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Variation in Branching Pattern of Axillary Artery.

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ABSTRACT

The axillary artery, a continuation of the subclavian artery, supplies the lateral chest wall, axilla, and upper extremity. Divided into three parts based on its relation to the pectoralis minor muscle, the axillary artery typically gives rise to six branches. Variations in its branching pattern are clinically significant for surgical and diagnostic procedures. This study involved the dissection of 64 upper limbs from 32 cadavers (25 males, 7 females). Each axilla was dissected following standard techniques, and variations in the axillary artery's branching pattern were documented. Classical descriptions of six branches served as the basis for identifying deviations. Variations were observed in 14 limbs (21.8%). Key variations included the origin of the lateral thoracic artery from the subscapular artery (9%) and a common trunk for thoracoacromial, lateral thoracic, and subscapular arteries (5%). The thoracoacromial trunk was absent in 2% of limbs, with its branches arising directly from the axillary artery. Embryological defects during vascular development likely account for these variations. Understanding these patterns is critical for interventions such as coronary bypass, axillary artery reconstruction, and angiographic imaging. Knowledge of axillary artery branching variations is crucial for accurate diagnosis and safe therapeutic interventions.

Keywords: Axillary artery, branching variations, vascular anatomy

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INTRODUCTION

In humans, the axillary artery is the direct continuation of the subclavian artery. It provides the blood supply to the lateral wall of the chest, axilla, and upper extremity. It originates from the side edge of the first rib before it is called the subclavian artery [1]. The axillary artery often consists of three parts depending on the artery location relative to the pectoralis minor muscle, which is superficial to the artery. The first part is proximal, the second part is posterior, and the third part is distal to this muscle. In normal anatomy, six branches arise from the axillary artery. The first branch, the superior thoracic artery (STA), originates from the first part. The second and third branches, the thoracoacromial artery (TAA) and lateral thoracic artery (LTA), originate from the second part. The fourth, fifth, and sixth branches, the subscapular artery (SSA), anterior circumflex humeral artery (ACHA), and posterior circumflex humeral artery (PCHA), respectively, originate from the third part [2].

Accurate knowledge of the normal and variant arterial anatomy of the axillary artery is important for clinical procedures in this region [3]. 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 [1].

METHODOLOGY

In this study, 32 cadavers (25 males and 7 females) so total 64 upper limbs were dissected. out of 64 upper limbs 32 are of right and 32 of left) were dissected. Each cadaver was placed in a supine position with arms abducted and palms facing up. Each Axilla was dissected following classical incisions and dissection procedures described in Cunningham's dissector The pectoralis major and pectoralis minor muscles were dissected. After the brachial plexus, axillary vein, the axillary artery was identified. The branching patterns and variations of the axillary artery were analyzed.

Classical descriptions of the branching pattern of axillary artery state that it has six branches, 1st artery (superior thoracic Artery) from first part, 2nd and 3rd artery (Thoracoaromial trunk and Lateral thoracic Artery) from second part and 4th, 5th and 6th arteries (anterior and posterior circumflex humeral, and subscapular arteries) from third part. Deviations from this pattern were considered as being a variation.

RESULT

We found variation in 14 limbs out of 64 limbs (32 cadavers- 25 males and 7 females) 21.8 %

Variation 1: Division of Thoracoacromial trunk into Deltoacromial branch which further gives Deltoid Artery and Acromial Artery and Clavipectoral branch which further gives Clavicular Artery and Pectoral Artery in 2 limbs.

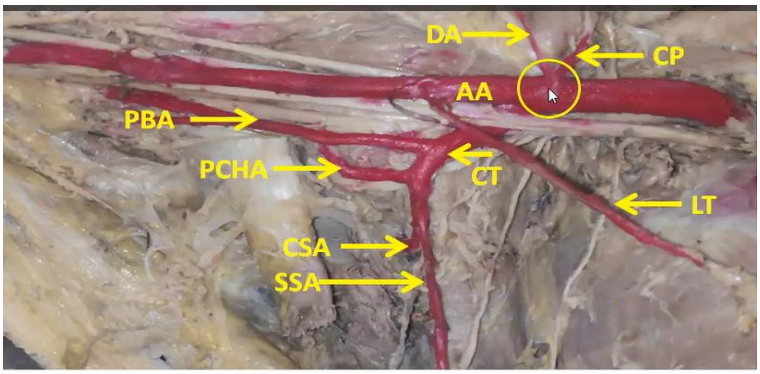

Figure 1

Variation 2: Origin of Lateral Thoracic Artery from Subscapular Artery in 6 limbs

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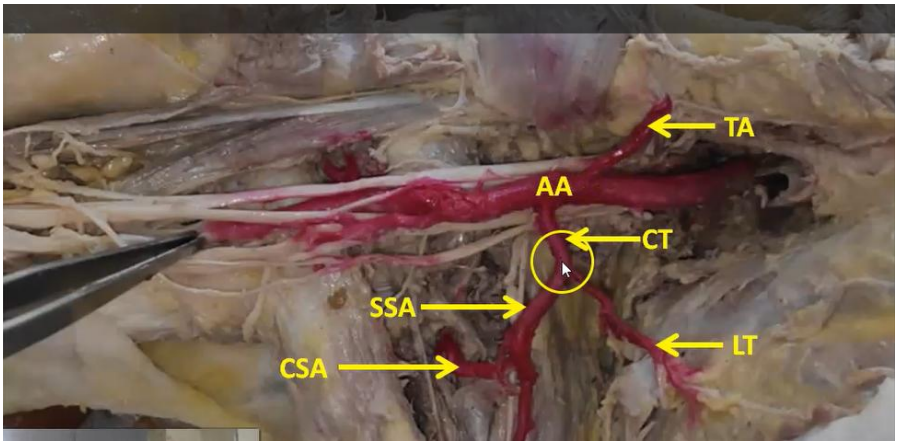

Figure 2

Variation 3: Common trunk which gives Subscapular Artery, Posterior circumflex humeral Artery and Profunda brachial Artery in 2 limbs.

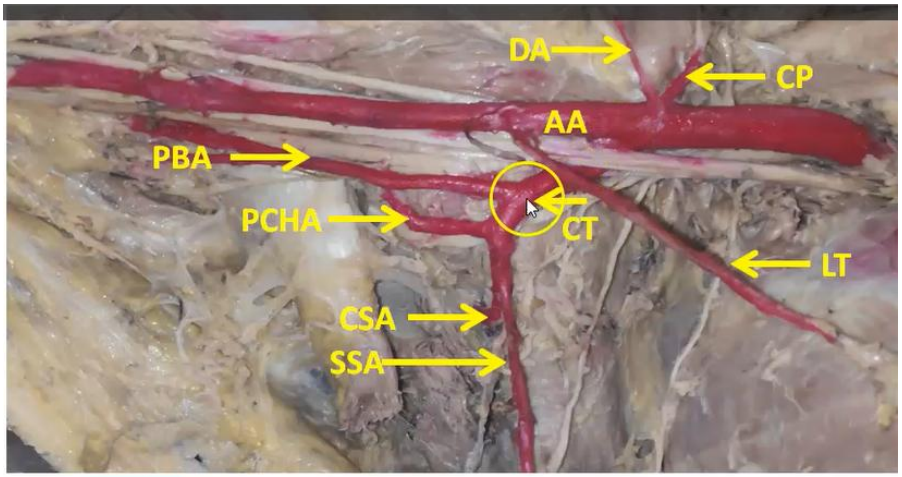

Figure 3

Variation 4: Common trunk which gives Thoracoaromial trunk, Lateral thoracic artery and subscapular artery in 3 limbs.

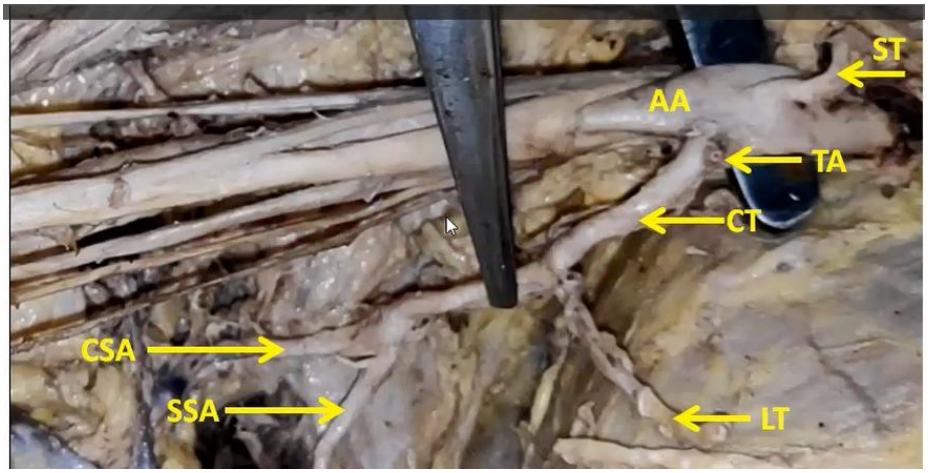

Figure 4

Variation 5: Absent Thoracoacromial trunk instead all branches arise directly from Axillary Artery in 1 limb.

DISCUSSION

Variations in branching pattern of axillary artery are due to defects in embryonic development of the vascular plexus of upper limb bud [4]. The vasculature of the upper limbs originates from the primitive axial and superficial brachial arteries, with the axillary, brachial and interosseous arteries arising from the primitive axial artery. In the proximal arm, both the brachial and axillary arteries merge with the superficial brachial artery, while in its distal part, the superficial brachial artery anastomoses with the brachial artery. In the forearm, the primitive axial artery (ulnar system) gives a terminal trunk which anastomoses with the median artery (derivative of forearm arteries), the deep branch of the radial artery (branch of the primitive axial artery) and the ulnar artery [5, 6]. Differentiation of the vessels occurs proximal to distal by regression of some capillaries and maintenance and enlargement of others. It is the variations in differentiation, regression and persistence of these capillaries which result in the variations seen in the vessels of the upper limb [5]. In-depth knowledge of the normal arterial anatomy of the axillary artery and its variants is essential for clinical diagnosis and treatment, for example in coronary bypass and shoulder dislocation [7].

The branching pattern of the axillary artery was studied with respect to its six classical branches. Of the 64 dissections undertaken and examined variations were noted in 14 specimens. These observations show that 21% of specimens are showing variations.

Subscapular artery from the third part of axillary artery gave origin to lateral thoracic artery in 14.6%, 1%, 23.4% and 26.4% in previous studies [7-10]. However we found origin of lateral thoracic artery from the subscapular artery(Figure 3) in 9% of the limbs.

The thoracoacromial trunk was a direct branch of second part of the axillary artery [8-10]. Pandey and Shukla [11] described variations in origin of the branches of thoracoacromial trunk, more on the right side, and divided these variations into three groups. In the first group, deltoacromial and clavipectoral sub trunks arose directly from the second part of the axillary artery, and the thoracoacromial trunk was absent. In the second group, only clavicular branch of thoracoacromial trunk arose from the second part of axillary artery whereas the remaining three were arising from thoracoacromial trunk. In the third group, all classical branches of thoracoacromial trunk arose directly from the second part of axillary artery and thoracoacromial trunk was absent. We did not find thoracoacromial trunk in 2% of the limbs and all the classical branches of it were directly arising from the second part of the axillary artery. In 3% of the limbs, thoracoacromial trunk was divided, just after its origin, into deltoacromial and clavipectoral sub trunks (Figure 1) which were divided into deltoid and acromial, clavicular and pectoral branches, respectively. Origin of thoracoacromial trunk, was found from a common trunk for thoracoacromial Artery, Subscapular Artery and Lateral thoracic artery (Figure 2) in 5% limbs.

Bergman RA et. al [12] reported Axillary artery may give origin to a common trunk from its third part from which anterior circumflex humeral, posterior circumflex humeral, subscapular and pro funda brachii arteries may arise. Saeed et al [13] reported the origin of a common subscapular-circumflex humeral trunk from the third part of axillary artery, which divided into subscapular, anterior circumflex humeral and posterior circumflex humeral arteries in 3.8% of cases. Ramesh et al [14] reported unusual origin of a common trunk from the third part of the left axillary artery, which gave origin to subscapular, anterior circumflex humeral, posterior circumflex humeral, profunda brachii, and ulnar collateral arteries. Vijaya et al [15] observed a common trunk from the third part of the axillary artery, which gave origin to anterior circumflex humeral, posterior circumflex humeral, subscapular, radial collateral, middle collateral and superior ulnar collateral arteries with absent profunda brachii artery. Cavdar [3] reported division of axillary artery in third part into deep and superficial brachial arteries: deep brachial artery divided into anterior circumflex humeral, posterior circumflex humeral, subscapular and profunda brachii arteries, so it may be similar to common trunk as we found; and the superficial brachial artery was divided into radial and ulnar arteries in cubital fossa. We found a common trunk from the third part of axillary artery in two of the limbs; the common trunk gave origin to posterior circumflex humeral, subscapular and profunda brachii arteries (Figure 3), and in 3 limbs the common trunk gave origin to Thoracoacromial trunk, Lateral thoracic artery and subscapular artery (Figure 4). Bhargava [16]

considered this common trunk as an original axillary brachial trunk, which failed to develop in early fetal life and became obstructed. Subsequently, an apparent axillary brachial trunk developed for supplying the distal part of the limb. This was probably a vasa aberrans, which sometimes arose from the brachial artery. This type of arrangement gives a good blood supply to the limb through profunda brachii if axillary artery or brachial artery was connected distally to the origin of this common trunk.

Knowledge of branching pattern of axillary artery is necessary during antegrade cerebral perfusion in aortic surgery [17], while treating the axillary artery thrombosis [18], using the medial arm skin flap [19], reconstructing the axillary artery after trauma, treating axillary artery hematoma and brachial plexus palsy, considering the branches of the axillary artery for the use of microvascular graft to replace the damaged arteries, creating the axillary-coronary bypass shunt in high risk patients, catheterizing or cannulating the axillary artery for several procedures, during surgical intervention of fractured upper end of humerus, and shoulder dislocations. Therefore, both the normal and abnormal anatomies of the axillary artery should be well known for accurate diagnostic interpretation and surgical intervention.

CONCLUSION

A knowledge of variations in the branching pattern of the axillary artery is important for both diagnostic purposes and therapeutic interventions [20-26]. Vascular radiologists acknowledge the significance of variations when conducting angiographic imaging [3], while surgeons may be faced with interpreting arterial variations in procedures for trauma or neoplasm [21]. The current study, therefore, aims to determine the incidence of variations in the branching pattern of the axillary artery.

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