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CASE REPORT

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A previously undescribed case of the axillary arch muscle

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The axillary arch muscle, also called Langer's muscle, axillopectoralis, or pectodorsalis, is a muscular variation of the latissimus dorsi muscle. During a standard anatomical dissection, the axillary arch muscle was found bilaterally. On both sides it originated from the latissimus dorsi as a muscle belly. Next it passed into wide tendinous structure attached to the tendon of the pectoralis major muscle. Then, a narrow tendinous slip inserted into the coracoid process was found. The axillary arch muscle was innervated by the thoracodorsal nerve on both sides. Knowledge about morphological variations in this region is important because there is a direct relationship with neurovascular structures, e.g. ending branches of the brachial plexus, which may lead to paraesthesia or muscle weakness. (Folia Morphol 2024; 83, 3: 750–755)

Keywords: axillary arch muscle, latissimus dorsi muscle, pectoralis major muscle, brachial plexus, paraesthesia, thoracodorsal nerve, compression

INTRODUCTION

The latissimus dorsi muscle (LDM) belongs to the superficial group of back muscles. It takes part in internal rotation, adduction, and extension of the arm. It is also responsible for scapular movements. Anatomically, its origin is located on the Th7-Th12 spinous processes, thoracolumbar fascia, crest of the ilium, ribs (9–12), and inferior angle of the scapula. In turn, its insertion is located on the intertubercular sulcus of the humerus (between pectoralis major muscle [PM] and teres major muscles) [9].

The LDM is characterised by morphological variations, especially in its attachments. Firstly, the spinal attachment can vary from Th5 to only the lumbar part of the spine [7], whereas costal attachments can start from the 8th rib to 12th rib, or the LDM may be attached only to the 12th rib [15]. In its distal attachment, the LDM can be fused with the teres major muscle [1]. Moreover, LDM fibres attached to the scapula can also be fused with the rhomboid major muscle. Another interesting variation of the LDM is the axillary arch muscle (AAM), also called Langer's muscle, the axillopectoralis, or pectodorsalis [1].

The AAM arises from the LDM, and in most cases it crosses the axilla anteriorly and runs to the axillary vessels and branches of the brachial plexus. Its insertion is usually located on the TM tendon. However, this structure can also be variable. For example, it can be distally attached to the short head of the biceps brachii (or its fascia), teres major muscle, coracoid process, coracobrachialis muscle, or pectoralis minor muscle [1]. The AAM can also be doubled [3]. Its innervation mostly is provided by the thoracodorsal nerve or medial pectoral nerve [1].

During a standard anatomical dissection, the AAM was found bilaterally. On both sides it originated from

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Figure 1. Right side; CP — coracoid process; LDM — latissimus dorsi muscle; PM — pectoralis major muscle; PMi — pectoralis minor muscle; TP — tendinous part of the AAM; TS — tendinous slip of the AAM.

the LDM as a muscle belly. Next it passed into wide tendinous structure attached to the PM tendon. Then, a narrow tendinous slip inserted into the coracoid process was observed. The AAM was innervated by the thoracodorsal nerve on both sides. Knowledge about morphological variations in this region is important because there is a direct relationship with neurovascular structures, e.g. ending branches of the brachial plexus, which may lead to paraesthesia or muscle weakness.

CASE REPORT

A female cadaver, 93 years old at death, donated to science, was subjected to routine anatomical dissection for research and teaching purposes at the Department of Anatomical Dissection and Donation, Medical University of Lodz, Poland. The region of chest and both upper limbs were subjected to a traditional anatomical dissection [17], and the morphological variations in this region were observed.

The AAM, which is a variant of the LDM, was observed bilaterally, originating as a muscular slip from the LDM. It was distally attached to the PM tendon, and behind that there was also a small tendinous slip attached to the coracoid process. The course of the AAM in both sides was the same.

On the right side, at the point where the AAM departed from the LDM, this muscular variation was 18.36 wide and 2.32 mm thick. The first part was represented by a muscle belly of length 46.32 mmm. Next, the tendinous structure attached to the PM tendon was discovered. The musculotendinous junction between this part and the first one was 16.34 mm wide and 0.38 mm thick, whereas the width of the attachment to the PM was 30.37 mm and the thickness was 1.35 mm. Then, this tendinous structure passed up into a narrow tendinous slip, and at the point of this transition it was 7.35 mm wide. This tendinous slip was 45.38 mm long, and it was distally attached to the coracoid process. Its insertion was 4.76 mm wide (Fig. 1).

On the left side, in the place where the AAM departed from the LDM, this muscular variation was 19.76 mm wide and 2.13 mm thick. The first part was represented by muscle belly of length 44.20 mmm. Next, a tendinous structure attached to the PM tendon was discovered. The musculotendinous junction between this part and the first one was 8.01 mm wide and 1.58 mm thick, whereas the width of the attachment to the PM was 33.58 mm and the thickness was 0.81 mm. Then, this tendinous structure entered/became/inserted into a narrow tendinous slip, and at the point of this transition it was 6.66 mm wide. This tendinous slip was 53.03 mm long, and it was distally attached to the coracoid process. Its insertion was 5.38 mm wide (Fig. 2).

On both sides, the AAM was innervated by the thoracodorsal nerve and located superficially to the branches of the brachial plexus and axillary vein.

To make these measurements, an electronic caliper (Mitutoyo Corporation, Kawasaki-shi, Kanagawa, Japan) was used. Each measurement was repeated twice with an accuracy of up to 0.01 mm.

During a dissection of the upper limb, no other morphological variabilities were found. Table 1 shows the morphometric measurements of the presented case.

DISCUSSION

The LDM is characterised by morphological variations, especially in its attachments. Firstly, the spinal

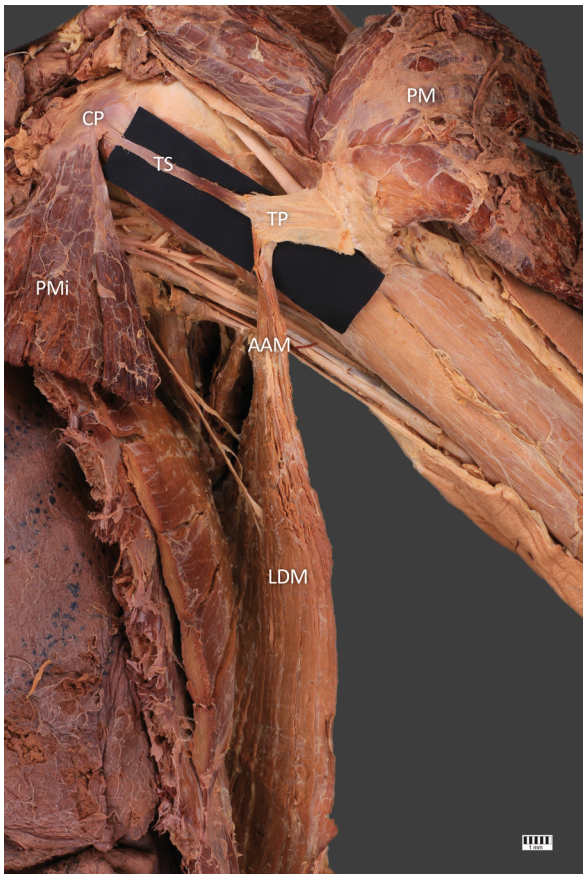

Figure 2. Left side; AAM — axillary arch muscle; CP — coracoid process; LDM — latissimus dorsi muscle; PM — pectoralis major muscle; PMi — pectoralis minor muscle; TP — tendinous part of the AAM; TS — tendinous slip of the AAM.

Table 1. Morphometric measurements of the presented case.

	Right side	Left side
Origin	From the latissimus dorsi	
Width	18.36 mm	19.76 mm
Thickness	2.32 mm	2.13 mm
Muscular part		
Length	46.32 mm	44.20 mm
MJ width	16.34 mm	8.01 mm
MJ thickness	0.38 mm	1.58 mm
Tendinous part	Attached to the tendon of PM	
Attachment to the PM — width	30.37 mm	33.58 mm
Attachment to the PM — thickness	1.35 mm	0.81 mm
Connection with tendinous slip — width	7.35 mm	6.66 mm
Tendinous slip	Attached to the coracoid process	
Length	45.38 mm	53.03 mm
Distal attachment — width	4.76 mm	5.38 mm

MJ — myotendinous junction; PM — pectoralis major muscle.

attachment may vary from Th5 to only the lumbar part of the spine [7], whereas costal attachments can start from the 8th rib to the 12th, or the LDM may be attached only to the 12th rib [16]. In its distal attachment, the LDM can be fused with the teres major muscle (Bergmann). Moreover, LDM fibres attached to the scapula can also be fused with the rhomboid major muscle. The AAM, also called Langer's muscle, the axillopectoralis, or pectodorsalis, is another interesting variation of the LDM [1]. The AAM embryologically originates from panniculus carnosus (an embryological remnant of a more extensive sheet of skin associated musculature) lying in the junction between the superficial fascia and the subcutaneous fat. In human the panniculus carnosus is only evident as muscle such as the platysma and dartos [14].

The panniculus carnosus is well developed in lower mammals, while in higher primates and humans it is only evident as muscles such as the platysma and dartos. In lower mammals, the panniculus carnosus is highly developed to form the pectoral group of muscles; however, in humans it has regressed because its functional importance decreased during evolution in favour of wider upper limb mobility. Our case and previous cases accompanying nervous variations suggested its embryological association with the brachial plexus [9, 10]. Its embryological and clinical significances should be investigated further with larger cases.

The AAM was first described by Bugnone in 1783, next by Ramsay in 1793, and then by Langer in 1846 [1]. It arises from the LDM, and in most cases it crosses the axilla anteriorly as far as the axillary vessels and branches of the brachial plexus. Its insertion is usually located on the PM tendon. However, this structure can also be variable.

Rizk and Harbaugh [12] carried out a study in which the prevalence of the AAM was assessed. This anomalous muscle was present in 4.3% of studied upper limbs. In all cases, the AAM arose from the LDM and inserted along a line extending from the coracoid process to the intertubercular groove. In these cases, there was a high possibility of compression of the neurovascular bundle in the axilla region [12]. Bertone et al. [2] also carried out a similar study. A standard anatomical dissection showed that the AAM was observed in 11.5 % of cases in which the axillary region was analysed. Most of the observed cases originated from the LDM and distally attached to the PM. In

some other cases, the AAM was distally inserted at the aponeurosis level of the coracobrachialis muscle [2]. Karanlik et al. [4] carried out a study based on results of 758 axillary surgeries. 395 of these patients had breast cancer, and 363 patients had melanoma. During surgeries, only 9 AAMs were found (1.2%), and all cases originated from the LDM and inserted to the PM [4].

Loukas et al. [6] described the AAM originating from the LDM, and its insertion was attached to the PM, pectoralis minor, and coracoid process. The nerve was supplied through a branch of the medial pectoral nerve [6]. Another variation was described by Turki and Adds [14]. As in other cases, the AAM originated from the LDM. However, its insertion is really interesting because this anomalous muscle was distally attached to the proximal part of the short head of the biceps brachii [14]. Sharma et al. [13] also described a similar case, in which the insertion was merged with the short head of the biceps brachii [13].

In the presented case, the AAM occurred bilaterally, which is a rare situation, and its proximal attachment was standard (from the LDM). Its muscular part inserted into/became a wide tendinous part attached to the PM. The interesting thing was a narrow tendinous slip arising from this structure. Its attachment was located on the coracoid process, just above the attachment of the coracobrachialis muscle, laterally to the attachment of the pectoralis minor muscle, and medially to the insertion of the short head of the biceps brachii. The description of this case is most similar to the description of the muscle presented by Loukas et al. [6]. However, in our case, we observed no attachment to the pectoralis minor muscle.

Depending on the course of the AAM, it can be clinically insignificant, or it can lead to different types of neurovascular compression. Depending on its course, the AAM can be clinically insignificant, or it can lead to different types of neurovascular compression. For example, this anomalous structure may cause brachial plexus compression (e.g. median nerve entrapment), thoracic outlet syndrome, hyperabduction syndrome (characterised with pain radiating to the arm, numbness, paraesthesia due to abduction of the arm for a prolonged period), shoulder instability syndrome, venous obstructive compression (axillary vein entrapment), and costoclavicular compression syndrome [11].

Knowledge about the possible course of the AAM is also important while performing all surgeries in the axillary region. The AAM can impede proper interpretation and visualisation of the lymph nodes during lymphadenectomy of breast carcinoma, which may result in incomplete clearance of this region. Moreover, it is also important during a sentinel node biopsy. Adequate exposure and good haemostasis are required to successfully implement this procedure (which can be difficult if this muscle is present) [4].

There is also another type of surgery, which can be also hampered by the AAM, i.e. ensuring operational access for a bypass surgery using axillary vessels. The AAM may lead to ischaemic necrosis, and such a pathology significantly reduces the chance of successful latissimus dorsi breast reconstruction (when the thoracodorsal pedicle is compressed by the unexpected AAM) [8].

In some cases, the AAM may be palpable during physical examination, which may mistakenly suggest lymph nodes enlargement or presence of tumour mass [10].

Kil et al. [5] carried out a study among patients who underwent sentinel lymph node biopsy. The AAM was found in 7.4% of this population. What is interesting is the fact that the sentinel lymph node biopsy failure rate was significantly higher among patients with the AAM. Besides, patients with the AAM were operated on average for 20.8 minutes, whereas in those without the AAM, the surgical intervention lasted on average 12.5 minutes. Another correlation was the fact that in most patients with the AAM, the sentinel lymph node was located in a high axillary region. Among other patients, it was usually located in low axillary region [5].

An analysis of the course of both AAMs in the presented case may cause compression of neurovascular structures, manifesting with entrapment of the axillary vein and the occurrence of symptoms such as thoracic outlet syndrome, including pain and cyanosis in this region, sudden swelling, as well as heaviness or fatigue in the arm.

In the presented case, compression of brachial plexus branches could also have occurred. Median nerve entrapment is quite a common manifestation, and its first symptom can be numbness and pain in the anterior forearm or lateral part of the hand. Also, weakness, pain, and tingling in the hand, wrist, and forearm regions can be observed. A loss of muscle in the thumb region is a very rare symptom. These symptoms are worsened during abduction, external rotation, and elevation of the shoulder, because the

AAM is located closer to the mentioned neurovascular structures and compresses them.

Occurrence of the above symptoms is manifested with several symptoms observed during physical examination. This may indicate that these symptoms, including palpable mass in the axillary region, fullness of the axilla, or loss of concavity, are secondary to the occurrence of the AAM. However, this anomalous muscle may be mistaken for lymphadenopathy or tumour. Hence, it is essential to confirm the diagnosis with imaging techniques. Magnetic resonance imaging seems to be the best option to visualise the AAM [10].

CONCLUSIONS

The LDM is characterised by morphological variations, and the ADM is one of them. Its origin in most cases is the same, but its insertion may vary. Depending on its course it can be clinically insignificant or lead to different types of neurovascular compression, like thoracic outlet syndrome, hyperabduction syndrome, or median nerve entrapment. Before performing surgeries in the axillary region, such as lymphadenectomy of breast carcinoma and sentinel lymph node biopsy, it is very important to know whether this muscle is present.

ARTICLE INFORMATION AND DECLARATIONS

Data availability statement

Please contact the author for data requests (Łukasz Olewnik PhD — email address: lukaszolewnik@gmail.com).

Ethics statement

The cadavers belonged to the Department of Anatomical Dissection and Donation, Medical University of Lodz.

Author contributions

Nicol Zielinska — project development, data collection and management, data analysis, and manuscript writing; Bartłomiej Szewczyk — data collection, data analysis, and manuscript editing; Łukasz Olewnik — data analysis and manuscript editing. All authors have read and approved the manuscript.

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Conflict of interest

The authors declare that they have no competing interests.

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