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CASE REPORT

Axillary Arch (Langer's Arch) in an 80-Year-Old White Male Cadaver

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Abstract

Recognizing the presence of an Axillary arch (Langer's arch or muscle) can be important for clinical associations, such as when patients present with compression neuropathies and syndromes related to the upper extremity. Its presence is also relevant during surgical interventions involving the axillary fossa, such as sentinel node biopsy axillary lymph node dissection and pectoralis muscle flaps. While neglecting to identify variations rarely leads to an increase in mortality, it is essential to identify for clinical relevance. It is similarly important to anatomical instructors in the education of future medical providers. During cadaveric dissection of fifty cadavers, we observed a unilateral Axillary arch (Langer's arch or muscle) found on the left side of an 80-year-old White Male cadaver inserting onto the tendon of the pectoralis major muscle. This anatomical variation is commonly referenced in the literature for its clinical significance. Operating surgeons, vascular interventionalists, and oncologists should be aware of this anatomical variant as it occurs while treating diverse patient populations.

Key Words: *Axillary arch; Langer's arch; Langer's muscle; Axillary anatomical variations; Muscle slips; Latissimus dorsi muscle slip*

Introduction

The latissimus dorsi muscle belongs to the superficial layer of the extrinsic back muscles. It originates from the spinous processes of thoracic vertebrae seven through twelve, thoracolumbar fascia, posterior third of iliac crest, ribs nine through twelve, and the inferior angle of the scapula. It inserts on the intertubercular sulcus of the humerus, between pectoralis major and teres major muscles (Figure 1a). It functions in shoulder internal rotation, adduction, extension, and as an accessory assistant in respiration [1].

Anatomical variations associated with the latissimus dorsi muscle are reported in the literature [2-5]. The variation discussed in this article is the Axillary arch or Langer's arch or muscle (Figure 1b). An Axillary arch is a rare muscular slip of the axilla, formed as a muscular arch 7 to 10 cm in length and 5 to 15 mm in breadth. It may cross from the edge of the latissimus dorsi, midway in the posterior axillary fold, over

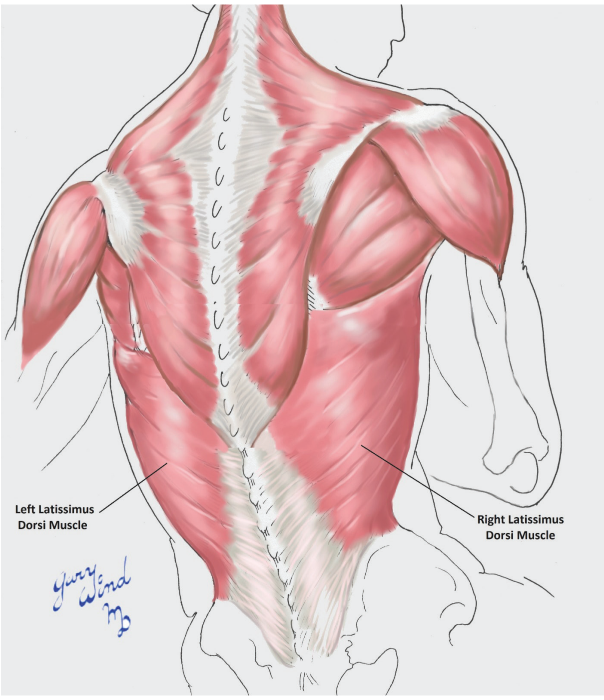

Figure 1a) *Illustrative schematic of the back, highlighting the left and right latissimus dorsi muscles.*

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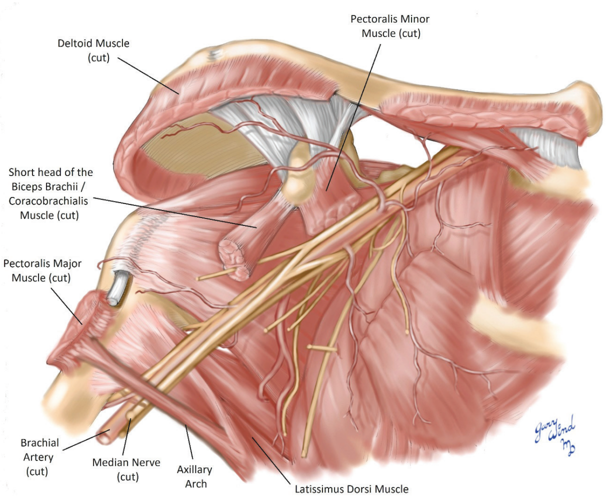

Figure 1b) *Illustrative schematic of the Axillary arch (Langer's arch or muscle) found within the latissimus dorsi muscle.*

the front of axillary vessels and nerves to join the tendon of pectoralis major muscle, coracobrachialis muscle, or fascia over the biceps brachii muscle [6]. Recognizing the presence of muscle slips is important for clinical associations, such as when patients present with compression neuropathies and syndromes related to the upper extremity, in surgical interventions involving the axillary fossa, and in experimental studies aimed at alternative use of the latissimus dorsi muscle. While neglecting to identify variations rarely leads to an increase in mortality, it is essential to identify for clinical relevance [7-11].

During anatomical dissection of fifty cadavers in the 2020 undergraduate first-year anatomy course at the Uniformed Services University of Health Sciences (USUHS), we found a unilateral latissimus dorsi muscle slip, known as an Axillary arch or Langer's arch or muscle, present in a preserved 80-year-old White Male cadaver provided by the Maryland State Anatomy Board.

Case Description

The Axillary arch or Langer's arch or muscle observed with the latissimus dorsi muscle was encountered on the left side of an 80-year-old White Male cadaver (listed cause of death of congestive heart failure) (Figure 2). The origin and insertion of the latissimus dorsi muscle was normal, as described previously. The Axillary arch muscle slip fibers split off the lateral border of the latissimus dorsi muscle at

Figure 2) *Facilitated display highlighting the Axillary arch (Langer's arch or muscle).*

the middle of the posterior fold of the axilla (Figure 3). This muscular arch formed anterior to the median and ulnar nerves, brachial artery, and brachial vein

Figure 3) *Facilitated display highlighting the Axillary arch (Langer's arch or muscle), with pectoralis major reflected.*

(Figure 4). It then crossed the axilla in front of the axillary vessels and nerves, to insert onto the tendon of the pectoralis major muscle (Figure 5). The nerve supply of the Axillary arch was the thoracodorsal nerve, a branch of the posterior cord of the brachial

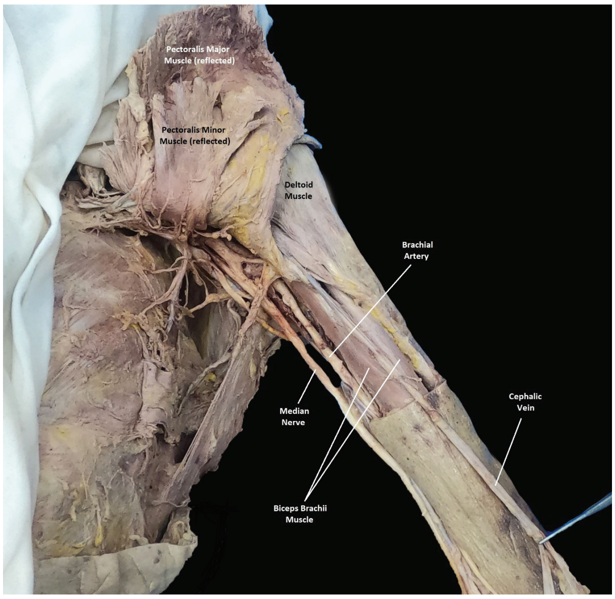

Figure 4) *Facilitated display highlighting the Axillary arch (Langer's arch or muscle), with pectoralis major and minor reflected.*

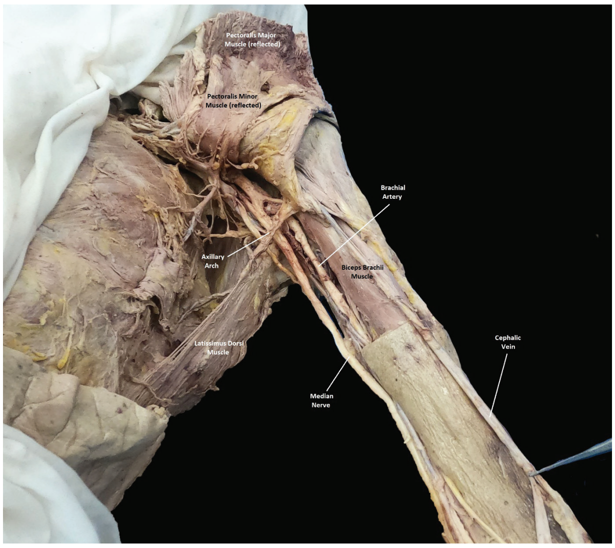

Figure 5) *Facilitated display highlighting the Axillary arch (Langer's arch or muscle) insertion onto fibers of the pectoralis major tendon.*

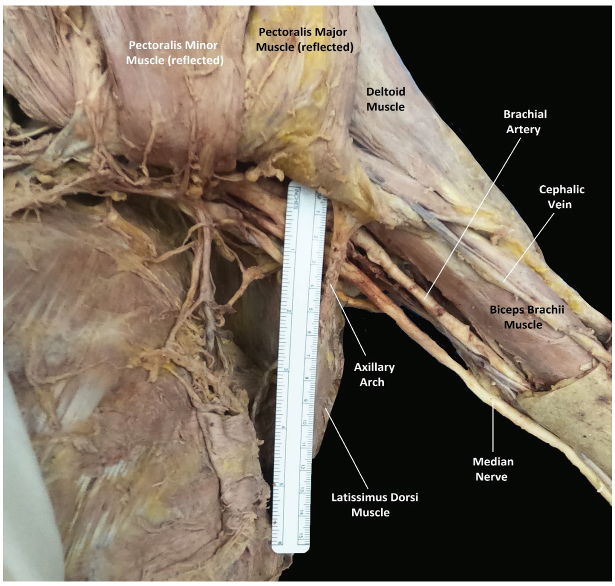

Figure 6) *Facilitated display of the Axillary arch (Langer's arch or muscle) demonstrating the length of the muscle slip.*

plexus. The Axillary arch was approximately 5.5 cm in length and ranging in breadth from approximately 0.5 to 1.7 cm (Figure 6).

Discussion

The muscle slip of the latissimus dorsi muscle is described as the presence of a muscular/tendinous slip, also known as an Axillary arch or Langer's arch or muscle, arising from the medial border of the latissimus dorsi muscle with no insertion onto the intertubercular groove of the humerus [12].

A 2019 meta-analysis of 10,222 axillas by Taterra et al. estimated the prevalence of an Axillary arch to be 5.3%, with the majority arising from the latissimus dorsi muscle or tendon (87.3%) and inserting into the pectoralis major muscle or fascia (35.2%) [13]. The Axillary arch may insert onto the fascia covering the short head of the biceps brachii, tendon of pectoralis major, or aponeurosis of the coracobrachialis muscle [14].

The embryological origins of the Axillary arch are unknown, though it is suggested that it was associated with the panniculus carnosus muscle. The panniculus carnosus muscle is a skin-associated superficial muscle that is highly developed in lower mammals such as rodents. In humans, Langer's arch is the most common embryologic remnant of the panniculus carnosus muscle in the pectoralis group, however the platysma and dartos muscles are also remnants of the panniculus carnosus muscle found in humans. The Axillary arch has regressed in humans due to decreased functional importance during evolution to favor increasing upper limb mobility [15-16].

The axilla is a complex region of neurovascular structures and lymphatic nodes surrounded by adipose tissue. Langer's arch can be related to the axillary structures, which are at risk of bleeding, nerve damage, or otherwise compromised if the presence of Langer's arch is not considered. Compression of the axillary neurovascular bundle by an Axillary arch should be included in the differential diagnosis of thoracic outlet syndrome. Pressure by the Langer's arch during contraction can cause axillary vein entrapment, lymphatic compression with subsequent venous thrombosis or lymphedema [7,17,18]. This has consequences to include lymph node obstruction and brachial plexus impingement.

Langer's arch can mislead lymphoscitigraphic findings and make sentinel lymph node localization difficult. Division of Langer's arch may be essential to adequately access the entirety of the axilla [19]. The presence of such an anatomical variation must be taken into consideration when planning surgical intervention such as during an axillary lymphadenectomy for breast cancer. The latissimus dorsi muscle comprises the lateral border of the surgical field for an axillary lymph node dissection. Considering this, the existence of a Langer's arch could confuse the true margin during a sentinel lymph node biopsy [20]. According to Sang et al. 2019, the majority of patients found to have Langer's arches were also found to have a series of lymph nodes lateral to the arch [20]. Furthermore, these nodes had a relatively high metastasis rate and in a few cases, was the only site of metastases. If a Langer's arch is identified during a procedure, it should be meticulously dissected [20].

Axillary arch muscle slips have clinical implications in transplant and reconstructive surgeries. The transfer of the latissimus dorsi muscle may be used to treat massive rotator-cuff deficiency [21]. The latissimus dorsi tendon transfer for rotator cuff deficiency can be performed successfully, however deep understanding of this complex anatomical variation is essential to provide a tension-free transfer while minimizing complications. If the Axillary arch is left intact, a tension-free transfer may become more difficult. The latissimus dorsi flap is the largest flap that can be harvested on a single pedicle. It may be tunneled from the back to a mastectomy area to create a reconstructed breast. A latissimus dorsi myocutaneous flap with tissue expansion is proven to be an effective method of immediate breast reconstruction after skin sparing mastectomy, rifle wounds to the face, and reconstruction of scalp and cranium defects [1]. A myocutaneous flap of the latissimus dorsi muscle is used to cover soft tissue defects in the head and neck region [17]. It can be combined with the serratus, scapular, or parascapular flaps to create a flap complex to cover massive wounds. A latissimus serratus rib osteomusculocutaneous free flap can be effective for reconstruction of defects in the mandible of patients where vascularized bone free flaps cannot be used. The relative thinness of the latissimus dorsi flap allows it to contour with irregular surfaces. The presence of the Axillary arch may complicate separation of the muscle and pedicle flap -- a 5-10 cm pedicle can be obtained off the subscapular system. The subscapular artery sends off the circumflex scapular artery branch and serratus artery branch before it enters the substance of the latissimus dorsi muscle as the thoracodorsal artery. The pedicle can be approached from the undersurface of the muscle in a distal to proximal approach or by directly dissecting the latissimus dorsi muscle from the axilla [1]. The variation of the Axillary arch in the latissimus dorsi muscle should be kept in mind during any operative procedure involving the axilla.

Conclusion

The potential of muscle slips for clinical implications should always be considered. The Axillary arch or Langer's arch or muscle should especially be considered in compressive neurovascular syndromes of the upper extremity and surgical procedures involving the axillary fossa. Knowledge of such axillary anatomical variations is important in a clinical setting when surgical intervention is needed in this region. Operating surgeons, vascular interventionalists, and oncologists should be aware of this anatomical variant as it occurs while treating diverse patient populations. It is equally important that knowledge of this anatomical variation is relayed when anatomical instructors are educating future medical providers.

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Disclaimer

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