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BILATERAL AXILLARY ARCH MUSCLE ALONG WITH VARIATION IN POSTERIOR CORD OF BRACHIAL PLEXUS

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ABSTRACT

Introduction: In the routine dissection of the axilla, a bi-lateral muscle variation of Latissimus Dorsi is observed which is commonly known as the Langer's muscle or the axillary arch muscle. This muscular slip is 9.5 cm in length and 2.7 cm in width; is attached on the posterior axillary fold and proximally to the fascia of the subscapularis muscle over the shoulder joint capsule. In the axilla, it is observed that the posterior cord of the brachial plexus has two branches/divisions and the additional muscle fibres run between them. The upper part of the posterior cord of the brachial plexus which forms the axillary nerve comes directly from the posterior division of the upper trunk, whereas the lower part which forms the radial nerve is formed from the posterior divisions of the middle and the lower trunk of the plexus. Both these branches are then interconnected by a small communicating nerve in the axilla just beneath the Langer's muscle. **Methods**: Regular dissection at Anatomy Dissection Hall, National Institute of Ayurveda, deemed to be university, Jaipur. Dissection methodology as per grant's dissector.

Result and Conclusion: Such anatomical arrangement commonly leads to compression of the neurovascular bundle and related symptoms. The Langer's muscle often has surgical as well as clinical implications and is often misdiagnosed for lymphadenopathies and breast carcinomas. Therefore, this variation needs to be studied and kept in mind in surgical approaches of the axilla.

Keywords: axillary arch muscle, langer's muscle, brachial plexus, dissection.

INTRODUCTION

Axilla: an introduction:

The axilla is a pyramidal space between the chest and the arm bounded anteriorly by the pectoralis muscles and posteriorly by the subscapularis, teres major and latissimus dorsi muscles. Its contents are the axillary vessels and the infra-clavicular part of the brachial plexus which supplies the whole of the upper limb[1]. This area is of great importance for the surgical approach specially to achieve anaesthetic blockade of the brachial plexus for most arm/forearm/hand surgeries. Thus, understanding the anatomical relation of all the structures of this region becomes necessary.

Langer's muscle is a rare but best-known variant structure in the axilla; and is also known as the Langer's arch, axillary arch muscle (LAA), axillopectoral muscle, Axillary arch or the pectorodorsalis muscle.[2] The axillary arch muscle was first described by Bugnone (1783) and Ramsay (1793) and later by Karl Langer in 1846.

Anatomically, it is the additional slip of the Latissimus Dorsi muscle, which is a large, triangular, flat muscle that forms a sheet covering the entire lower back i.e., the lumbar and the lower thorax region overlapping the inferior angle of the scapula. The Latissimus Dorsi forms the posterior axillary fold as it passes over the teres major muscle curves around it to finally insert as a flattened tendon on the floor of the intertubercular sulcus of the humerus bone.[3] The additional fibre of arch muscle arises midway from this posterior axillary fold, passes anterior to the axillary vessels and nerves to join the tendons of the pectoralis major, coracobrachialis or the fascia over the biceps brachii. This slip is usually 7-10 cm long and 5-15 mm wide. [4]

Latissimus Dorsi is majorly supplied by the thoracodorsal artery and innervated by the thoracodorsal nerve which arises from the posterior cord of the brachial plexus C6, C7 and C8.[5] It majorly acts adduction, extension and medial rotation of the shoulder joint. It is also known as the 'climber's muscle' due to its actions of pulling the trunk forward and upward while climbing. In addition, it is active towards the end of forced expiration.

Cords and branches of brachial plexus: In the lower axilla, the lateral, medial and posterior cords of the brachial plexus assume their appropriate relation with the second part of the axillary artery deep to the pectoralis major muscle.[6]They further divide into branches to supply the upper limb. The posterior cord is formed by the union of the posterior divisions of the upper, middle and lower trunks and gives off 5 branches: upper and lower subscapular nerve, thoracodorsal nerve or nerve to the latissimus dorsi, the axillary nerve in the axilla and continues as the radial nerve distally. The axillary nerve arises from the posterior cord of brachial plexus(C5, C6); at first, lies lateral to the radial nerve, runs over subscapularis muscle to enter the quadrangular space (bounded: anteriorly: subscapularis, posteriorly: teres minor, medially: teres major and laterally: surgical neck of the humerus) to supply the shoulder joint and the deltoid muscle.[7] The radial nerve also arising from the posterior cord (C5, C6, C7, C8 & T1) is the largest branch of the brachial plexus. It passes behind the axillary and brachial arteries and anterior to the subscapularis muscle, Latissimus dorsi and teres major muscle to reach the lower triangular space (bounded: superiorly: lower border of teres major, medially: long head of triceps and laterally: medial border of shaft of the humerus). Now, it enters the posterior compartment of the arm to supply the back of the entire upper limb.[8] Several variations have been reported in these branches of brachial plexus over the years.

MATERIALS AND METHODS

Routine dissection of the axilla of a formalin-fixed male cadaver at the National Institute of Ayurveda deemed to be university, Jaipur. The dissection was performed following the methodology of Grant's dissector, south Asian edition and additionally Cunningham's manual of practical anatomy, volume 1 (upper and lower limb) was referred to as per requirement. Reference books of anatomy and surgery e.g., grey's anatomy (41st international edition), Netter's atlas, Moore clinically oriented anatomy, various published articles were thoroughly studied to draw interferences.

In the routine dissection of the axilla, after exposing the pectoralis major and minor muscles and clearing the fat pad of the region; an additional slip of muscle attached to the anterior boundary of latissimus dorsi muscle was observed.

Attachments: On further dissection of this slip it was found that the additional fibres are attached distally to the mid of the posterior axillary fold in form of the tendon and proximally to the fascia of the subscapularis muscle and the under the surface of the pectoralis minor muscle over the shoulder joint capsule anteriorly. Refer to figure 1.

Dimensions: This fibromuscular slip was 9.5 cm in length with muscular part 7 cm long and tendinous part 2.5 cm long and 2.7 cm in width

Nerve supply: Usually the Langer's muscle is supplied by the lateral pectoral nerve or by the intercostobrachial nerve, the medial pectoral nerve and the thoracodorsal nerve but in this case due to variation in the branching pattern of the brachial plexus it has a separate supply directly from the brachial plexus: by a nerve arising from the junction between the posterior division of upper trunk and anterior division of lower trunk.

Relation with branches of the Brachial plexus: Further, in the axilla, it is observed that the posterior cord of the brachial plexus has two branches/divisions and the additional muscle fibres run between them. The fibres of the posterior cord running anterior-superior to this slip continue in the arm as radial nerve and the fibres which lie posterior-inferior form the axillary nerve. Refer figure 2

Variation in the formation of the posterior cord of the brachial plexus: On supra-clavicular dissection of the brachial plexus on the cadaver, it was seen that the posterior-inferior branch of posterior cord forming axillary nerve is coming directly from the posterior division of the upper trunk; whereas the anterior-superior branch which forms the radial nerve is formed from the posterior divisions of the middle and the lower trunk of the plexus. Both these branches are then interconnected by a small communicating nerve in the axilla just beneath the Langer's muscle. Refer figure 2 & 3

Branching pattern of the posterior cord: Also, the upper subscapular nerve and the lower subscapular nerve arises from the axillary nerve; whereas the thoracodorsal nerve arises from the radial nerve but immediately comes to lie posterior to the Langer's muscle to supply the latissimus dorsi muscle. Refer figure 4

This rarely found variation was observed on both sides of the cadaver. The anomaly was delineated, and the specimen was photographed [Figure].

DISCUSSION

The axillary arch muscle is a common anomaly found in the axilla and is considered as the vestigial muscle of the panniculus carnosus[9]: a layer of striated muscle found in non-primates and other animals like monkeys used for climbing onto trees but with lost functional significance in humans due to evolution. It is usually present in association with other anomalies such as the chondroepitrochlear muscle (4th pectoral muscle), two axillary veins, variants of the brachial plexus or the absence of the intercostobrachial nerve[10]. In the present case, it is present with a variant of the brachial plexus. The existence of a variant branching pattern of the brachial plexus can be attributed to several factors influencing its embryonic development. In embryonic development, the brachial plexus first appears as a single Radicular cone of axons of spinal nerves, growing distally to reach the muscles and skin of the upper limb; later these Axons divide to form ventral and dorsal divisions.[11] Several signalling molecules and transcription factors have been identified which induce the differentiation of the dorsal and ventral motor horn cells. Misexpression of any of these signalling molecules can lead to abnormalities in the formation and distribution of particular nerve fibres. Once formed, any developmental differences would persist postnatally[12]. The branching of the plexus is a complicated process and depends on the interaction between organizers and the host muscle. Also, the muscles develop from the myotomes which are innervated by specific spinal nerves. So, it can be said that the variation in the branching of the posterior cord observed here might be due to the presence of the otherwise absent vestigial Langer's muscle.

Clinical Relevance:

Clinically, the Langer's muscle can be palpated while physical examination as a mass on the medial side of the axilla in over-head abduction of the shoulder joint and when the palm is put on the back of the head. In such cases, it is often misunderstood with axillary lymphadenopathy or soft tissue tumour and histological examination and MRI becomes important for differential diagnosis.

It can also cause entrapment of the neuro-vascular bundle present beneath it during some arm movement and result in circulatory deficiency, chronic pain and paresthesia.[13] In the present case there is a high probability of compression of the axillary nerve and the thoracodorsal nerve which may have affected movements of the deltoid and latissimus dorsi (over-head abduction). In such cases, surgical intervention can provide relief.

Surgical significance:

As the axillary approach in cases of mastectomy, lymphadenopathies, reconstruction procedures, surgeries of limb and palm (for anaesthetic blockade of brachial plexus) and axillary by-pass are nowadays common in surgical practices; the presence of axillary arch muscle may impact the surgical procedure. Mainly it has the following impact[14]:

a. Some of the lymph nodes may be hidden beneath the arch muscle and missing these nodes in cases of breast cancers puts the patients at the risk of re-occurrence.
b. It may be believed as the true border of the latissimus dorsi muscle; thus, misguiding the surgeon for supra-axillary incision which processes the risk of rupturing the axillary artery or the brachial plexus branches.

CONCLUSION

In the present case, Langer's muscle- a rare variation of the latissimus dorsi muscle present in almost 7% population is found in the axilla of a male cadaver along with a variant of the posterior cord of the brachial plexus. Though usually asymptomatic; it may sometimes lead to entrapment of axillary vessels and the branches of the brachial plexus resulting in associated symptoms. The mass appears similar to soft tissue cancer mass and lymphadenopathies; so, proper knowledge is important for differential diagnosis. It may also, misguide surgeons for supra-axillary plane incisions or by hiding some lymph nodes. Thus, Knowledge of such variations are important to avoid potential compilations both intra- and post-operatively as an axillary approach in cases of mastectomy, lymphadenopathies, reconstruction procedures and axillary by-pass are nowadays common in surgical practices.

FIGURES

Figure 1 dissected axillary region showing the Langer's muscle (LAA) present in between the radial nerve (RN) and the axillary nerve (AN); beneath the axillary vessels (AA) (cut from proximal end) also marked in the figure: Latissimus dorsi muscle (LD), Subscapularis muscle (SSM), coracobrachialis muscle (CBM) Pectoralis minor muscle (PMI), Musculocutaneous nerve (MCN) and the Ulnar Nerve (UN)

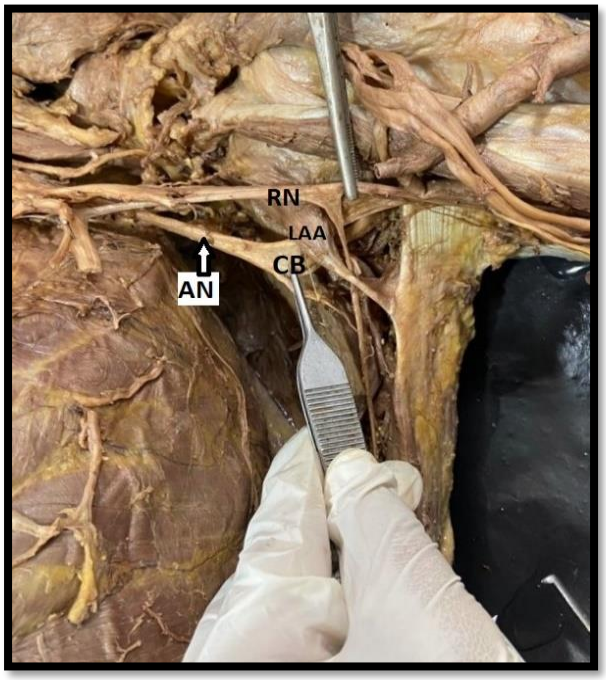

Figure 2 Langer's muscle (LAA) found between the axillary (AN) and the radial nerve (RN). The communicating branch (CB) between the radial nerve (RN) and the axillary nerve (AN) can be seen here present beneath the Langer's muscle (LAA)

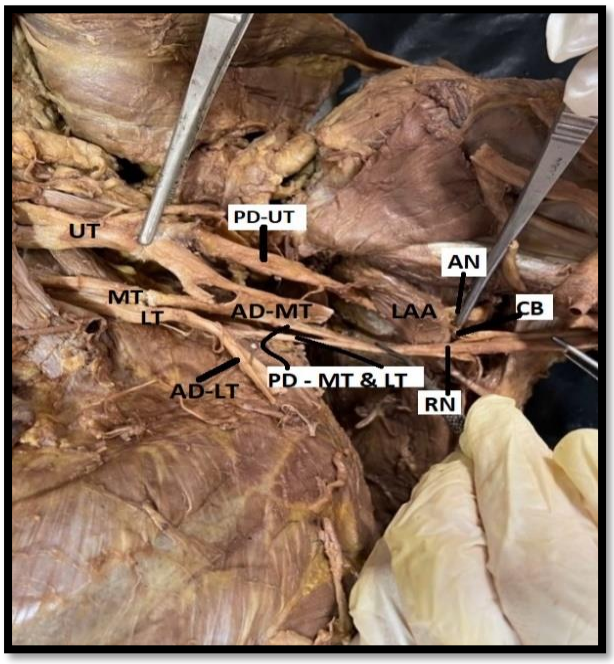

Figure 3 Represents the formation of the posterior cord of the brachial plexus; the posterior division of the upper trunk (PD-UT) runs beneath the Langer's muscle (LAA) and continues as the axillary nerve (AN) whereas the posterior division of the middle and lower trunk (PD- MT & LT) runs over the LAA to form the Radial nerve (RN). A small communicating branch (CB) connects the AN & RN. Also, seen in figure: upper, middle & lower Trunk of brachial plexus (UT, MT & LT), anterior division of the middle & lower trunk (AD-MT & AD-LT)

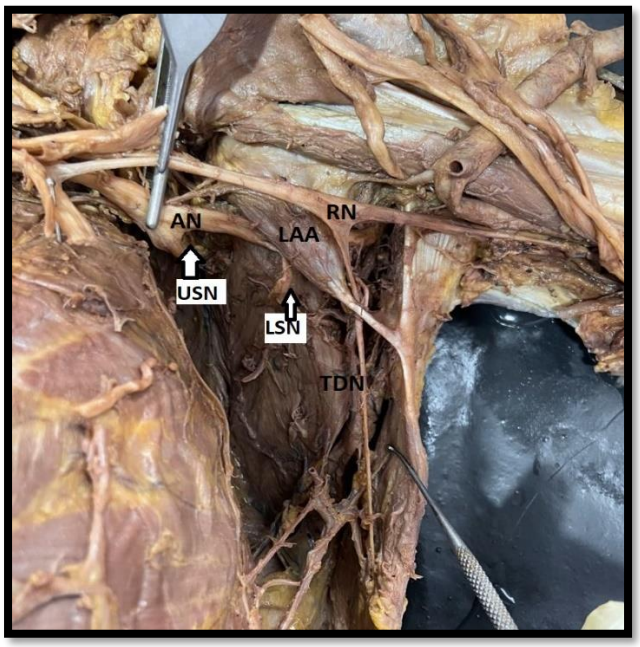

Figure 4 represents the branching pattern of the posterior cord of the brachial plexus; the upper/anterior part of the posterior cord forms the Radial nerve (RN) and also gives off Thoracodorsal nerve (TDN); the lower/posterior part of the cord forms the axillary nerve (AN) which gives of Upper and lower subscapular nerves (USN & LSN)

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