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ORIGINAL ARTICLE

Anatomical Variation of the Axillary Artery in Central Punjab Population of Pakistan

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ABSTRACT

Background: Axillary artery continues directly from subclavian artery. It usually provides six branches in three parts. Superior thoracic artery is provided by first part of axillary artery whereas the second part provides thoracoacromial artery (TAC) and lateral thoracic artery (LT) and third part provides posterior circumflex humeral artery (PCH), anterior circumflex humeral artery (ACH) and subscapular artery (SS). This branching pattern of axillary artery usually involves anatomical variation and typically inofvolves posterior circumflex humeral artery, lateral thoracic artery and subscapular artery. The variation in this pattern contains surgical and clinical as well as anatomical relevance given the accessibility towards humerus and shoulder joint.

Methodology: This study (bilateral axilla dissection) was performed on 28 preserved axillae (14 dead bodies) to permit axillary artery's examination and its parts. The study was conducted in anatomy department, Services Institute of Medical Sciences, Lahore, from November 2022 to April 2023.

Results: 76% of cases showed the characteristic branching pattern of the LT, which originates from the axillary artery posterior to the pectoralis minor muscle, and the SS, which produces the thoracodorsal (TD) and circumflex scapular (CS) arteries. 8% of the time, it was noticed that the SS originated from the LT. Six percent of the time, the LT was seen to be coming from the SS. In the absence of SS, the LT was seen to produce the TD and circumflex scapular artery 3% of the time. According to 76% of classical descriptions, the PCH developed from four distinct sources, the third portion of the axillary artery. 12% from the SS. from the DB 8% deep brachial artery and the LT 3%.

Conclusion: It is rather typical for the axillary artery and its branches to have vascular diversity. As this variation can increase the risk of bleeding during surgery of axilla so it is crucial to consider it seriously. It can also cause difficulty in angiography interpretation after axillary catheterization.

Keywords: Anatomy of axilla, axillary artery, variation in axilla and vascular variation, lateral thoracic artery (LT), subscapular artery (SS), posterior circumflex humeral artery (PCH).

INTRODUCTION

The axillary artery directly continues from the first rib (outer border) to the teres major muscle (lower border) of subclavian artery. The pectoralis minor muscle anatomically divides the axillary artery into three sections[1]. The first, second and third parts are proximal, behind and distal to the muscles respectively. Almost six branches are known to be emerging from the axillary artery. The first part which is proximal to the muscle provides superior thoracic artery. The second part which is behind the muscles gives TAC and LT. The three arteries PCH, ACH and SS are included in the third part[2]. There exists a substantial collateral circulation linked with axillary arteries and subclavian branches, especially around the scapula. This obviously becomes significant from a clinical standpoint when the axillary artery is injured. A common trunk may give rise to several of its branches, or individual branches of the designated artery may develop[3]. Anatomical changes in the axillary artery's branching pattern are rather common and usually involve PCH, SS, and LT. In a report of Saeed et al (2002) a bilateral thoracic humeral trunk arises from the second part of the axillary artery (1.9%) and branches into the lateral thoracic, circumflex humeral, subscapular, and thoracodorsal arteries[4]. A bilateral common subscapular-circumflex humeral trunk emerges from the third part of the axillary artery (3.8%) and branches into the circumflex humeral and thoracodorsal arteries. The axillar artery variation branching pattern contain surgical and clinical as well as anatomical connection given to the humerus and shoulder joint proximity as well as deltoid muscle's neurovascular supply. This study highlights the anatomical variation of the axillary artery in a Central Punjab population of Pakistan[5].

METHODOLOGY

This study is cross-sectional and descriptive designed to find out axillary artery anatomical variation in a Central Punjab population, during the period from November 2022 to April 2023. The procedure for bilateral axilla dissection was performed on 28 embalmed axillae (14 cadavers) to permit the investigation of axillary artery along with its branches. Out of 28 specimens 7 belongs to female while 21 belongs to male cadavers. At the time of death all cadavers aged between 20-75 years. The study was conducted in Services Institute of Medical Sciences, Lahore, human anatomy department, Central Punjab Pakistan. Cadavers with no pathological conditions and trauma that affect axillary area were included in this study. Cadavers having deformities in upper limb and signs of surgical intervention in axillary artery were excluded from this study. Data for this study was collected based on position, origin, and course of posterior circumflex humeral, lateral thoracic and subscapular arteries. By following standard protocols of dissection, dissection was done by trained anatomists. The skin, subcutaneous tissue, and fascia covering the axillary region were carefully removed to reveal it. The axillary artery was located and followed from its starting point at the outside edge of the first rib to its end point at the teres major muscle's lower border. Based on accepted anatomical classifications, such as the Adachi classification, variations were categorized. Focus was placed on the branching patterns, including the subscapular artery's origin, typical trunk forms, and any abnormal branches. The frequency of each type of variation was calculated. To find any meaningful correlations between changes and demographic variables like age and sex, chi-square tests were employed. The cadavers utilized in the study were treated with respect and dignity thanks to the study's adherence to the ethical norms for anatomical research.

RESULTS

As shown in table 01 many of the branching patterns of axillary artery variation were seen. According to LT and SS, there exist four different patterns along with classical pattern of branching[6]. In 76% of cases, the LT followed the conventional branching pattern

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that started from the axillary artery posterior to the pectoralis minor muscle, and in 88% of those cases, the SS produced the CS and TD arteries. Six percent of the time, the LT was shown to be coming from the SS, and in sixty percent of those cases, it was bilateral. In the absence of SS, the LT was finally seen to produce the CS artery and TD 3% of the time, and it was bilateral in 54% of those cases.

Table 1: variability frequency of SS and LT

Sr no.	Frequency (%))	Bilateral frequency (%)	Variation
1.	76	88	Classic LT/SS
2.	8.5	67	TD away from LT
3.	8	44	SS away from LT
4.	6	60	LT away from SS
5.	3	54	Only LT

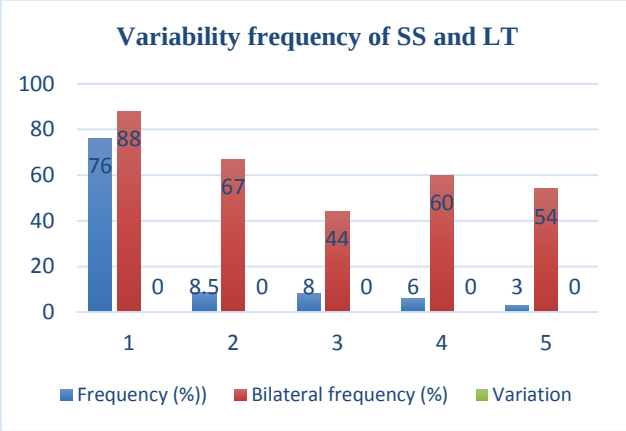

Figure: 1:

From table 02 we can observe that PCH comes out from four distinct sources. In 76% of cases, PCH was bilateral, and its origin was the third segment of the axillary artery as stated traditionally. In 12% of cases, the PCH came from the SS, and in 38% of those cases, it was bilateral. In 8% of cases, PCH was bilateral and derived from the deep brachial artery (DB). Lastly, the PCH did not appear to originate bilaterally and instead came from LT3% of the time. Along the way to the deltoid muscle, the PCH's distribution and course were noted.

Table 2: Variability frequency of PCH

Sr No.	Frequency (%)	Bilateral frequency (%)	Variation
1	76	87	PCH (Classic)
2	12	38	PCH away from SS
3	8	73	PCH away from DB
4	3	0	PCH away from LT

Traditionally, the axillary nerve and the PCH pass through the quadrangular area on their way to supply the deltoid muscle. Almost four PCH sources were seen in this study i.e., LT, SS and axillary artery. However, only 15% of the time when the PCH started from the DB did it pass through the quadrangular area. There are almost 85 percent of such cases in which PCH originates from DB, it changes into triangular space and when it passes through deltoid muscle.

Table 3: PCH distribution

Variation	Quadrangular space (%)	Triangular space (%)
PCH (Classic)	100	0
PCH away from SS	100	0
PCH away from DB	15	85
PCH away from LT	100	0

DISCUSSION

According to many researchers' anatomical variation along with its branching pattern seems common. Our goal is to focus on the clinical importance of vascular variations. Jurjus et al in 1999 presented the availability of abnormal bilateral disparity variation in axilla arterial pattern in his study[7]. There exists a great variation in axillary artery's third part. From common trunk the two circumflex arteries may arise. Such abnormal branching pattern shows continuing capillary plexus branches of growing limb buds, and their different course may lead to concern for surgeons and radiologists because of complications in pectoral region and axilla surgeries[8]. The axillary artery originates from the seventh cervical segmental artery, and any anomaly during development causes the peculiar branching pattern. Most commonly, when the length of an embryo is almost 11 mm (about 0.43 in), there is an increase in the seventh cervical intersegmental artery. By doing so it will become the most prominent vessel of an axilla. There exists a slow degeneration process on T1, C7 and C6 segmental arteries. A variety of alternatives that have existence during upper limb vessels formation are responsible for abnormal patterns of arterial branching. The current study's findings, which show the frequency of the LT, TD, and PCH's alternate origins as well as the vessel's path and distribution to its destination, are pertinent to the anatomical field[9]. Given that the PCH may go through the triangular space rather than the quadrangular space on its route to the deltoid muscle, these findings are pertinent to clinicians. Deep understanding of the vascular variations is crucial for those surgeons who will do surgical operations with axillary destruction for CA-breast, to orthopedic and anesthesiologist surgeons keeping the procedures' frequency done in area for humerus, the axillary artery is additionally regularly accelerated by violence compared to another artery, being more open when diseased[10]. To lessen the old shoulder dislocation, it has ruptured. Correct understandings of variant and normal arterial pattern of human upper extremities are crucial for both angiography and reparative surgery variation in axillary artery branching pattern. Knowing variations in axillary artery helps in practicing clinically, more specifically in those surgeries that involves axilla and pectoral region[11]. These differences can make treatments like lymph node dissection for breast cancer more difficult and increase the risk of ischemia or bleeding. Preoperative imaging, such as CT angiography and Doppler ultrasonography, is crucial for planning surgical techniques that will prevent unintentional arterial damage and for mapping the structure of the arteries[12]. This knowledge is important for orthopedic surgeons that handle humeral fractures and for anesthesiologists that perform regional blocks[13]. Ongoing education and research on vascular differences highlights the significance of incorporating this anatomical expertise into clinical training and practice, as it improves surgical outcomes, increases patient safety, and decreases complications[14].

CONCLUSION

This study systematically figures out the axillary artery anatomical variations and its branches diversity and pattern in Central Punjab population of Pakistan. Notably, differences in the subscapular artery's origin and branching, the development of common trunks, and the existence of aberrant branches were recorded frequently. Major observations involve the occurrence of common trunk frequency emergence for circumflex humeral arteries and the scapular and many other atypical branches emerging from the axillary artery, that could have important inference for surgical interventions in axillary region. The subscapular artery's origin and course exhibited significant heterogeneity, offering distinctive features particular to this group while yet complying with certain previously documented patterns. These differences are important because they emphasize the necessity for thorough preoperative planning and imaging to prevent unintentional damage to these veins, which is especially important for radiologists and surgeons. Moreover, this study also highlights the significance of knowing

regional anatomical changes, helping in the development of more precise educational tools and anatomical models. The data collected and presented in this study will not only cover the broader area of anatomical literature but also focuses on the importance of studies that are region-specific. Because the differences seen in this population from Central Punjab could not be the same as those described in other ethnic or geographic groupings, specific anatomical investigation is crucial.

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