

A case of large scalenus minimus muscle

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ABSTRACT

During the dissection of an 80-year-old, white, male cadaver, a large scalenus minimus muscle was detected on the right side. Scalenus minimus muscle, a fiber bundle which strengthens the suprapleural membrane, arises from the anterior tubercle of the transverse process of the 7th cervical vertebra, and inserts to the inner border of the first rib and cupula pleura. In the present case, the scalenus minimus muscle on the suprapleural membrane was large on the right side. Its origin was on the anterior tubercle of the transverse process of the 7th cervical vertebra, and the muscle was located between the C7 and C8 anterior rami. The present case is noteworthy because of its great dimension and relation with the brachial plexus. Apart from its importance in cervical region anesthesia and surgery, such an anatomical structure can lead to several clinical conditions both by spasm and compression such as neurogenic thoracic outlet syndrome.

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The suprapleural membrane over the cupula pleura is strengthened by additional bands or slender muscle fibers, which are referred to as the scalenus minimus muscle (Sm) in some cases. If it exists, this muscle originates from the anterior tubercle transverse process of the 7th cervical vertebra and extends to the inner margin of the first rib behind the groove for the subclavian artery and the cupula pleura.¹ It is also defined as a part of the scalene muscle mass, the anterior scalene muscle.² Here, we present a case with bilateral Sm; larger

only on the right side. Possible clinical conditions (for example, thoracic outlet syndrome, spontaneous pneumothorax) that Sm may cause, are discussed. The aim of this report is to take the attention of surgeons, neurologists and anesthetists to these possible muscular variations for these clinical conditions in the cervical region.

Case Report. Bilateral Sms, larger on the right side were encountered during the dissection of an 80-year-old male cadaver (Figures 1a & 1b). On the right side, the anterior scalene muscle (15 mm in width) was observed in its anatomical position, posterior to the subclavian and internal jugular veins, and the phrenic nerve. It arose from the anterior tubercle of the transverse process of the 5th-6th cervical vertebrae, and coursed almost vertically to attach to the inner margin of the first rib. It received nerve fibers from the superior trunk of the brachial plexus (C4-6). The middle scalene muscle (18.7 mm in width) extended from the posterior tubercles of the transverse processes of the 3rd-6th cervical vertebrae to the inner margin of the 1st rib. Two nerve branches coming from C5-6 roots innervated this muscle. Between the anterior and middle scalene muscles, the subclavian artery and C7-8 and T1 roots of the brachial plexus were observed. The posterior scalene muscle (19 mm in width) was between the posterior tubercle of the transverse process of the 7th cervical vertebra and the outer surface of the 2nd rib. Nerve branches coming from C7-8 and T1 roots innervated this muscle. On the same side (right) of the cadaver, a large Sm was observed over the suprapleural membrane. It began from the anterior tubercle of the transverse process of the 7th cervical vertebra, passed between the C7-C8 ventral rami of the brachial plexus, and attached to the inner margin of the first rib and the anterior part of the cupula pleura. Its width was 9.15 mm in length. Its nerve supply was through the fibers coming from the C8 and T1 ventral rami. The fibers coming from T1 ventral ramus were scattered over the underlying fascia after piercing the muscle. There was a Sm on the left side as well, but it was observed as slender muscle fibers over the suprapleural membrane as its definition in classical textbooks. Its length and maximum width were 27.5 mm and 4.1 mm. It passed under all the rami forming the brachial plexus and attached to the inner margin of the first rib and the cupula pleura.

Discussion. The incidence of Sm varies in the literature. Rusnak-Smith et al³ dissected only left sides of 10 cadavers and found Sm in a single case. In another study, the incidence

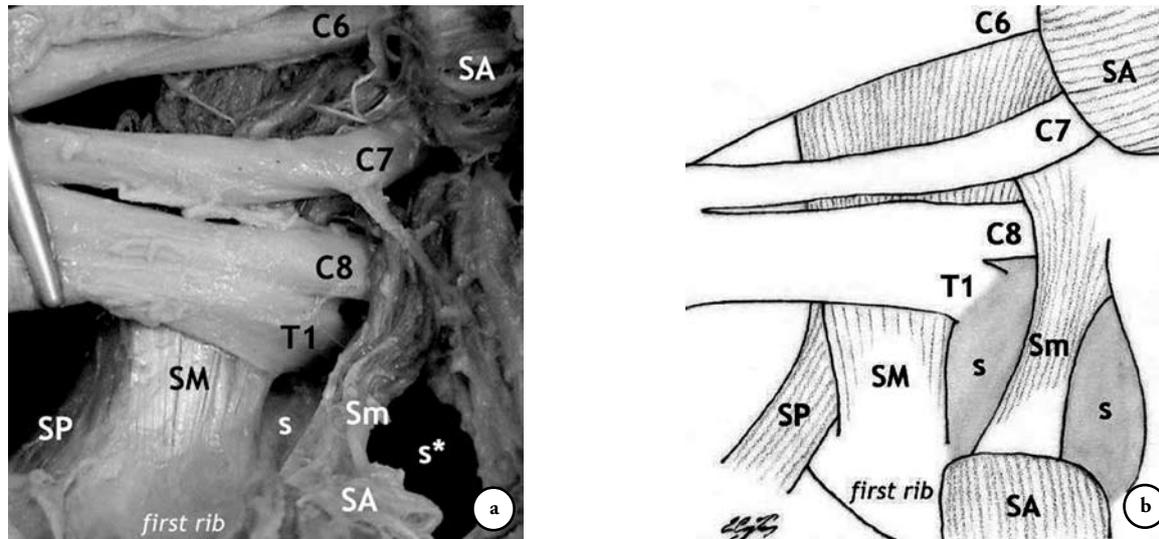


Figure 1 - The relation of the large scalenus minimus muscle with the brachial plexus, particularly with the C8 and T1 nerve roots, on the right side. a) Scalenus anterior muscle was cut and removed to better show the scalenus minimus muscle b) Schematic presentation of the relation between large scalenus minimus muscle and the brachial plexus. SA - scalenus anterior muscle, SM - scalenus medius muscle, SP - scalenus posterior muscle, Sm - scalenus minimus muscle, s - suprapleural membrane, s* - the ruptured suprapleural membrane.

was given as 46%, in which the 28% of the cases were bilateral.⁴ According to Bergman,⁵ 72% of the European children have Sm. Makhoul and Machleder² analyzed 200 patients who underwent surgery for neurovascular compression and reported that 10% of the patients had scalenus minimus muscle. Various reports on its incidence are likely because of its definition depending on its dimension. Some authors consider it as the slender muscle fibers found over the cupula pleura,⁴ while others define it as a part of the scalene muscle mass, precisely the anterior scalene muscle.^{2,8} The present case is noteworthy because of its great dimension and the fascial covering, indicating that Sm is a separate muscle than those of the scalene group muscles. Moreover, the relation of such a large muscle with the rami, which contributes to the brachial plexus, increases its significance regarding its possible potential to lead to several clinical conditions, namely, neurogenic thoracic outlet syndrome (NTOS) or spontaneous pneumothorax.

Several reasons that produce compression on the brachial plexus in the area between the superior thoracic aperture and axilla form a neurogenic compression syndrome, which is referred to as the "NTOS".⁶ Brachial plexus variations,⁷ cervical rib, repetitive trauma to the plexus elements,⁶ anomalous fibrous bands, or scalene muscle anomalies^{3,6,8,9} may cause NTOS. Among those, the spasm of the anterior scalene muscle is the most common, which is also known as the "scalenus anticus syndrome". Also, the scalene muscle anomalies are the predominant etiological factor in upper plexus TOS.⁸ In the present case, the large Sm passed between the C7 and C8 ventral rami and attached to the first rib. It is likely for such an anatomical structure to cause NTOS by narrowing the scalene triangle, which is bounded by

the anterior and middle scalene muscles and the first rib. Interestingly, it was reported by Bergmann et al⁵ that particularly the anterior and middle scalene muscles, which attach to the first rib may cause stress fracture of this rib, and they claimed that an abrupt distension of the cupula pleura by the scalenus minimus muscle is responsible for the spontaneous pneumothorax.

Overall, this case is an important sample regarding the etiologic role of Sm both in NTOS and spontaneous pneumothorax.

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