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Research Article

Musculus Cervicis Accessorius: A Variant Accessory Muscle of the Axiomuscles

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Abstract: Supernumerally anatomical structures is of clinical and surgical importance and requires a greater knowledge on their existence. The present article reports the anatomic variation on the number and position of axiomuscles in the cervicothoracic region observed during routine dissection of a 72-years-old embalmed male cadaver on the left shoulder region. According to the origin, insertion and innervation topographies of the extra muscle, it was considered as musculus cervicis accessorius. The existence of this muscle is of importance to surgeons, anatomists and physiotherapist during their normal routine procedures or during evaluation of CT and MRI scans by the radiologists.

Keywords: *axiomuscles; levator scapula; musculus cervicis accessorius; variation*.

Background

The muscles of the shoulder region are usually grouped into three topographic units basing on the origin, direction and insertion of their fibers: the scapulohumeral, axiohumeral, and axioscapular groups. Levator scapulae muscle (LSM) forms part of the axiomuscles belonging to the latter group together with rhomboid major, rhomboid minor, serratus anterior, and trapezius. The LSM usually described to originate from the transverse process of first four cervical vertebrae, and inserted to the upper medial border of the scapula at the superior angle (Testut, L & Latarjet, A. 1979; Drake, R.L. *et al.*, 2015). It elevates and aid on retraction and adduction of the scapula or may slightly rotate it (Drake R.L. *et al.*, 2015; Varjao, L.G. *et al.*, 2012).

Variations on the attachments and tendinous expansions of the LSM has been described as to the temporal and occipital bones, rhomboid, trapezius and serratus muscles (Williams, P.L. *et al.*., 1995). However, the current article describes the anatomical variation in which a strap-like muscle originate from the first cervical vertebrae descends and inserts on the third and fourth

MATERIAL, METHODS AND RESULTS

A detailed cadaveric study of the left shoulder region was carried out for undergraduate medical students to explain the topographical anatomy concerning the muscles and neurovascular structures of this region. The axioscapular muscles of a 72 year-old adult Japanese male cadaver revealed an unusually positioned, supernumerally muscle on the superficial muscles of the back. This muscle was a strap-like extended from the posterior tubercle and lateral margin of the transverse process of the first cervical vertebrae (Cv1) descended inferoposterioly to the spinous processes of the third (T3) and fourth (T4) thoracic vertebrae (**Figure 1**).

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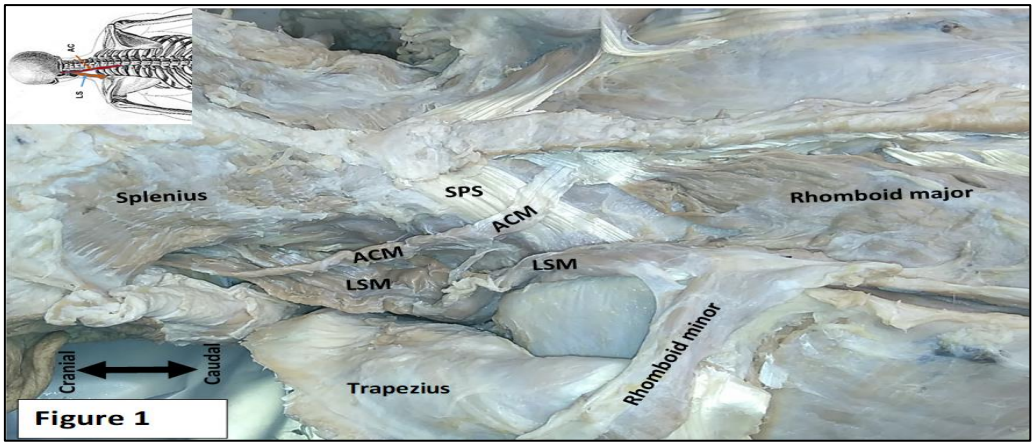

Figure 1: Photograph from 72-years-old embalmed male cadaver showing the axioscapula muscles and other superficial back muscles. Note the position and direction of the musculus cervicis accessorius (*ACM*). The insert illustrates the origin and insertion of the ACM. *SPS*: serratus posterior superior muscle; *LSM*: levator scapulae muscle

Superiorly, it was covered by first portion of sternocleidomastoid and trapezius muscles. It was bounded anteriorly by Levator scapular and posteromedial by splenius capitis muscles.

Inferiorly, it passes (located) above the serratus posterior superior muscle but below rhomboid minor and major muscles before inserting to T3 and T4 spinous processes. It forms an X-shaped appearance at junction with serratus posterior superior muscle, a feature which also formed when its tendons cross with tendons of rhomboid major at the point of insertion (**Figure 2**). At this point it resulted into formation of two quadrangular spaces: superomedial and inferolateral.

It resulted in angle formation of 60º with serratus posterior superior muscle and 110º with rhomboid major muscle. The length of the muscle measured 128 mm and the width measured 9 mm at the origin, 13 mm at the middle, while its tendons spanned for 11 mm.

Nerve supply to this muscle was derived from anterior ramus of third and fourth cervical spinal nerves. It received blood supply from a branch of dorsal scapula artery.

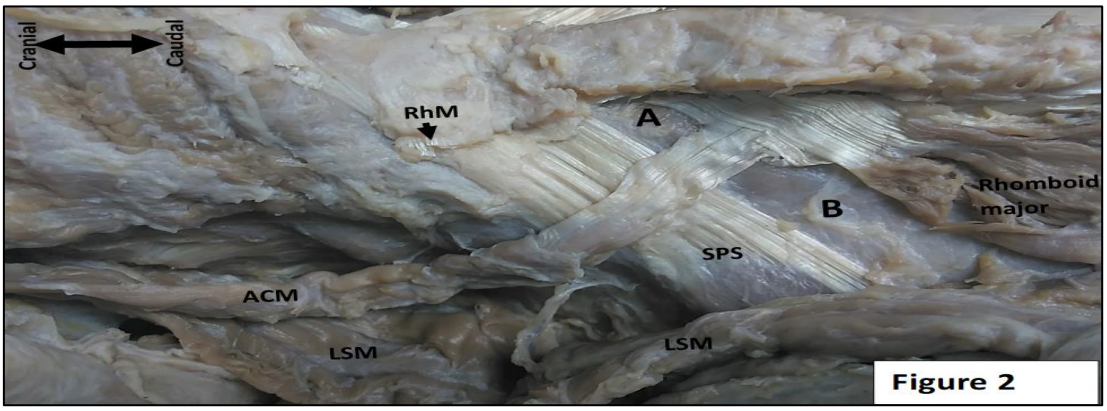

Figure 2: Photograph from 72-years-old embalmed male cadaver displaying crossing of the musculus cervicis accessories (*ACM*) over the serratus posterior superior (*SPS*) forming a "X-patern" and resulting in quadrangular spaces: superomedial (*A*) and inferolateral (*B*). *LSM*: levator scapulae muscle; *RhM*: Rhomboid minor muscle (Cut).

DISCUSSION

The report on existing anatomical variations involving the axiomuscles that connects the axioskeleton components and to the appendicular skeleton structures is of significant in clarifying the deviations in precision of shoulder movement and its alignment.

Although anatomical literature has revealed various variations involving the levator scapula muscle and its attachments including bifurcation of the distal attachments, insertion into serratus muscles or ligamentum nuchae, or first ten ribs, fixation on occipital and temporal bones (Testut, L. & Latarjet, A.

1979; Varjao, L.G. 2012), the current observation deviates from them and hence suggest a new nomenclature "*muscullus cervisis accessorius (MCA)*" for the variant muscle, due to its origin, orientation and insertion points. The MCA is among the axioskeleton musculature connecting the cervical vertebrae and thoracic vertebrae by its origin and insertion respectively.

Usually the levator scapulae arises as four slips of muscle that twisting and run distally to its insertion on the scapula (Cantrell, M. 2019). The present case, the LSM had three slips while the other was completely separate and with independent path hence forming the musculus cervicis accessorius. This muscle when contracts it aids the left scalene anterior and middle muscles on bending the neck towards the left. Hence assists in rotation and lateral flexion of ipsilateral side (left side).

Embryological Note

Axioscapular group of muscles which is also classified as hypaxial muscles, Embryologically develop from the axial somites together with axial skeleton (Buckingham, M. & Relaix, F. 2015) following activation of homeobox genes coding for proteins that act as transcriptional regulators (Rudnicki, M.A. *et al.,* 1993; Standring, S. 2008). Massive signalling molecules enhances this myogenesis activities. Activation of myogenic progenitor cell surface receptors by these signalling molecules at the transverse process of the cervical vertebrae induces intracellular pathways that causing the proximal premuscle fibers to aggregates forming the levator scapula concerned with the cranial displacement of the scapula, while the distal give rise to serratus anterior (Bentzinger, C.F. *et al.,* 2012; Keibel, F & Mall, F.P. 1910). Any factor which could interfere with the intrinsic or extrinsic control of these activities, will lead to failure in the formation of the proper levator scapula muscle or its attachment.

In an 11 mm embryo, the fibers forming Levator scapula muscle migrate from lower cervical region to the thorax (Lewis, W.H. 1910). It is well known that muscles forming distant from the somite require *Pax3*-dependent migrating progenitors (Buckingham, M & Relaix, F. 2015; Bentzinger, C.F. 2012; Epstein, J.A. *et al.,* 1996) and epithelial-to-mesenchymal transition which will give rise to long-range migratory myogenic progenitor cells control and modulating their adhesiveness to the surrounding embryonic structures (Jaffredo, T. *et al.,* 1988; Brand-Saberi, B. *et al.,* 1993; Bentzinger, C.F. *et al.,* 2012, Deries, M. & Thorsteindottir, S. 2016). Any defect on this signalling molecules/pathways could lead to abnormal adhesion of the migrating myogenic progenitor cells which might results into variant origin, insertion and position of the formed muscle as observed in the present case.

It is well known that the definitive (secondary) muscles fibers develop from the fusion of primary fibers (fetal myoblasts) in the trunk and limbs. Kelly and Zacks reported that, "*the secondary myotubes remain attached to primary fibers for a short period before elongating and become independent fibers that distinguished from primary fibers*" (Kelly, A.M & Zacks, S.I. 1969). The observation made in the present case could also be due to the failure in detachment of these secondary myotubes hence remains attached to its origin primary hypaxial origin leading to the formation of a distinct accessory muscle in the cervical region.

CONCLUSION

Development of anatomical variants are linked with aberrations affecting signalling molecules and/or transcription factors that coordinate embryonic development. Understanding the existence of supernumerally anatomic variants with respect to myogenesis activities, such as *musculus cervicis accessorius*, is of clinical importance to surgeons, radiologists and physiotherapists in their routine procedure.

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Conflict of Interest

None

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