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A VARIATION IN THE ORIGIN, COURSE AND BLOOD SUPPLY OF THE POSTERIOR CIRCUMFLEX HUMERAL ARTERY

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ABSTRACT

Learning ordinary anatomy is an essential part of medical training. New knowledge about anatomical variations helps surgeons to improve their surgical techniques and avoid complications. The posterior circumflex humeral artery usually arises from the axillary artery and passes through the quadrilateral space along with the axillary nerve. In our study, we introduce a human cadaver specimen with unusual arterial variation. In this case, instead of passing through the quadrilateral space, the posterior circumflex humeral artery coursed along the lower edge of the teres major muscle to the surgical neck of the humerus. In our data, the posterior circumflex humeral artery arose from brachial artery and the branches of this artery supplied the deltoid muscle, teres minor and infraspinatus tendons, and the lower part of the long head of the triceps brachii muscle.

Keywords: *anatomical variation; posterior circumflex humeral artery; course and blood supply; quadrilateral space; clinical relevance*

INTRODUCTION

Usually the posterior circumflex humeral artery begins from the axillary artery and runs with axillary nerve through the quadrilateral space [1, 9, 12]. In very rare cases, the posterior circumflex humeral artery may originate from the

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brachial artery [6, 11, 26]. This artery generally supplies blood to the rotator cuff muscles, although some articles emphasize the blood supply to the deltoid muscle, and teres minor and infraspinatus tendons [5, 8, 16, 22]. The anatomical boundaries of the posterior region of shoulder are as follows: the long head of the triceps brachii muscle passes between the teres minor and teres major and separates the quadrilateral space from the trilateral space. The quadrilateral space is bounded laterally by the surgical neck of the humerus [1, 12].

In literature, the quadrilateral space syndrome is characterized by axillary nerve and posterior circumflex artery compression within the quadrilateral space [7, 10, 21]. This compression often appears in overhead throwing athletes who play baseball, volleyball, football and also swimmers [4, 15, 22, 23, 27]. In addition to this, axillary nerve and posterior circumflex humeral artery injuries may occur with shoulder joint dislocations as the displacement of the humeral head into the quadrilateral space may damage these structures. Proximal humeral fractures (surgical neck fractures) in elderly patients have also been associated with injuries of the quadrilateral space structures [3, 12]. Injuries to this artery should be considered clinically significant.

Therefore, the aim of this study was to document the unusual origin, course and blood supply of the posterior circumflex humeral artery.

MATERIALS AND METHODS

During the anatomical dissection of the left shoulder of a deceased 80-year-old person, an unusual anatomical variation of the posterior circumflex humeral artery was found.

Prior to the dissection, the left shoulder specimen was injected with 200 ml of latex diluted in a 10% aqueous solution stabilized with 0.7% concentration ammonia via the subclavian and the brachial arteries simultaneously. After the injection, the left shoulder specimen was fixed in alcohol – formalin – glycerol solution and meticulously dissected using a dissection microscope. Macroscopically, the left shoulder specimen was without rotator cuff tendon ruptures. Next, the deltoid muscle was released from the cranial side: at the clavicle, acromion and spina scapulae. The deltoid muscle was separated from the underlying subacromial bursa and was moved laterally. Blood vessels were isolated, and arterial and venous vessels separated. Veins and axillary fat were removed to clearly visualize the subclavian and axillary arteries, together with their branches and the axillary nerve.

The anatomical shoulder specimen was collected from a voluntarily donated body. The ethics permissions was received from *Gesetz über das Leichen-, Bestattungs- und Friedhofwesen des Landes Schleswig-Holstein vom 04.02.2005, Abschnitt II, § 9 (Leichenöffnung, anatomisch).*

RESULTS

The axillary nerve travelled through the quadrilateral space, but the posterior circumflex humeral artery did not pass through the quadrilateral space. The posterior circumflex humeral artery ran under the lower edge of the teres major muscle towards the surgical neck of the humerus. The distance between axillary nerve (quadrilateral space) and origin of the posterior circumflex humeral artery was 3.6 cm (Figure 1). In this case, the posterior circumflex humeral artery did not arise from the axillary artery but began from the brachial artery (Figure 1).

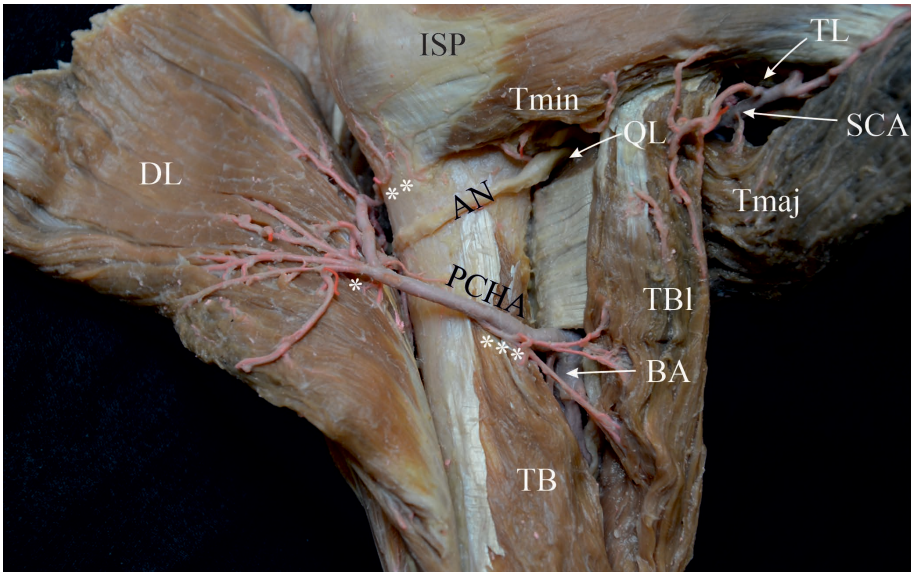

Figure 1. The posterior view of the left shoulder specimen. The deltoid muscle (DL) has been released from the clavicle, acromion and spina scapulae. The axillary nerve (AN) penetrates the quadrilateral space (QL) and the scapular circumflex artery (SCA) of the trilateral space (TL). The posterior circumflex humeral artery (PCHA) began from the brachial artery (BA). The posterior circumflex humeral artery branches: to deltoid muscle (*), to infraspinatus and teres minor tendons (**), to the lower part of the long head of the triceps brachii muscle (***). Infraspinatus muscle (ISP), teres major muscle (Tmaj), teres minor muscle (Tmin), triceps brachii muscle (TB), long head of the triceps brachii muscle (TBl).

The posterior circumflex humeral artery crossed the surgical neck posteriorly and gave off left branches to supply the deltoid muscle and teres minor and infraspinatus tendons. Near the surgical neck of the humerus it gave off right direct branches that supplied blood to the lower part of the long head of triceps brachii muscle. The circumflex scapular artery travelled through the trilateral space and gave branches to the upper part of the long head of the triceps brachii muscle (Figure 1).

DISCUSSION

The most important aspect of the present study was to visualize and describe an unusual anatomical variation of the posterior circumflex humeral artery, its origin, course and blood supply. Usually, the artery passes through the quadrilateral space together with axillary nerve [1, 12]. The present study showed that the posterior circumflex humeral artery ran under the lower edge of the teres major muscle and headed towards the surgical neck of the humerus Iliev et al. [11] described a similar course of the same artery, but their artery gave anastomosis with the anterior circumflex humeral artery, which was not present in our dissection. Other authors have also described the unusual course of the posterior circumflex humeral artery, but have investigated it in relation to other muscles, such as latissimus dorsi and pectoralis major [13, 25].

Typically, the posterior circumflex humeral artery arises from the axillary artery, but in our case it started from the brachial artery, which occurs very rarely. In literature we found one article [11] that described a similar variation. According to Elajnaf et al. [6], the posterior circumflex humeral artery began from a profunda brachii artery (deep artery of the arm).

Based on our data, the posterior circumflex humeral artery provides blood supply to the deltoid muscle, teres minor and infraspinatus tendons and the long head of the triceps brachii muscle. Some authors have reported that posterior circumflex humeral artery generally supplies rotator cuff muscles and long head of the triceps muscle [2, 17, 24]. Others have more precisely described the supply area of the posterior circumflex humeral artery for the infraspinatus and teres minor tendons, two thirds of the posterior surface of the deltoid muscle and subacromial bursa [5, 8, 18, 19, 20]. The results of the present study are partly in line with Põldoja et al. [19] who have shown that the posterior circumflex humeral artery gives direct branches to the long head of the triceps brachii muscle. Based on our data, two different sources supply this muscle: the upper part branches from the circumflex scapular artery and the lower part branches from the posterior circumflex humeral artery.

Clinical relevance

The clinical relevance of anatomy and blood supply should not be underrated. According to many authors, the quadrilateral space syndrome is a shoulder pathology which involves both arterial and nerve compression induced by repetitive external rotation and abduction of the shoulder joint. It mainly affects young people who play basketball, volleyball, football or practice swimming [7, 9, 14, 21, 22, 23]. In the unusual anatomical variation described by us, the posterior circumflex humeral artery did not pass through the quadrilateral space; therefore, we would think that in this case the compression only affected the axillary nerve.

Chen et al. [3] showed that the posterior circumflex humeral artery injury is more common in elderly people with humerus fractures. As in our case report, the posterior circumflex artery also crossed the humerus, it could be endangered by humeral fractures and during surgical exposures.

The authors hope that this case report will help doctors better understand the quadrilateral space compression syndrome and be aware of the different anatomical variations during surgery to minimize the risk of complications, such as perioperative bleeding.

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