



Anatomy and clinical implications of the sternalis muscle: A literature review

Pedro Fechine Honorato

E-mail: hpedrofechine@gmail.com

Anna Vitória Paz Moreira

E-mail: annavitoriapaz2099@gmail.com

Anaylle Vieira Lacerda de Oliveira

E-mail: anaylle.vieira@gmail.com

Dhiego Alves de Lacerda

E-mail: dhiegomedicina@gmail.com

Isabelle Lima Lustosa

E-mail: isabelle.lustosa@hotmail.com

Renata Silva Cezar

Institution: Centro Universitário Santa Maria – UNIFSM

Address: Cajazeiras - PB

E-mail: renata.cezar11@gmail.com

Jalles Dantas de Lucena

Institution: Centro Universitário Santa Maria - UNIFSM

Address: Fortaleza – CE

E-mail: jallesdantas@gmail.com

ABSTRACT

The sternalis muscle (SM) is an inconsistent and highly uncommon structure among the muscles of the anterior chest wall (POVEDA et al., 2013). It lies between the superficial fascia and the pectoral fascia, found in about 8% of the population (SNOSEK et al., 2014). The frequency of its occurrence varies significantly among different ethnic groups, being more prevalent in the Chinese population at 23.5% and less prevalent in the Taiwanese population at 1% (RAIKOS et al., 2011; VISHAL et al., 2013), while its incidence is 4.4% in the European population and 8.4% in the African population (LOUKAS et al., 2004).

Keywords: Anatomy, Sternalis Muscle, Clinical Importance.

1 INTRODUCTION

The sternalis muscle (SM) is an inconsistent and highly uncommon structure among the muscles of the anterior chest wall (POVEDA et al., 2013). It lies between the superficial fascia and the pectoral fascia, found in about 8% of the population (SNOSEK et al., 2014). The frequency of its occurrence varies significantly among different ethnic groups, being more prevalent in the Chinese population at 23.5% and less prevalent in the Taiwanese population at 1% (RAIKOS et al., 2011; VISHAL et al., 2013), while its incidence is 4.4% in the European population and 8.4% in the African population (LOUKAS et al., 2004).



According to the study by Snosek et al. (2014), the SM presents several morphological variations, both unilaterally and bilaterally. Generally, its location is parallel to the sternum bone and apparently lacks an evident function. There is still significant controversy surrounding the nerve supply and embryological origin of this muscular segment of the chest. It may be partially or entirely absent (STANDRING, 2016), and its prevalence is relatively higher in women than in men (AGUADO-HENCHE et al., 2018).

Although the SM lacks a defined function due to its varied origins and insertions, there's a generalization that contraction from its insertion towards its origin, shortening it, suggests a role in elevating the lower chest wall. It could serve as an accessory to inspiration when its insertion is at the lower margin of the rib cage (LIU et al., 2012).

Understanding the sternalis muscle (SM) in clinical practice holds immense importance as it helps prevent common diagnostic errors and guides surgeries in the thoracic region of the patient (NUTHAKKI et al., 2007). Additionally, it serves as a grafting option for plastic surgeries, particularly in grafts for breast reconstruction (KHAN, 2008; MEHTA et al., 2010) and grafts for the face, head, and neck (IBRAHIM et al., 2012; JELEV et al., 2001; RAIKOS et al., 2011).

This study aims to present the anatomy and clinical implications of the sternalis muscle through an integrative literature review.

2 MATERIALS AND METHODS

This is a literature review study, aiming to explore the sternalis muscle (SM), including its prevalence, clinical characteristics, and associated features. It involves data collection and proposes a meticulous assessment of information sourced from scientific articles and books. Ultimately, this study aims to improve knowledge and critical thinking that support decision-making in clinical practice.

The bibliographic research was conducted in November 2023, using 2 databases: the US National Library of Medicine (PubMed) and the Scientific Electronic Library Online (SciELO). The search employed the following Health Sciences Descriptors (DeCS): anatomy, clinical, incidence, and sternalis muscle. The Boolean operator 'AND' was used to combine the selected descriptors.

Only articles published between 2001 and 2022 in Portuguese, Spanish, and English languages, in full text and freely available, were selected. Conference proceedings, theses, dissertations, editorials, incomplete texts, and studies not conducted on human subjects were excluded. Initially, titles and abstracts of the identified studies were reviewed, and those meeting the objectives of this study were chosen for full-text reading.



3 RESULTS E DISCUSSIONS

In the initial search, 54 studies were found. After applying the eligibility criteria and reviewing titles and abstracts, 39 publications were excluded, leaving 15 articles selected for full-text reading and writing of this review.

Regarding the methodological design, the selected studies encompassed diverse types such as cross-sectional, systematic review, cohort, and randomized clinical trials, with qualitative and descriptive characteristics.

According to the research by Young and colleagues (2006), the sternalis muscle (SM) was present in 86 (6.2%) out of 1,387 patients. This muscle tends to be more prevalent in female patients (44 out of 597, 7.3%) than in male patients (42 out of 790, 5.3%), although statistical significance was not observed ($p=0.058$). Among the patients with the SM, 23 had bilateral SM, while the remaining 63 had unilateral SM. The study also revealed 28 cases of left-sided SM and 35 cases of right-sided SM.

Regarding the measurements of the sternalis muscle (SM), Young and colleagues (2006) demonstrated that the height, anteroposterior diameter, and width did not significantly differ between unilateral and bilateral muscles ($p=0.182$, 0.911 , and 0.114 , respectively). It is worth noting that the height and anteroposterior diameter did not show significant differences between male and female patients ($p=0.470$, 0.329 , respectively), but the width was greater in males patients ($p<0.001$). Furthermore, all cases of SM exhibited a flat appearance, except for one case. Thus, the SM were located longitudinally in a paraesternal position in all cases.

The sternalis muscle (SM) can be identified during thoracic surgeries or diagnostic imaging procedures, such as mammography, what can potentially account for a slightly higher prevalence in women than in men (BAILEY; TZARNAS, 1999).

The sternalis muscle (SM) is highly variable anatomically, which decreases the probability of it having an essential function. It doesn't imply that the muscle can't ever exert an action on skeletal elements located between its insertions; rather, its action might be idiosyncratic, that is, dependent on specific muscle morphology, and not generalizable in a way that applies in all cases. Any action of the SM influencing the positions of skeletal elements involved by the muscular body would likely depend on other more regular muscles serving as its primary drivers (PETTO et al., 2020).

Currently, most examples of the sternalis muscle (SM) have been reported from cadaver studies, allowing for function to be inferred but not conclusively confirmed (PETTO et al., 2020).

The motor function of the sternalis muscle (SM) has not been conclusively established (JELEV et al., 2001) and has been a subject of speculation among various authors. Based on the origins and insertions of this musculature, Hung et al. (2012) indicate that this muscle could contribute to the elevation of the lower chest wall, potentially acting as an accessory to inspiration, given its close association with the



costochondral joints that extend to the sternocostal joints, allowing for movements in rib elevation. Conversely, Zaher et al. (2009) suggest a proprioceptive function of this musculature to detect movements of the anterior chest wall.

Regarding the clinical significance of the sternalis muscle (SM), recent publications commonly discuss its relevance in the context of investigative procedures (e.g., mammography, magnetic resonance imaging, electrocardiogram) and/or surgical interventions (e.g., mastectomy) of the anterior chest wall. Most clinically-oriented articles emphasize the importance and the necessity of heightened awareness regarding the presence of the SM in the anterior chest wall (RAHMAN et al., 2009).

Mehta et al. (2010) discuss that the sternalis muscle (SM) can cause alterations in the electrocardiogram (ECG), and in certain exams, such as routine mammography, the superficial location of the SM might be mistaken for a suspected breast neoplasm during initial investigation or as a recurrence of cancer during post-treatment examinations (GOKTAN et al., 2006). This confusion can be clarified through computed tomography and magnetic resonance imaging. Additionally, in radiotherapy, the depth at which mammary nodules are irradiated may also vary in the presence of the SM (RAIKOS et al., 2011).

Furthermore, studies indicate that once identified, the sternalis muscle (SM) can be a viable grafting option for reconstructive plastic surgeries, such as autografts in breast reconstruction (KHAN, 2008; MEHTA et al., 2010), as well as grafts for the face, head, and neck (IBRAHIM et al., 2012; JELEV et al., 2001; RAIKOS et al., 2011).

In mastectomies, understanding this muscle is crucial for surgeons to identify it early on, aiding in the decision-making process regarding an appropriate dissection plan. Therefore, the extension of breast tissue deep to the muscle should not be neglected during surgery (RAIKOS et al., 2011).

4 FINAL CONSIDERATIONS

This study discussed the anatomy and clinical aspects of the sternalis muscle (SM), highlighting the importance of its identification in medical practice. Unfortunately, many medical professionals are unaware that this musculature can have significant implications in both imaging and thoracic surgery.

The sternalis muscle (SM) is a relatively uncommon anatomical variant in the chest wall, with an estimated frequency of occurrence in about 8% of the global population. It can be found in both men and women, and it may present unilaterally or bilaterally.

Its location demands caution from medical professionals since this muscle can be confused for malignant neoplasms in mammography or even cause changes in electrocardiograms. It might also be mistaken for a tumor during initial investigations or be considered a cancer recurrence during post-treatment examinations.



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