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CASE REPORT

Accessory subscapularis muscle – A forgotten variation?

Muscle subscapulaire accessoire – Une variation oubliée ?

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KEYWORDS

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MOTS CLÉS

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Summary The quadrangular space is a space in the axilla bounded by the inferior margin of the teres minor muscle, the superior margin of the teres major muscle, the lateral margin of the long head of the triceps brachii muscle and the surgical neck of the humerus, medially. The axillary nerve (C5-C6) and the posterior circumflex humeral artery and veins pass through this space in order to supply their territories. The subscapularis muscle is situated into the scapular fossa and inserts itself into the lesser tubercle of the humerus, thus helping stabilize the shoulder joint. A supernumerary muscle known as accessory subscapularis muscle originates from the anterior surface of the muscle and usually inserts itself into the shoulder joint. It is a rare variation with few reports of its existence and incidence. We present a case of the accessory subscapularis muscle in a male cadaver fixated with a 10% formalin solution. The muscle passed anteriorly to the axillary nerve, thus, predisposing an individual to quadrangular space compression syndrome. We perform a review of the literature and address its clinical, anthropological and anatomical significance.

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Résumé L'espace quadrangulaire est situé à l'aisselle, délimité par la marge inférieure du muscle petit rond, la marge supérieure du muscle grand rond, la marge latérale de chef long du muscle triceps brachial et le col chirurgical de l'humérus, Le nerf axillaire (C5-C6) et l'artère et les veines circonflexes postérieures de l'humérus passent dans cet espace pour alimenter leurs territoires. Le muscle subscapulaire est situé dans la fosse subscapulaire et s'insère dans la tubérosité mineure de l'humérus, aidant ainsi à stabiliser l'articulation de l'épaule. Un muscle surnuméraire appelé muscle subscapulaire accessoire provient de la face antérieure du muscle

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subscapulaire et s'insère habituellement dans l'articulation de l'épaule. C'est une variation rare avec peu de rapports de son existence et de son incidence. Nous présentons un cas de muscle subscapulaire accessoire sur un corps masculin fixé avec une solution de formol à 10 %. Le muscle passait en avant du nerf axillaire, donc, prédisposant le sujet au syndrome de compression de l'espace quadrangulaire. Nous avons effectué une revue de la littérature et abordons sa signification clinique, anthropologique et anatomique.

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Introduction

The subscapularis muscle (SM) originates from the subscapular fossa and inserts itself into lesser tubercle of the humerus, thus reinforcing the shoulder joint together with the other rotator cuff muscles (infraspinatus, supraspinatus and teres minor muscles) [1].

The axillary nerve (AN) (circumflex nerve) rises from the posterior cord of the brachial plexus (C5-C6), and passes through the quadrangular space together with the posterior circumflex humeral artery and vein. It is responsible for the innervation of the deltoid and teres minor muscles and the superior and posterior portion of the arm's skin [1,2]. The quadrangular space (of Velpeau) is situated in the axilla, and it is bounded superiorly by the inferior margin of the teres minor muscle, inferiorly by the superior margin of the teres major muscle, medially by the humerus and laterally by the medial border of the long head of the triceps brachii muscle [1].

Variations regarding the SM are well known in the literature, but there are no recent reports or studies emphasizing its clinical significance. A variation of the SM that possesses great surgical and clinical significance is the subscapularis secundus, also known as accessory subscapularis muscle (ASM), this accessory slip reaches the shoulder joint and can pass anteriorly to the AN [3–5].

The presence of accessory muscles at the axillary region is usually associated with neurovascular bundle compression [5–7].

We report the case of an ASM and its relation with the AN in a male cadaver, addressing its clinical significance regarding AN compression and discussing its anthropological, evolutionary and historical value.

Case report

A male cadaver fixated in a 10% buffered formalin solution was dissected during regular lessons on the Anatomy Laboratory of the Fluminense Federal University. While dissecting the rotator cuff muscles, it was found an uncommon anatomical variation of the SM. An accessory slip arose from the anterior and lateral surface of the SM and inserted itself onto the shoulder joint thus, being identified as an ASM (subscapularis secundus), furthermore, the AN ran posteriorly to the ASM before reaching the quadrangular space (Fig. 1).

Discussion

Older textbooks comments that the SM is not formed until the ninth week of intrauterine development. After a muscle mass is formed, it differentiates itself in order to form the latissimus dorsi, teres major, and subscapularis muscles. The inferior portion of the SM is detached and isolated, thus, forming the ASM [8]. Nowadays, it is stated that those muscles are derived from the dorsal muscle mass from the upper limb bud, and this process begins at the fifth week of development, when myogenic precursors start migrating to form large myoblasts condensations (dorsal and ventral), which will give origin to the muscles of the dorsal and ventral aspect of the limb bud, respectively [9,10].

It seems that the SM is the most variable muscle of the rotator cuff group [5]. The following variations of the SM have been described in the literature: division of the SM into 2 or 3 isolated portions; a slip arising from the SM tendon and joining the axillary fascia; a slip connecting the SM with the pectoralis major muscle or the short head of the biceps brachii muscle; a slip arising from an accessory process of the lesser tubercle and joining the shoulder joint capsule (tensor capsulae); a supernumerary muscle that leaves the infraglenoidal tubercle and inserts onto the surgical neck of the humerus (glenobrachialis); a muscle band rising from the ventral and lateral surface of the SM and reaching the joint capsula (subscapularis secundus) [1,3,5].

The incidence of the subscapularis secundus was reported by Gruber as 5% (10 out of 200) (Le Double, 1897) [8] and Kameda (1976) [4] as 10 out of 190 specimens (10 out of 380 arms). According to Le Double (1897) [8], Testut found this variation in 3 of 18, Krause in 3 of 35 and Knott in 3 of 39 subjects. Yoshinaga et al. (2008) reports the incidence of this variation as 0.45% of its specimens (1 out of 222 subjects) [7].

Over the course of history, the ASM has been given a great deal of different names such as subscapulo-capsular muscle, subscapulo-humeral muscle, subscapularis minor muscle, infraspinalis secundus, subscapularis secundus, axillary slip of the subscapularis, accessory subscapularis-teres-latissimus muscle, thus, causing confusion and difficulties in communication [7,8,11].

Concerning the first description of this muscle, Le Double (1897) [8] in his treatise on muscular variations, reports that the ASM was firstly described by Blandin and Cruveilhier around 1838, albeit in a rough fashion, while Gruber described the muscle more accurately, in respect to its

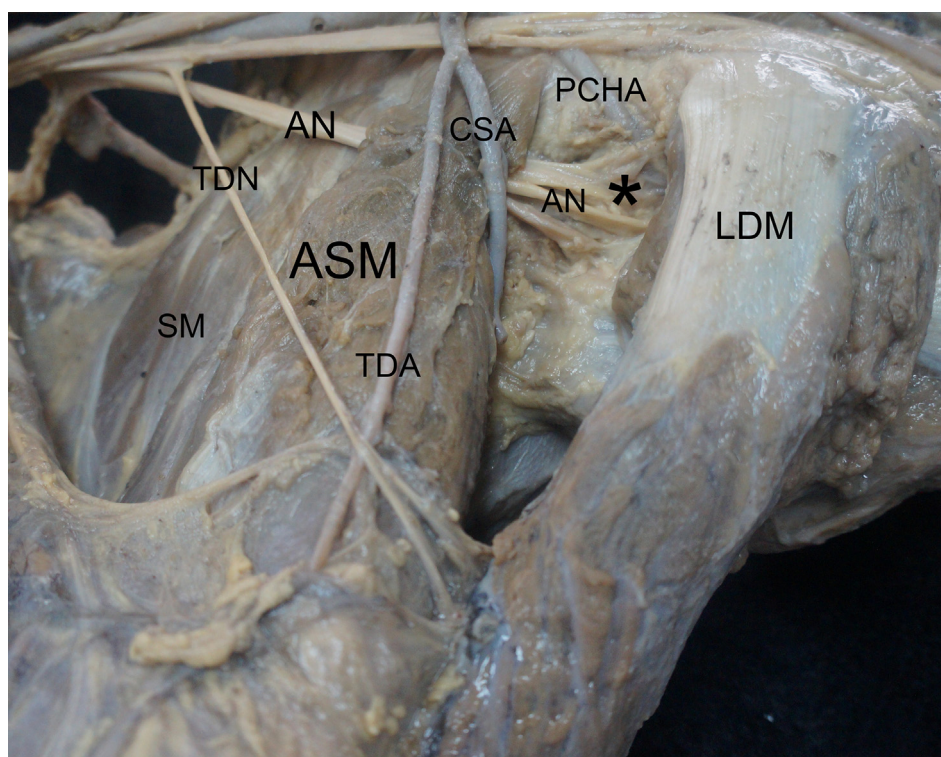


Figure 1 Anterior view of the subscapularis and subscapularis secundus muscles. The accessory muscle band can be seen originating from the anterior surface of the subscapularis muscle and the axillary nerve passing posterior to it. AN: axillary nerve; SM: subscapularis muscle; ASM: accessory subscapularis muscle; TDN: thoracodorsal nerve; TDA: thoracodorsal artery; CSA: circumflex scapular artery; PCHA: posterior circumflex humeral artery; *: quadrangular space; LDM: latissimus dorsi muscle.

morphology. Macalister (1864) [12] and Henle (1855) [11] give full credit to the ASM description to Gruber in 1854. Afterwards, this variation was described by many anatomists (Henle, Wood, Haughton, Knott, Kolliker, Bardeleben, Macalister, Krause, Walsham).

Macalister (1864) [12] described a muscle which was “split into two portions by the circumflex nerve” (e.g. axillary nerve), although he labeled the muscle as “subscapulo-humeral muscle”. Breisch (1986) [6] described a bilateral case of ASM in which the AN also passed posterior to the supernumerary muscle.

Yoshinaga et al. (2008) reported a case of ASM in one arm, and the presence of the axillary arch in the other arm of the same cadaver. Furthermore, their study on the nerve fibers of this muscle concluded that the development of the ASM is related to the latissimus dorsi muscle due to its innervation, although further studies are needed to confirm the actual innervation of this accessory muscle [7].

Anthropological and evolutionary value of this variation is on the account of its presence in lower mammals, such as Pan troglodytes, as stated by Ziegler (1964) [13]. Furthermore, it can be divided in seven bundles in Gorilla species, and it is continuous in Pongo species [14]. Those different dispositions of the SM can be explained by postural and locomotor activities, such as climbing trees [15]. An historical review allowed us to report the fact that the ASM was found by Haughton in higher vertebrate species, by Macalister in horses, seals and different species of monkeys [8].

Moreover, Le Double (1897) [8] and Macalister (1864) [12] points out an analogy of this ASM to variations in muscles of the lower limb (iliocapsularis), which would be of great interest to comparative anatomy. The action of the ASM is speculated by Henle (1855) [11] as being the same of the SM: medial rotation of the shoulder joint and stabilization of the capsule.

The AN is not subject to many variations, in fact, few of them has been described [3], recent studies showed that the AN usually innervates the long head of the triceps brachii [16].

Variations on its trajectories are caused by the presence of supernumerary muscles, such as the ASM. Hence, the AN and the posterior circumflex humeral artery and veins can be compressed before reaching the quadrangular space or at the space itself, thus causing a condition known as Quadrangular space syndrome [5,6,17,18].

This debate whether it can be compressed by accessory muscles or not seems to have been forgotten over time, whereas most of the publications dealt with compression caused by cysts or exostosis [5,17,19]. In contrast to the ASM, other variations on the axilla regarding supernumerary muscles, such as the axillary arch, has been widely described and reported in the recent literature [5].

We believe that the presence of an anomalous muscle such as the ASM can cause compression on the neurovascular bundle of the region, due to the fact that the accessory muscle possessed a large fleshy portion. Moreover, it could also

cause pain and numbness of the area during medial rotation of the arm - one of its actions.

Conclusion

We believe that even though there is a scarce literature concerning the presence, incidence and clinical significance of the subscapularis secundus, its study is worthwhile due to its anthropological and morphological aspects. Furthermore, since supernumerary muscles can cause nerve entrapment or compression syndromes (such as the presence of the axillary arch), credit to the ASM in the role of AN compression on the quadrangular space should be given. This is the second case to be reported in the literature that shows an unusual relation between the ASM and the AN.

Disclosure of interest

The authors declare that they have no competing interest.

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