and absorption of the parts usually distinct.

CONCLUSION

The arterial variations of branching pattern of axillary artery should be well known for accurate diagnostic interpretation and surgical interventions are clinically important for vascular and plastic surgeons, orthopaedicians and radiologists performing angiographic studies on the upper limb. Sound knowledge of axillary artery is important for the fact that after the popliteal artery it has the second highest rate of puncture and damage in intensive movements and its role in bleeding in distal part of limb in the cases of injuries, surgeries and embolies. It has been ruptured in an attempt to reduce old dislocations, especially when the artery is adherent to the articular capsule.

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CONFLICT OF INTEREST

Conflict of interest declared none

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