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VARIANT ANATOMY OF SUBSCAPULAR AND CIRCUMFLEX HUMERAL ARTERIES - A CADAVERIC STUDY ON THIRD PART OF AXILLARY ARTERY

Anatomy

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ABSTRACT

Introduction - Axillary artery (AA) is the continuation of subclavian artery. The AA gives off six branches. The first part gives rise to superior thoracic artery (STA). The second part gives off thoracoacromial artery (TAA) and lateral thoracic artery (LTA). From the third part subscapular artery (SSA), anterior circumflex humeral artery (ACHA) and posterior circumflex humeral artery (PCHA) arise. **Aim** - Present study is aimed at detecting the variable patterns of origin and course of subscapular and circumflex humeral arteries from the third part of axillary artery. **Materials And Methods** - This descriptive study was conducted in seventy eight upper limbs of thirty nine embalmed cadavers belonging to the Department of Anatomy, Govt Medical College, Kozhikode, Kerala. The axillary artery and its branches were traced and studied in detail through dissection method to detect the variations, giving emphasis to the branches from its third part. **Results** - The variations detected are common trunk of origin for SSA & PCHA , common trunk of origin for SSA, ACHA & PCHA, origin of SSA from 2nd part of AA, origin of SSA along with LTA from 3rd part of AA and common trunk of origin for ACHA & PCHA. **Conclusion –** This variant anatomy of the third part of axillary artery finds enormous importance in the current era of advanced interventions and cardiovascular surgeries

KEYWORDS

Axillary artery, subscapular artery, anterior circumflex humeral artery, posterior circumflex humeral artery.

INTRODUCTION

Axillary artery (AA) is the continuation of subclavian artery. It extends from the outer border of first rib to the inferior border of teres major muscle. The course of AA is divided into three parts by pectoralis minor and they lie proximal, posterior and distal to this muscle. The AA gives off six branches. The first part gives rise to superior thoracic artery (STA). The second part gives off thoracoacromial artery (TAA) and lateral thoracic artery (LTA). The thoracoacromial artery divides into four branches – pectoral, deltoid , acromial and clavicular branches. From the third part subscapular artery (SSA), anterior circumflex humeral artery (ACHA) and posterior circumflex humeral artery (PCHA) arise. The SSA is the largest branch which runs along the lateral border of scapula and and approximately 4cm from its origin it divides into circumflex scapular and thoracodorsal arteries[1].

The potential of clinical significance of axillary artery is being increasingly recognised in last two decades. A thorough knowledge of normal and variant pattern of axillary artery is essential for interventional cardiologists , cardiovascular surgeons and general surgeons during different types of interventions and surgical procedures of axillary and pectoral regions. Several studies have been done to delineate the anatomical details and variations of axillary artery. The type and frequency of these variations should be well understood and documented to prevent iatrogenic injuries during various types of surgical procedures.

MATERIALS AND METHODS

This descriptive study was conducted in seventy eight upper limbs of thirty nine embalmed cadavers belonging to the Department of Anatomy, Govt Medical College, Kozhikode, Kerala over a period of three years, after getting clearance from Institutional Research Committee and Institutional Ethics Committee. All available specimens except those with diseased and injured vessels were included in this study. The exposure of axillary artery was achieved by, following the classical incisions and dissection procedures given in Cunningham's Manual of Practical Anatomy[2]. The axillary artery and its branches were traced and studied to detect the variations, giving emphasis to the branches from its third part. The origin and course of SSA, ACHA and PCHA were studied in detail. The data was analysed and the variations were photographed without colouring the vessels, to get the natural look.

RESULTS

The branches from third part of axillary artery (AA) showed much variations. The largest branch SSA arose as a common trunk in six specimens. Of these, SSA originated along with PCHA in four (5.1%) specimens (figure 1) and along with ACHA and PCHA in two (2.6%) specimens (figure 2). The remaining courses of these arteries were normal.

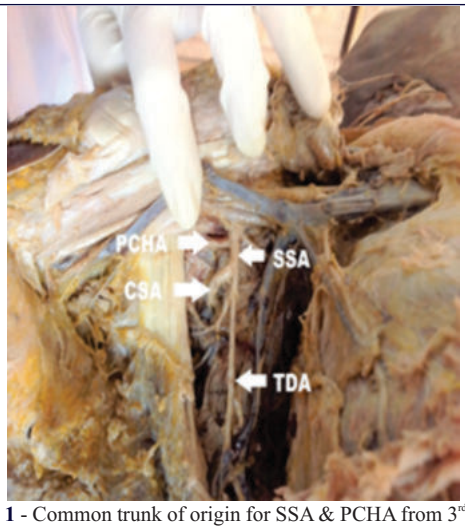

Figure 1 - Common trunk of origin for SSA & PCHA from 3rd part of AA.

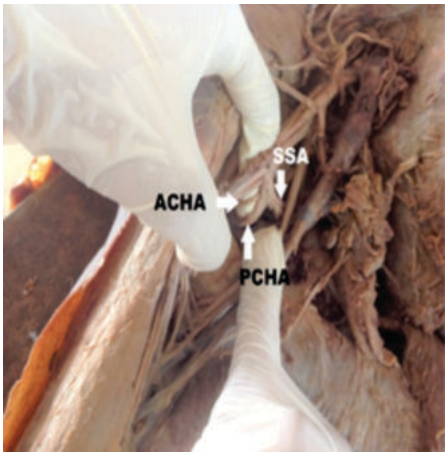

Figure 2 -Common trunk of origin for SSA, ACHA & PCHA from 3rd part of AA.

The SSA originated from the second part of AA in three (3.8%) specimens (figure 3) . A comparative analysis is given in table 1. In these three specimens ACHA and PCHA arose as normal from the third part of AA.

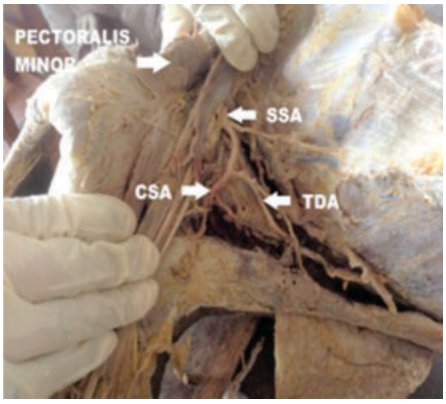

Figure 3 - Origin of SSA from 2nd part of AA.

Table 1 –A comparative analysis on the origin of SSA from 2nd part of AA

Sl No	Authors	Origin of SSA from 2nd part of AA (%)
1	Huelke et al3	15.7
2	Karambelkar et al4	6.66
3	Bala et al5	4.5
4	Present study	3.8

The origin of SSA and LTA from a common point from the third part of AA was visualised in one (1.3%) specimen (figure 4).

Figure 4 - Origin of SSA along with LTA from 3rd part of AA.

Another variation observed was the common trunk of origin for ACHA and PCHA (figure 5). Two (2.6%) specimens showed this variation.

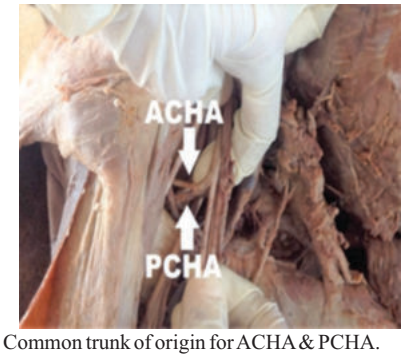

Figure 5 - Common trunk of origin for ACHA & PCHA.

Considerable variations were detected in the size of ACHA and PCHA. In most specimens ACHA was thin and PCHA was thick vessel (figure 6).

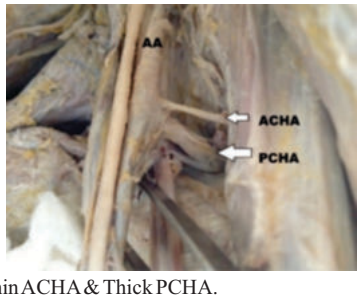

Figure 6 – Thin ACHA & Thick PCHA.

An analysis was carried out after entering the details of all observed variations in a table (Table 2).

Table 2- Prevalence of variations in the present study

Sl No	Variations of present study	Prevalence %
1	Common trunk of origin for SSA & PCHA from 3rd part of AA	5.1
2	Common trunk of origin for SSA, ACHA & PCHA from 3rd part of AA	2.6
3	Origin of SSA from 2nd part of AA	3.8
4	Origin of SSA along with LTA from 3rd part of AA	1.3
5	Common trunk of origin for ACHA & PCHA from 3rd part of AA	2.6

DISCUSSION

Literature documents many variations in the branching pattern of axillary artery especially 3rd part. Huelke[3] in his study reported that subscapular artery arose from the first part of AA in 0.6% cases, from the second part in 15.7% cases, and from the third part in 79.2% cases. Karambelkar et al[4] documented the origin of subscapular artery from the second part of AA in 6.66% of cases. Bala et al[5] described the origin SSA from 2nd part of AA in 4.5% of cases, in which, it divided into four terminal branches.

Saeed et al[6] observed the common subscapular-circumflex humeral trunk from the 3rd part of both axillary arteries in two male cadavers. As per their study the subscapular and the circumflex humeral branches of the axillary artery were sharing a common stem of origin from the axillary artery . Two cm distal to its origin, it gave two posterior circumflex humeral branches and the parent trunk continued as thoracodorsal branch of subscapular artery. The two PCHA were unequal in size and followed the axillary nerve to reach the surgical neck of the humerus. The anterior circumflex humeral artery was very small with 3mm external diameter and direct origin from the 3rd part of the axillary artery.

Astha et al[7] reported a case in which a common trunk arose from the third part of the axillary artery which divided into anterior and posterior circumflex humeral, subscapular and Profunda brachii artery. Astik and Dave[8] also observed similar variation in which these arteries originated from a common trunk, in a study conducted in eighty upperlimbs of forty cadavers.

Samuel et al[9] described the presence of a common trunk from the third part of the axillary artery giving rise to anterior circumflex humeral, posterior circumflex humeral, and subscapular arteries and which then descended into the arm to give radial collateral, middle collateral and continued as the superior ulnar collateral artery.

Dimovelis et al[10] documented a rare case in which subscapular arterial trunk gave origin to thoracodorsal, circumflex scapular, posterior humeral circumflex, and lateral thoracic artery. As per their opinion such a variation might cause undesired sequelae during trauma management and a variety of common flap harvesting operations including latissimus dorsi, scapular and parascapular flaps.

Singh et al[11] described two types of common stem from axillary artery during in a female cadaver, during routine undergraduate dissection. A common stem arising from the 2nd part of left axillary artery which divided into the lateral thoracic artery, the subscapular artery and an alar artery. A common trunk arising from the 2nd part of right axillary branched out to give the posterior circumflex humeral artery, the subscapular artery and an alar artery.

Shanthakumar and Rao[12] came across a variation in branching pattern of right axillary artery in a male cadaver, during routine dissection. According to their description left axillary artery was found to be normal. The first part of axillary artery gave rise to superior thoracic artery as usual, but the second part gave a common trunk which divided into the lateral thoracic and subscapular arteries. The third part of the artery gave origin to anterior and posterior circumflex humeral arteries

Aizawa et al[13] labelled the subscapular and related arteries in the deep region of the axilla, as subscapular artery system (Sbs system) and classified them into 3 groups; S-type, I-type and P-type Sbs systems. In the S-type Sbs system, the Sbs artery branches off the lateral thoracic, which itself emerges from the 2nd part of the axillary artery. In the I-

type and P-type Sbs systems, the Sbs artery branches off the proximal and distal segments of the 3rd part of the axillary artery.

Banerjee et al[14] reported a case of common trunk for PCHA and LTA in a sixty five year-old embalmed female cadaver. The PCHA curved backwards around the humeral neck and made anastomosis with the ACHA. The LTA supplied serratus anterior and the pectoral muscles and made anastomosis with intercostal arteries. As per Baur et al's[15] study the LTA branched directly from the AXA in 49%, from the TDA 33%, and from the SSA in 6% of cases.

Sarkar et al[16] documented a case in which third part of the axillary artery gave anterior circumflex humeral artery at a higher level than usual and a common trunk for muscular branches which arose first, lateral thoracic artery, subscapular artery and posterior circumflex humeral artery. Lateral thoracic artery instead of subscapular artery was the largest branch of the axillary artery in their report.

Yang et al[17] conducted a study in fifty nine upper limbs and noticed different variations of axillary artery. As per their study the most frequent branching pattern was common origin of the LTA and SSA, which was seen in twenty specimens they studied. The AHCA and PHCA were originated together in nineteen cases. The both patterns were combined in twelve cases. The common trunk for the SSA, PHCA, and AHCA was found in two cases.

Akhthar et al[18] observed case in which the first part of the axillary artery gave origin to the superior thoracic artery as usual and the second part gave thoracoacromial artery, which showed the normal course and branching pattern. In addition to this branch, the second part also gave a large common trunk from which lateral thoracic artery and subscapular artery arose. The subscapular artery was divided into circumflex scapular and thoracodorsal arteries. The third part of the axillary artery gave anterior and posterior circumflex humeral arteries only.

CONCLUSION

Present study which focussed on the third part of axillary artery showed much variations in the pattern of origin of subscapular artery, anterior and posterior circumflex humeral arteries. The observed variations are common trunk of origin for SSA & PCHA , common trunk of origin for SSA, ACHA & PCHA, origin of SSA from 2nd part of AA, origin of SSA along with LTA from 3rd part of AA and common trunk of origin for ACHA & PCHA. The axillary artery is increasingly being used in cardiovascular surgeries as it is relatively less affected by atherosclerosis. So a robust idea on these variations will help the clinicians to prevent iatrogenic injuries during different types of cardiovascular interventions and other surgical procedures of axillary and pectoral regions.

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