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ANATOMIC VARIATIONS

Describing the sternalis muscle: a new variant and an amended classification

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Abstract

Purpose With emphasis on the clinical setting, knowledge of anatomical variation decreases misdiagnoses and surgical complications. We report a previously undocumented variant of sternalis muscle and recommend an augmented classification scheme.

Methods Dissection of the anterior thoracic wall on an 83-year-old female cadaver revealed bilateral sternalis muscles. The Snosek et al. classification system was referenced to describe the variant types.

Results The right sternalis muscle has a single belly and can be classified using the Snosek et al. classification system as a simple type, right single. The left sternalis muscle presented with three muscle bellies, each having a unique pattern of superior attachments (heads). This variation is previously undocumented and requires a more detailed classification.

Conclusions We propose the addition of a new subtype of sternalis classification, as well as a modification to the Snosek et al. (Clin Anat 27:866–884, 2014) classification scheme, to include classification of different muscle bellies when multiple are present.

Keywords Sternalis muscle · Anterior thorax · Anatomic variation · Classification

Introduction

Sternalis muscle is a rare variation of the anterior thoracic wall located deep into the hypodermal layer and superficial to the pectoral fascia [5, 6]. The superior attachment is typically the sternum and/or the medial infraclavicular region, with inferior attachments onto the external oblique muscle aponeurosis, rectus sheath, costal cartilages, or lower ribs [5]. Innervation of the sternalis muscle is described as branches of the anterior thoracic nerves and/or intercostal nerves with need for further research and documentation [5, 8]. Based on location and attachments, this muscle variant may have an accessory role in magnifying the actions of pectoralis major muscle and/or elevating the lower chest wall [8]. There are no physical signs or symptoms associated with the presence of sternalis muscle [8]. Although rare, this muscle is well documented; reported frequencies of incidence for the sternalis muscle range from 1 to 23.5%, depending on the population, sample size, and criteria used for analysis [4, 5, 9].

Sternalis muscle was first described by Cabrolius in 1604 and has been identified by various names [8, 10]. The presentation of sternalis muscle is variable, and classification of these variants was initiated by Jelev et al. [5] who proposed type I and type II categories. This classification system was expanded by Ge et al. [4] to include a type III category, and application of classification to each muscle separately versus bilaterally. Snosek et al. [9] further developed a system of organization for sternalis variants by introducing 3 types (simple, mixed, other) and 15 subtypes.

Awareness of sternalis muscle and its variations is clinically relevant, as its unknown presence may lead to misdiagnosis on a mammogram, or prolong surgery on the anterior chest wall. If the presence of this muscle is predetermined through imaging, it may also be used as a flap in reconstructive or plastic surgery of the head and neck [2, 7, 8].

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Materials and methods

Anterior thoracic wall dissection on an 83-year-old Caucasian female cadaver exposed the bilateral sternalis muscles. The Snosek et al. [9] classification system was used to describe the variant types.

Results

Classified using the Snosek et al. [9] system, the right sternalis muscle presented as a simple type, right single. This muscle has a single belly and is fusiform in shape. The superior attachment is on the right lateral aspect of the manubrium of the sternum, and it attaches inferiorly into the rectus sheath.

The left sternalis muscle has three separate bellies joined by a common (intermediate) tendon, each belly with different superior attachments. The superior muscle belly has three converging superior attachments (heads). The medial head of the superior belly attaches to the superior portion of the body of the sternum, the middle head attaches to the inferior manubrium and vicinity of sternal angle, and the lateral head of the superior belly blends with the inferior tendon of the sternocleidomastoid muscle. The inferior attachment of the superior muscle belly diverges and becomes enmeshed with the intermediate tendon. The medial muscle belly is fusiform in shape and has a single superior attachment (from the intermediate tendon) and a single inferior attachment into the rectus sheath. The lateral muscle belly has two heads that converge and a single inferior attachment that intermingles with the superior portion of the external oblique aponeurosis. The medial head of the lateral muscle belly attaches to the intermediate tendon, and the lateral head interweaves with the pectoral fascia at the left lateral border of the manubrium (Figs. 1, 2). This particular variant of sternalis muscle is previously undocumented in the literature and cannot be classified using the current system created by Snosek et al. [9].

Fig. 1 Photograph of bilateral sternalis muscle with simple type-right single, and mixed type-left triple: superior, tricipital converging and bicipital diverging; lateral, bicipital converging; medial, single

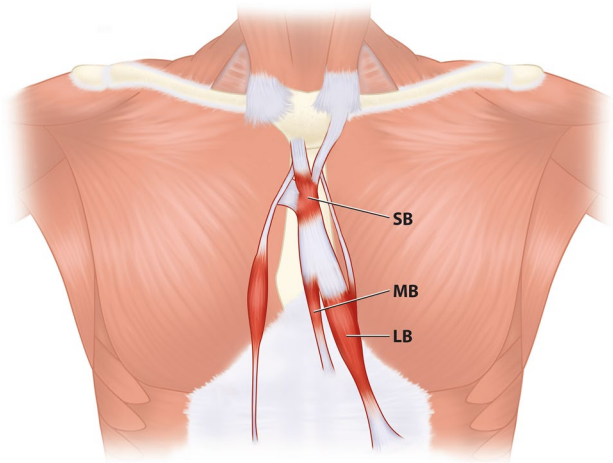

Fig. 2 Illustration of bilateral sternalis muscle with simple type-right single, and mixed type-left triple, with superior muscle belly tricipital converging and bicipital diverging, lateral muscle belly bicipital converging, and medial muscle belly single. *SB* superior belly, *LB* lateral belly, *MB* medial belly

Discussion

The Snosek et al. [9] classification scheme fails to account for variation among individual bellies of the sternalis muscle. We recommend modifications to the Snosek et al. [9] classification system to include categorization of individual muscle bellies. Expanding the taxonomy to account for muscle bellies allows the classification of the muscle to be maximally descriptive. A number of recent case studies reporting novel variations of this muscle demonstrate the need to re-assess the current methods of categorizing variants of the sternalis muscle [3, 8, 9, 11]. Using the proposed amendment to the Snosek et al. [9] classification, this newly reported variant is left triple: superior, tricipital converging and bicipital diverging; lateral, bicipital converging; medial, single.

Familiarity of the sternalis muscle and its variations is clinically important and can be promoted by documentation and additions to current classifications as unique variations are identified. The appearance of this muscle may mimic lesions of the anterior thoracic wall, such as breast carcinoma on a mammogram, possibly leading to misdiagnosis and an unnecessary biopsy [1, 2, 8]. This muscle's undetermined presence can also lead to complications during surgery and even prolong time in the operating room.

Improved classification of sternalis allows clinicians more precise means to chart the presence and uses of sternalis muscle bellies. Avoiding unnecessary differential diagnostic procedures and surgical complications will protect patients from preventable pain and anxiety that often accompany a biopsy or prolonged surgery.

Magnetic resonance imaging or a computed tomography scan is useful for determining the presence of a sternalis muscle [8]. The superficial position of sternalis muscle makes it ideal for use as a muscular flap for breast reconstruction following a mastectomy or in the head and neck for plastic and reconstructive surgery.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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