Original Article

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Study of Axillary Arch: Embryological Basis and Its Clinical Implications

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Abstract

Aim: To study the incidence, embryological basis and clinical implications of unusual but most common anatomical variant, axillary arch. *Materials & Methods:* The study was conducted in the department of Anatomy, Subbaiah Institute of Medical Sciences, Shimoga during routine cadaveric dissection on 60 upper limbs. *Results:* Of the 60 upper limbs dissected, Axillary arch was seen in one right upper limb. It was extending between latissimus dorsi and fascia covering the subscapularis muscle after crossing the posterior cord of brachial plexus and circumflex scapular vessels. It was supplied by a branch from the thoracodorsal nerve. *Conclusion:* The presence of an axillary arch needs to be considered in differential diagnosis of axillary swellings and also in surgeries of shoulder region. Therefore it is mandatory to know the variant slips of the musculotendinous arch.

Keywords: Axillary Arch; Latissimus Dorsi; Neurovascular Bundle; Clinical Implications.

Introduction

The axillary arch muscle is an accessory muscle that extends between the pectoralis major and latissimus dorsi [1]. It is a variant muscular slip of the pectoralis major muscle and is about 7 to 10 cm in length and 5 15 mm in breadth, crossing from the edge of latissimus dorsi, midway in the posterior fold, over the front of the axillary vessels and nerves to join the tendon of pectoralis major, coracobrachialis or fascia over the biceps [2]. The axillary arch muscle develops embryologically from the pectoral muscle mass. It is hence generally innervated by the medial pectoral nerves [3]. However, because of its close relationship with the latissimus dorsi, it may receive nerve supply from the thoracodorsal nerve [4]. It can also receive nerve fibers from the lateral pectoral nerve and intercostobrachial nerve [5].The most commonly described form of this muscle extends from latissimus dorsi to pectoralis major, the short head of biceps brachii or to the coracoid process of the scapula. Many other variants of this anomaly have also been observed like the muscle adhering to the coracoid process of the scapula, medial epicondyle of the Humerus or blending with the fibers of teres major, long head of triceps brachii, coracobrachialis and pectoralis minor [6]. Its embryonic origin is not clear and some anatomists consider muscular arches of the axilla as rudimentary phylogenetic remnants of the panniculus carnosus [7]primarily, the axilla contains the diverging elements derived from the brachial plexus and axillary vessels [1]. This arch is an atavistic anomaly in the axillary region and is also described by few authors as chondro-epitrochlearis when it extends from the pectoralis major muscle to the medial epicondyle [8].

Various terminologies are used to describe this variant structure as "Achselbogen", "axillopectoral muscle", "axillary arch", "Langer's axillary arch" or "muscular axillary arch" [5]. Nowadays, the term "Langer's axillary arch", first coined by Testut in 1884, describes any muscular anatomical variant running from the lateral border of latissimus dorsi to various points anterolateral to the humerus. Historically, the axillary arch was first described in 1783 by Bugnone, then again by Ramsay in 1793 and then finally by Langer in 1846 [5]. It should be noted, however, that both arches mentioned by Bugnone and Ramsay were muscular in nature, while Langer specifically mentions a fibrous variant, suggesting that Langer's axillary arch can have various degrees

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of muscularisation and is not simply either muscle or fibrous [9]. However, the muscle has been named after Langer who gave the first description of the muscle in 1846 [10]. The incidence of axillary arch muscle reported in different population groups as 7% in Japanese, 10% in Belgian, 0.25% in British Population [11].

Knowledge of muscular, vascular, and neural variations in the axillary region is of clinical importance in mastectomies, breast reconstruction, and axillary bypass operations [12]. The axillary arch can cause thoracic outlet syndrome and shoulder instability. Entrapment of the neurovascular bundle within the arch can lead to entrapment syndrome. In addition, the axillary arch hides a small group of lateral axillary nodes, which can mislead the surgeon during breast surgery [13].

Materials and Methods

The study was conducted in the department of Anatomy, Subbaiah Institute of Medical Sciences, Shimoga during routine cadaveric dissection on 60 upper limbs, irrespective of age and sex.

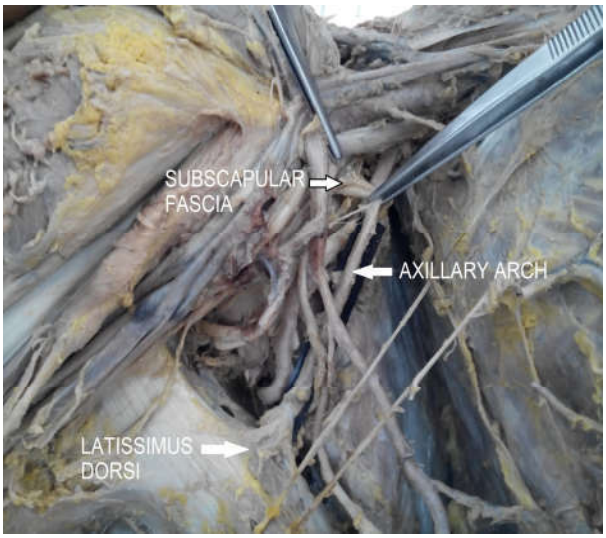

Fig. 1: Axillary arch showing its attachment

Results

Of the 60 upper limbs dissected, Axillary arch was seen in one right upper limb. It was extending between latissimus dorsi and fascia covering the subscapularis muscle after crossing the posterior cord of brachial plexus and circumflex scapular vessels. It was supplied by a branch from the thoracodorsal nerve.

The incidence of axillary arch in our study was 1.66% and this was compared with other studies as shown in Table 1.

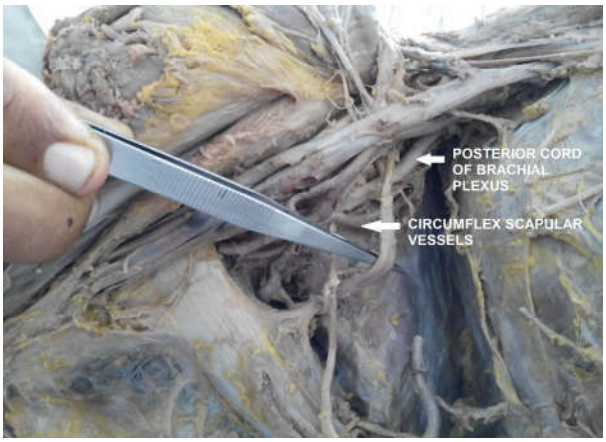

Fig. 2: Structures crossed by axillary arch

Fig. 3: Axillary arch with its nerve supply

Table 1: The incidence of the axillary arch muscle in different population

Author	Year	No. of arches	No. of upper limbs	Percentage	Population
Serpell and Baum [14]	1991	4	2000	0.2	Caucasian
Clarys et al [23]	1996	16	183	8.7	Caucasian
Turgut et al [24]	2005	1	26	3.8	Caucasian
Pai MM [11]	2006	1	68	1.47	Indian
Vaishaly K et.al [25]	2013	1	30	3.33	Indian
Bharambe and Arole [28]	2017	1	30	3.33	Indian
Present study	2018	1	60	1.66	Indian

Discussion

Axilla is a fascial lined pyramidal tent shaped portal for transmitting the neurovascular bundle between upper limb and neck and also contains the axillary group of lymph nodes which are of clinical and surgical importance.

A muscular variant known as the 'Axillary arch of Langer' is a musculo-tendinous slip observed in the axilla stretching across the neurovascular bundle. When present, the classical variant extends from the lower border of latissimus dorsi to the trilaminar tendinous insertion of pectoralis major muscle [14].

The next most common variant described by Dovernoy, is the Chondro-epitrochlearis, a musculo-tendinous arch that extends from pectoralis major to medial epicondyle [15]. Landry SO Jr also described chondro-epitrochlearis muscle which bifurcated into two slips, with the upper slip inserted into the capsule of the shoulder joint close to the origin of long head of biceps and the lower slip into the medial epicondyle [8].

Dharap in 1993 described an axillary arch which was unusually extending from the lower border of latissimus dorsi muscle to the coracoid process of the scapula. He also observed several accessory slips wherein three fibrous strands extended from the arch to the pectoralis minor, short head of biceps and coracobrachialis, two muscular slips to the deep surface of teres major muscle and innumerable accessory muscular slips arising from the ribs and costal cartilages [16].

Lin C reported an interesting case of bilateral chondro-epitrochlearis muscle with contracture, restricting abduction of arm in a seventeen year old Chinese boy [17].

A unique case was reported by Lama P et. al., where both the 'Axillary arch of Langer' and the 'chondroepitrochlearis' were observed in the same axilla. The 'Axillary arch of Langer' originated from the lattisimus dorsi muscle, while the 'chondro-epitrochlearis' originated from the pectoralis major muscle and both the muscular slips crossed over the axillary neurovascular bundle and had a common insertion into the lateral lip of inter-tubercular sulcus of the humerus and the fascia covering the biceps brachi muscle [18].

In general population, the frequency of axillary arch is reported as 4–12%; however, this ûgure is predominantly based on results from cadaveric studies. About 0.25% to 6.5% of incidence is reported in clinical studies [19]. The incidence of axillary arch muscle reported in different population groups as 7% in Japanese, 10% in Belgian, 0.25% in British Population [11]. The differences in population frequency of the axillary arch are probably related to differences based on genetics [20].

Regarding the possible genesis of this muscular arch, various theories are proposed. In lower mammals the panniculus carnosus is very well developed to form the pectoral group of muscles. With evolution these muscles have regressed due to reduced functional importance [21]. In 1980 bilateral axillary arch muscle was reported in a case of Trisomy 13 indicating a possible genetic basis [22].

In the present study, out of 60 upper limbs, Axillary arch was seen in one right upper limb, the incidence being 1.66%. It was extending between latissimus dorsi and fascia covering the subscapularis muscle after crossing the posterior cord of brachial plexus and circumflex scapular vessels. It was supplied by a branch from the thoracodorsal nerve.

Our study was compared with the study of axillary arch by L. Jelev et. al [5] who has provided a classification depending on the situation of the axillary arch in relation to the neurovascular bundle. According to the author, two groups are explained, superficial being the classical variant wherein the arch crossing the entire neurovascular bundle and deep group wherein the arch usually crosses only parts of neurovascular bundle. Our finding belonged to the deep group, where the axillary and radial nerves could possibly be compressed.

Axilla is a region of hyper dynamic blood flow and muscular or fibrous slips when present, passes across the neurovascular bundle thus compressing these structures leading to stasis of blood and resulting in axillary vein thrombosis and subsequent thromboembolism, nerve compression, hyper-abduction syndrome, arterial occlusion and edema of lymphatics [26].

An axillary arch can compress upon the lateral axillary lymphatics and restrict their removal during axillary surgeries for breast cancer thus increasing the risk of recurrence of carcinoma [13]. Breast reconstruction surgeries involve the use of latissimus dorsi myocutaneous flaps and once the flap is raised the pedicle is rotated and presence of a musculo-tendinous arch in such cases can result in axillary vein entrapment syndromes resulting in postoperative lymphoedema of the upper limb [27].

In axillary surgeries the incision is given along the anterior margin of Latssimus dorsi but in the presence of a musculo-tendinous arch, the surgeon maybe under confusion regarding the placement

of the incision. This may lead to an incision above the axillary vein causing damage to the axillary sheath as a level below the vein is usually more favorable in presence of axillary arch [14]. Surgical excision of the arch in cases of axillary contractures is suggested followed by physiotherapy to prevent scarring [17].

Conclusion

The presence of an axillary arch needs to be considered in differential diagnosis of axillary swellings such as lipomas, ectopic breast tissue, inflammatory axillary lymph nodes, infundibular follicular cyst, nodular fibromatosis and metastatic deposits in the axillary lymph nodes. The possibility of attachment of a slip of the axillary arch to the capsule of shoulder joint should be kept in mind during shoulder joint surgeries. A myocutaneous flap of latissimus dorsi is used in breast reconstructive surgeries and to cover large soft tissue defects in head and neck region.

Clinical detection of this muscle is difficult; however, it is possible to detect the presence of the axillary arch on performing computed tomography scan or magnetic resonance imaging of the axillary region. Therefore knowing the exact extent, attachment and innervation of this muscle becomes mandatory.

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