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# Unilateral observation of axillary (Langer's) arch during dissection: A case report

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ABSTRACT

The axilla is a clinically significant region with a complex structure. One of the most common anatomical variations in this area is Langer's axillary arch, also known as the axillopectoral muscle, pectodorsal muscle, or arcus axillaris. During a routine dissection of an embalmed elderly female cadaver for educational purposes, we identified an unusual muscle slip originating from the latissimus dorsi. This muscle crossed over the neurovascular structures in the axilla and inserted into the pectoralis major, forming a rare axillary arch (of Langer's). This variation can be clinically relevant, as it may cause neurovascular compression, leading to conditions like thoracic outlet syndrome, hyperabduction syndrome, or median nerve entrapment. Recognizing this arch before surgery is important in axillary and breast reconstruction procedures, allowing surgeons to decide whether to preserve or cut the arch during the operation.



## 1. Introduction

The axilla is a clinically significant region with a complex structure. It contains lymph nodes and vessels, the main arteries and veins supplying the upper limb, as well as the brachial plexus fascicles and the nerves they form (Weninger et al., 2024). A common anatomical variation in this region is the axillary arch, also known as Langer's arch. It is referred to by various names, including the axillopectoral muscle, pectodorsal muscle, or arcus axillaris ((Jung et al., 2016). The axillary arch typically appears as a thin muscular band connecting the latissimus dorsi and pectoralis major muscles (Ucerler et al., 2005). While the origin of the latissimus dorsi is consistent, its insertion can vary, commonly attaching to the pectoralis major, coracoid process, short head of the biceps tendon, or coracobrachialis (Rajakulasingam and Saifuddin, 2020). The prevalence of this variation muscle ranges from 7% to 27% (Iamsaard et al., 2012). Interestingly, a recent meta-analysis and reviews show that many studies about axillary arch provide highly different prevalences, ranging from 1.7% to 43.8%. These discrepancies might partially reflect ethnicity and the methods used for detecting axillary arches (Weninger et al., 2024). Typically, diagnosis of the axillary arch occurs through physical investigation or imaging techniques. However, an axillary arch may be found during surgical exploration of the axilla. Even though 7-8% of axillary arch incidences are associated with surgical findings, greater incidents are associated with cadaver dissection (Bharambe and Arole, 2013). The axillary region is a clinically important area because it possesses neurovascular and lymph node structures associated between the neck and the upper limb. Anatomical variations of axillary muscular slips may cause obstructions of axillary vessels and nerves. Muscular variations in the axillary region may be involved in thoracic outlet syndrome, shoulder instability, the development of lymph edema of the upper limb, and surgical interventions such as breast surgery (Iamsaard et al., 2012). The abnormal structures in the axilla will interfere functionally and neurologically with the neurovascular bundle and lymphatic system of the axilla. The location of the axillary arch relevant to adjacent structures may explain patient impairments (Kim, 2021).

## 2. Case report

During the routine dissection of embalmed cadavers for teaching purposes at King Saud University College of Medicine, the upper limbs were examined to study the compartments of the pectoral

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and axillary regions. During the dissection of an elderly female cadaver, an unusual muscular slip was observed. This slip originated from the latissimus dorsi, crossed the axilla, and inserted into the pectoralis major. As shown in Fig. 1A, the structure was identified as the axillary arch muscle (also known as Langer's muscle). This thin muscular slip arose from the lateral border of the tendinous part of the latissimus dorsi, extended across the axilla, and lay superficial to the median nerve, inserting at the superior margin of the pectoralis major's insertion. All neurovascular structures and lymphoid tissues were positioned posterior to this abnormal muscle, as shown in Fig. 1B.

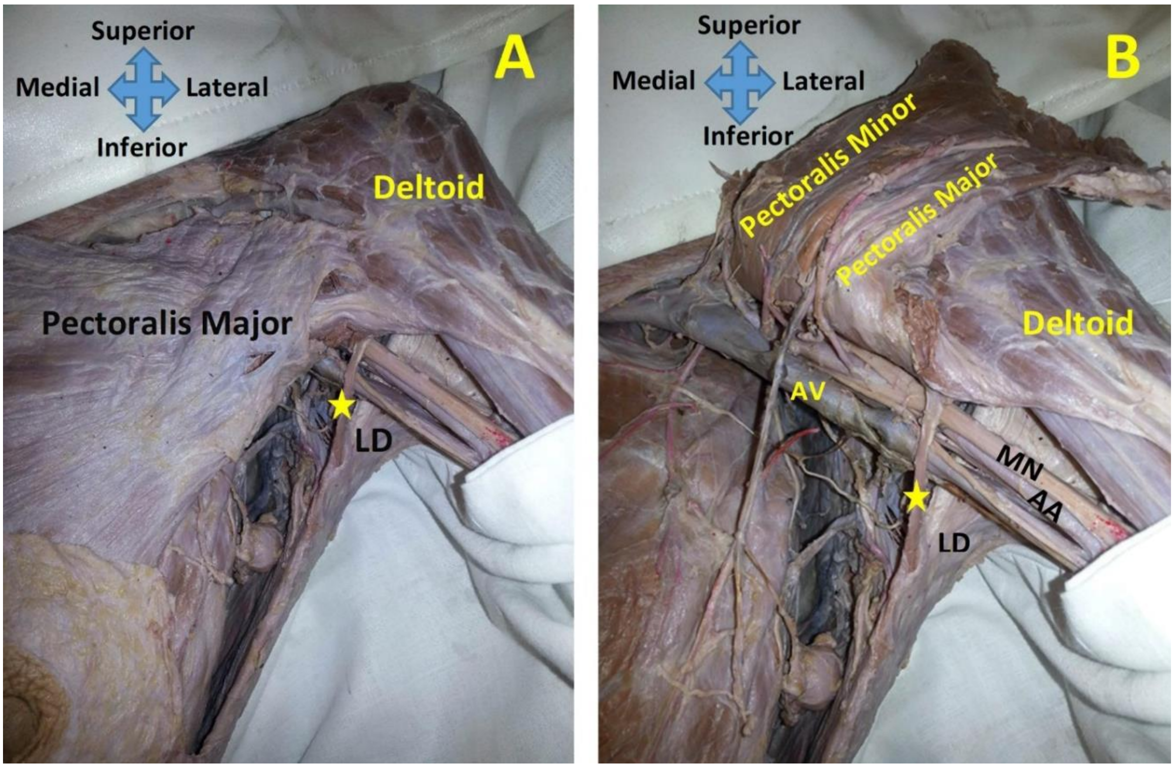


**Fig. 1:** Anterior view of the dissected left axilla: (A) Without reflecting the pectoralis major muscle. (B) After reflecting the pectoralis major and pectoralis minor muscles. AV: Axillary vein; MN: Median nerve; AA: Axillary artery; LD: Latissimus dorsi muscle; Yellow star indicates the axillary arch

## 3. Discussion

The axillary arch was first described by Ramsay in 1795 and later confirmed by Langer in 1864 (Bertone et al., 2008). This anatomical variation has been referred to by several names, including "axillopectoral arch," "Langer's muscle," "Langer's axillary arch," "arcus axillaris," "pectodorsal muscle," and "axillopectoral muscle" (Jung et al., 2016). The muscle slip can vary in shape and size and generally exists in two main forms: a direct continuation of the latissimus dorsi muscle fibers (type 1 - muscular), originating from the latissimus dorsi tendon (type 2 - fibrous), or a combination of the two (Jelev et al., 2007). In this case, the arch displayed a clear muscular origin from the latissimus dorsi. Typically, it appears as a single bi-directional band but may split into a double- or multi-band structure spanning the axilla. While most cases are bilateral, unilateral occurrences are also reported. In this instance, the arch was unilateral.

### 3.1. Clinical significance of axillary arch

The axillary arch, depending on its position, can be clinically insignificant or cause various forms of neurovascular compression. This anomaly may lead to conditions such as brachial plexus compression (e.g., entrapment of the median nerve) and thoracic outlet syndrome, which presents symptoms like paraesthesia, compressional pain, muscle weakness, swelling (oedema), and thrombosis in the distal upper limbs (DiLosa and Humphries, 2021). It is also associated with hyperabduction syndrome, characterized by pain radiating to the arm, numbness, and paraesthesia due to prolonged arm abduction, as well as shoulder instability syndrome. Additionally, it can result in venous compression (e.g., axillary vein entrapment) and costoclavicular compression syndrome (Zielinska et al., 2023).

Neurovascular compression linked to the axillary arch may increase the risk of postoperative upper limb lymphedema and thoracic outlet syndrome, especially during arm abduction or external rotation (Provyn et al., 2011). Compression of the brachial plexus, particularly the median nerve, and its branches from the medial and lateral cords, has also been reported as a potential complication (Pahwa et al., 2011).

### 3.2. Diagnosis of axillary arch

The axillary anatomy in individuals with axillary arches differs from the standard anatomical structure. Therefore, it is essential for radiologists and surgeons to be aware of the potential presence of axillary arches during procedures and to have detailed knowledge of their connections, dimensions, appearance, and tissue composition (Weninger et al., 2024).

During clinical examination, an axillary arch may be palpable and could be mistaken for enlarged lymph nodes or soft tissue tumors (Prabhar et al., 2014). However, not all axillary arches are detectable through physical examination. Accurate diagnosis often requires magnetic resonance imaging (MRI) (Mérida-Velasco et al., 2003). Although the presence of an axillary arch may not always cause functional impairments, similar muscular anomalies, such as the chondro-epitrochlearis, have been known to restrict arm abduction to 85 degrees (Daniels and Rovere, 2000).

### 3.3. Surgical implications

Sentinel lymph node biopsy (SLNB) is currently the standard surgical method for axillary nodal staging in patients with clinically axillary node-negative breast cancer (Veronesi et al., 1997). However, the presence of an anomalous axillary arch significantly increases SLNB failure rates (Kil et al., 2014). The axillary arch exhibits various anatomical variations, and its presence or absence should be assessed during every SLNB or axillary dissection to minimize potential complications associated with this ectopic muscle (Chêne et al., 2007).

In patients with an axillary arch, locating the sentinel lymph node (SLN) can be challenging. Keshtgar et al. (1999) noted that the SLN is often situated behind the axillary arch, complicating its identification. Additionally, Serpell and Baum (1991) reported that the axillary arch might be mistaken for the latissimus dorsi or pectoral muscle, which are key surgical landmarks during axillary node dissection. This variation has also been linked to major thrombosis in the upper extremities (Pahwa et al., 2011). Surgical procedures for patients with an axillary arch take significantly longer, averaging 20.8 minutes compared to 12.5 minutes in those without the arch (Kil et al., 2014).

Anatomical variations in the axillary region can hinder surgical accessibility, obscure the surgical field's boundaries, and compromise the procedure's safety and effectiveness (Markou et al., 2023). Early identification of the axillary arch is critical in clinical practice. Radiologists familiar with this variation can better identify it and provide relevant information to referring physicians. Accurate preoperative recognition helps surgeons decide whether to preserve or cut the arch during surgery (Karanlik et al., 2013). For example, understanding these variations can aid surgeons in axillary lymphadenectomy (Rahbar et al., 2012). In some cases, however, cutting the axillary arch is necessary to ensure lymph node removal and prevent local disease recurrence (Uzmansel et al., 2011).

Recognizing the course of the axillary arch is vital for all surgeries in the axillary region. The arch may obstruct proper visualization and interpretation of lymph nodes during lymphadenectomy for breast carcinoma, potentially resulting in incomplete clearance. Its presence can also complicate SLNB, as achieving adequate exposure and hemostasis is more difficult in such cases (Zielinska et al., 2023). Therefore, a thorough understanding of the axillary arch's anatomy is essential for successful surgical outcomes.

## 4. Conclusion

The axillary arch, typically a thin muscular slip connecting the latissimus dorsi muscle to the pectoralis major muscle, is among the most common muscular anatomical variations in the axillary region. Its prevalence varies widely, ranging from 7% to 27% in some studies and from 1.7% to 43.8% in a recent meta-analysis. Depending on its anatomical course, the axillary arch may be clinically insignificant or associated with neurovascular compression syndromes such as thoracic outlet syndrome, hyperabduction syndrome, or median nerve entrapment.

Preoperative identification of the axillary arch is crucial in axillary surgeries and breast reconstruction procedures. Recognizing this variation allows surgeons to plan appropriately, deciding whether to preserve or transect the arch during surgery to optimize outcomes and minimize complications.

## Compliance with ethical standards

### Ethical considerations

This study was conducted using cadaveric specimens obtained in compliance with the ethical standards of King Saud University and applicable national and international guidelines for the use of human remains in research and education. All cadavers used were donated to the university for academic purposes, and proper consent and institutional approval were obtained prior to dissection. The study adhered to the principles outlined in the Declaration of Helsinki and relevant local regulations.

### Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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