

The *pectoralis quartus* and *chondro-epitrochlearis* combined muscle variation: description and surgical relevance

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ABSTRACT

The authors describe a rare unilateral muscle variation in the thoracic wall combining the *pectoralis quartus* and *chondro-epitrochlearis* muscles. A routine dissection was performed in the upper right limb of a male adult cadaver with approximately 35-50 years of age, embalmed in formalin 10%. An accessory muscle, the *pectoralis quartus*, was identified and was associated with a tendon that was inserted in the medial humeral epicondyle, characteristic of the *chondro-epitrochlearis* muscle tendon. Such variations have significant clinical relevance to orthopedics, mastology, neural and vascular surgery, and other specialties, for surgical approaches in both the axillary and brachial regions.

Keywords

Anatomy, Regional; Dissection; Autopsy; Anatomic Variation.

INTRODUCTION

Many accessory muscles of the thoracic wall have been described in the literature. Those that originate at the ribs or costal cartilages and have an insertion in the brachial region are rare and are classified into two categories: *pectoralis quartus* and *chondro-epitrochlearis*. The *pectoralis quartus* is inserted in the proximal arm structures, generally in the proximal humeral epiphysis, deep in the tendon of the pectoralis major muscle.¹ Concerning the *chondro-epitrochlearis*, it forms a tendon that crosses the arm inferiorly and medially to attach to the medial epicondyle of the humerus.² Barcia and Genovés³ use an intermediate classification called *chondrofascialis*, which comprises the muscles of thoracic origin that have an insertion in the intermuscular septum.

The low prevalence of such variations is demonstrated in an anatomical study performed in 107 cadavers, where the presence of *pectoralis quartus*

was identified in only three of them, suggesting a prevalence of 2.8%.⁴ In that same study, no *chondro-epitrochlearis* was found. Although other muscle variations occasionally accompany the occurrence of the accessory muscles in the thoracic wall, the simultaneous occurrence of the *pectoralis quartus* and the *chondro-epitrochlearis* has rarely been reported.^{5,6} Therefore, knowledge of these variations of great importance, especially for surgeons approaching the axillary region.

CASE REPORT

An upper limb routine dissection of a male cadaver of approximately 35-50 years of age, fixed in 10% formalin, at the Laboratory of Applied Morphology, Universidade Federal do Espírito Santo was performed. Initially, a superficial dissection was performed by

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removing the skin and subcutaneous tissue from the pectoral, deltoid, axillary, and brachial regions of the limb.

By accessing the transition region between the brachial and pectoral fascia, it was possible to identify a thickening of the medial aspect of the brachial fascia, which was confirmed by bending it medially through transparency visualization. This structure was isolated from the other parts of the common muscle fascia, and its width and length were measured with a caliper. The contralateral limb did not present such anatomical variation.

AUTOPSY PRESENTATION

The right pectoralis major muscle demonstrated a common muscle fascia and superficial fibers. Its deep aspect exhibited a horizontally oriented muscular fascicle associated with its inferior fibers, which contributed to the anterior wall of the axilla. Laterally, these fibers formed a tendon that ran towards the humerus (Figure 1).

The deep muscular fascia of the horizontal fascicle gave rise to a fibrous band with approximately 3.40 mm wide and 21.10 cm long that crosses the arm anteriorly and medially, and inserts in the brachial fascia, the medial intermuscular septum of the arm and the medial humeral epicondyle. In its course, it superficially crosses the median nerve in the medial face of the middle third of the arm and is deep in the basilic vein at this point. This structure, which had the appearance of a fascial thickening in its proximal part, acquired in its distal portion the robust, whitish, and shiny characteristic of a tendon (Figure 1).

CLINICAL DISCUSSION

Despite the rare cases of accessory muscles between the pectoral and brachial regions, during this routine dissection, we identified a unilateral case. Considering its muscular component, the present case could be classified as *pectoralis quartus* in association with the pectoralis major muscle. However, the accompanying aberrant tendon presents the arrangement of the *chondro-epitrochlearis* muscle tendon, which in our specimen demonstrated insertion in the horizontal fibers of the pectoralis major muscle and the medial

humeral epicondyle. The *pectoralis quartus* muscle is a rare variation with 2.8% of incidence,⁴ and its association with *chondro-epitrochlearis* has been rarely described in the literature.^{5,6} These features highlight the relevance of this description.

A similar finding was described in 1884.⁵ The specimen consisted of a muscle component originating from the fifth rib and following deeply into the pectoralis major muscle towards the axilla, where it was divided into two fascicles: the superior fascicle followed laterally to insert into the humerus, deep into the pectoralis major tendon, while the lower fascicle gave rise to a tendon that attached to the medial epicondyle of the humerus.



Figure 1. Dissection of the pectoral, scapular, axillary and brachial region: 1) Deep common fibers of the pectoralis major muscle (reflected), 2) Deep horizontal fibers of the pectoralis major muscle (reflected), 3) Pectoralis minor muscle, 4) Biceps brachii (long head), 5) Coracobrachialis muscle, 6) Median nerve, 7) Belly of the biceps brachii, 8) Basilic vein. The empty arrow indicates the *chondro-epitrochlearis* tendon, and the asterisk (*) indicates the medial epicondyle of the humerus.

The coexistence of *pectoralis quartus*, *chondro-epitrochlearis*, and *axillary arch* had first been documented in 1991.⁶ Furthermore, subsequent studies have described the presence of *pectoralis quartus* concomitant with other variations such as *axillary arch*,^{4,7} *pectoralis intermedius*,⁸ and supernumerary head of the biceps brachii.^{9,10}

Hypotheses have been raised in an attempt to explain the origin of these muscle variations. Palagama et al.¹¹ performed a phylogenetic analysis and pointed out that, in quadruped mammals, the insertion of the pectoralis major reaches distal regions of the humerus, and that its tendon has no torsion, characteristics also observed in the presence of *chondro-epitrochlearis muscle* in humans. This analysis highlights the evolutionary relationships and supports the theory that *chondro-epitrochlearis* may be embryologically derived from aberrant lower fibers of the pectoralis major.¹¹ Regarding the *pectoralis quartus*, Birmingham¹² considers it as a segmented portion of the pectoralis major, while Huntington¹³ argues that the muscle is a remnant of *panniculus canosus*.

The accessory muscles in the axillary region have minimal functional significance to the limb. Nonetheless, they have clinical implications and, mainly, surgical complications. Considering the topography, their presence may limit the surgical field, making it difficult to access and remove axillary structures such as lymph nodes in lymphadenectomy.¹⁴

The preoperative identification of these muscles by imaging is difficult, and few cases have been reported in the literature.^{15,16} If identified during the surgical procedure, Natsis et al.⁴ propose that the *pectoralis quartus* is bent towards the pectoralis major. In the case where *chondro-epitrochlearis* or atypical forms of *pectoralis quartus* prevents surgical access, it is proposed that the muscle be divided since its removal does not imply functional impairment.

From the surgical point of view, the importance of identifying these variations must be emphasized, as the erroneous recognition of the accessory muscle as part of the *pectoralis major* can lead to changing the surgery to lower levels, since the volume and the change in the lower margin of the anterior axillary wall may be at a lower level, increasing the risk for iatrogenic lesions⁴ – in our specimen the median nerve ran deep through the *chondro-epitrochlearis* tendon in

the middle third of the arm. In addition, the presence of *chondro-epitrochlearis muscle* can compress the ulnar nerve and brachial veins in its pathway to generate nerve complications,¹⁷ vein thrombosis, or lymphedema.¹⁵ Aesthetic and mobility changes by preventing complete abduction of the shoulder have also been reported. Such events could be reversed with careful muscle excision.¹⁸

CONCLUSION

We present a rare combination of muscular anatomical variations in the root of the upper right limb. Such anatomical variation may increase the surgical complexity and the risk of iatrogenic injuries. Therefore, knowledge of these anatomical variations is important for surgical planning and management in the axillary region.

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REFERENCES

1. Macalister A. Additional observations on muscular anomalies in human anatomy. (Third Series) With a catalogue of the principal muscular variations hitherto published. Trans R Ir Acad. 1875;25:1-134.
2. Perrin JB. Notes on some variations of the pectoralis major, with its associate muscles. J Anat Physiol. 1871;5(Pt 2):233-240, 420-13-420-19. PMID: 17230890.
3. Barcia JM, Genovés JM. Chondrofascialis versus pectoralis quartus. Clin Anat. 2009;22(8):871-2. <http://dx.doi.org/10.1002/ca.20798>. PMID:19418449.
4. Natsis K, Vlasis K, Totlis T, et al. Abnormal muscles that may affect axillary lymphadenectomy: surgical anatomy. Breast Cancer Res Treat. 2010;120(1):77-82. <http://dx.doi.org/10.1007/s10549-009-0374-5>. PMID:19306056.
5. Testut L. Les anomalies musculaires chez l'homme expliquées par l'anatomie comparée, leur importance en anthropologie. Paris: G. Masson; 1884 [cited 2019 Oct 15]. Available from: <https://gallica.bnf.fr/ark:/12148/bpt6k6230258d>
6. Bergman RA. Doubled pectoralis quartus, axillary arch, chondroepitrochlearis, and the twist of the tendon of pectoralis major. Anat Anz. 1991;173(1):23-6. PMID:1952092.

7. Bonastre V, Rodríguez-Niedenführ M, Choi D, Sañudo JR. Coexistence of a pectoralis quartus muscle and an unusual axillary arch: case report and review. *Clin Anat.* 2002;15(5):366-70. <http://dx.doi.org/10.1002/ca.10053>. PMID:12203382.
8. Arican RY, Coskun N, Sarikcioglu L, Sindel M, Oguz N. Co-existence of the pectoralis quartus and pectoralis intermedius muscles. *Morphologie.* 2006;90(290):157-9. [http://dx.doi.org/10.1016/S1286-0115\(06\)74497-6](http://dx.doi.org/10.1016/S1286-0115(06)74497-6). PMID:17278455.
9. Song H, Kim J, Yoon S-P. Coexistence of a pectoralis quartus muscle, a supernumerary head of biceps brachii muscle and an accessory head of flexor digitorum profundus muscle. *Folia Morphol (Warsz).* 2019;78(1):204-7. PMID:29802720.
10. Carroll MA, Lebron EM, Jensen TE, Cooperman TJ. Chondroepitrochlearis and a supernumerary head of the biceps brachii. *Anat Sci Int.* 2019;94(4):330-4. <http://dx.doi.org/10.1007/s12565-019-00483-5>. PMID:30863930.
11. Palagama SPW, Tedman RA, Barton MJ, Forwood MR. Bilateral chondroepitrochlearis muscle: case report, phylogenetic analysis, and clinical significance. *Anat Res Int.* 2016;2016:5402081. <http://dx.doi.org/10.1155/2016/5402081>. PMID:27242928.
12. Birmingham A. Homology and innervation of the achselbogen and pectoralis quartus, and the nature of the lateral cutaneous nerve of the thorax. *J Anat Physiol.* 1889;23(Pt 2):206-23. PMID:17231782.
13. Huntington GS. The derivation and significance of certain supernumerary muscles of the pectoral region. *J Anat Physiol.* 1904;39(Pt 1):1-54.27. PMID: 17232622.
14. Totlis T, Iosifidou R, Pavlidou F, Sofidis G, Natsis K, Bousoulegas A. Complicated axillary lymphadenectomy due to a pectoralis quartus muscle. *Chirurgia (Bucur).* 2012;107(3):397-8.
15. Thomet C, Belgrado J-P, Vankerckove S, et al. The chondroepitrochlearis muscle: a rare case of axillary vein thrombosis and lymphedema. *Lymphology.* 2016;49(3):133-9. PMID:29906070.
16. Sousa Rosas CH, Bezerra LCB, Yoshitake R, et al. Pectoralis quartus muscle: a rare anatomical variant. *Breast J.* 2019;tbj.13579. <http://dx.doi.org/10.1111/tbj.13579>. PMID:31486163.
17. Spinner RJ, Carmichael SW, Spinner M. Infraclavicular ulnar nerve entrapment due to a chondroepitrochlearis muscle. *J Hand Surg Br.* 1991;16(3):315-7. [http://dx.doi.org/10.1016/0266-7681\(91\)90060-2](http://dx.doi.org/10.1016/0266-7681(91)90060-2). PMID:1960500.
18. Tröbs R-B, Gharavi B, Neid M, Cernaianu G. Chondroepitrochlearis muscle--a phylogenetic remnant with clinical importance. *Klin Padiatr.* 2015;227(4):243-6. PMID:25437344.

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