

Sternalis muscle: a mystery still

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Despite intensive anatomical research during the last century, anatomical structures or variations of these structures may still cause confusion or even iatrogenic injury. A matter of debate is the sternalis muscle. We present a review of the literature of the sternalis muscle with special emphasis on its clinical anatomy.

Key words: sternalis muscle

For such a seemingly insignificant member of the human musculature, the sternalis muscle has provided a wealth of uncertainty and debate. From its first mention by Cabrolus in 1604 (reported by Turner) [19], the sternalis has undergone examination after examination with regard to such vital considerations as its origin, nerve supply, function, ethnic prevalence, and clinical significance. It has been called by various authors *musculus sternalis*, *presternalis*, *rectus sternalis*, *sternalis brutorum*, or *thoracicus* [19].

Following its initial discovery, formal descriptions of the sternalis did not begin until 1726, when Du Puy [20] encountered a bilateral example. Shortly thereafter Boerhaave (reported by Turner) [19] gave an in-depth description of two specimens that he had encountered. Analyses and observations have been made to the present day, giving quite a thorough account of the vast variation that can occur in the morphology of this muscle. Current imaging techniques have also entered the sternalis arena, largely due to the implications for issues of mammography [5, 13].

The literature of the subject provides constantly varying assessments of the morphological presentation of this muscle, especially in its tendency to present bilaterally or unilaterally, casting even greater uncertainty over its importance in the present day workings of the human machine as a whole. Accordingly, many sources claim it to be a phylogenetic remnant carried over from primates [3, 7, 9, 13, 19],

although Kida et al. [10] maintain that this argument is no longer valid. Nevertheless, the classification of this not uncommon muscular variant is essential to complete the current annals of anatomical knowledge.

This muscle is reported as having variable prevalence in society as a whole, and is found anywhere within the range of 3% to 6%, regardless of sex [3, 6, 15, 17, 19, 20]. A much lower percentage was observed in our group, with 3 sternalis muscles out of 300 cadavers [1%] (personal observations), unpublished data. However, when the figures are scrutinised, ethnic differences become obvious, the least prevalence being among races of European descent (4.4%), with an increasing incidence amongst people of African descent (8.4%), and the greatest prevalence in Asian populations (11.5%) [3].

It has been established with certainty that the sternalis presents in a unilateral or bilateral fashion [1, 8, 14]. This however, is the most easily understood and accepted area of variability concerning this muscle. Studies by Bailey and Tzarnas [2] and Barlow [3] indicate that they both agree that the prevalence of the unilateral form is twice as common as the bilateral form, but many other researchers have discovered equal ratios between the two morphologies [4, 6].

The sternalis has also been identified in a number of anatomical positions and descriptions. Turner [19] described the sternalis as a flat, ribbon-shaped

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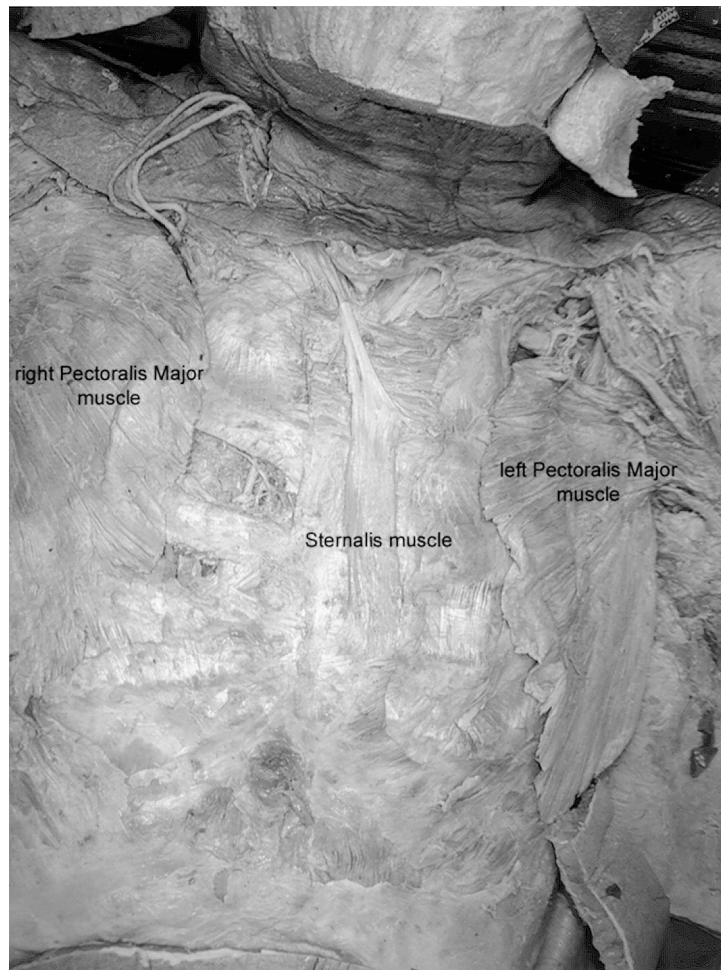


Figure 1. A typical unilateral sternalis muscle situated in the left side of the thorax. The pectoralis major muscle is removed from its origin (sternal and clavicular parts) and is retracted laterally.

muscle that varied in thickness, length, and width, and noted its parallel course along the sternum. Shah [17] discovered during his research that the sternalis resembled a flat band of longitudinal fibres that lies close to the sternum and in front of the pectoralis major, in line with the rectus abdominis and the sternocleidomastoid. Bradley et al. [5] noted that the muscle had an “irregular flame shape” along its parasternal and longitudinal course. The range of dimensions of the muscle is as follows: the greatest length discovered was 14.4 cm, the shortest 2 cm; the maximum width 2.6 cm and the minimum width 0.25 cm [5, 9, 19, 20].

Jelev et al. [9] have provided an exceptional summing-up of some of the defining characteristics of the sternalis. Among these are the necessity of its being found between the anterior thoracic superficial fascia and the pectoral fascia, originating from the sternum or infraclavicular area and having inser-

tions into the rectus sheath, costal cartilage, lower ribs, or external oblique aponeurosis. This assessment encompasses findings in the majority of published works currently available concerning the sternalis, and again testifies to the seeming lack of direction in providing any sort of meaningful, consistent function for it in humankind at large.

The issue of innervation of the sternalis is also under debate. It is often stated as being either from the pectoral nerves, as described by Harish and Gopinath [7] and Morita [12], or the intercostal nerves in the region. Yap [20], Barlow [3], Shah [17], Jelev et al. [9] and Shen et al. [18] all claimed that the intercostal nerves provided sternalis innervation. Yap [20] and Jelev [9] go further and state that it is the anterior thoracic branches of the intercostals that provide innervation.

These discrepancies have sparked debate concerning the possible muscular origins of the sternalis, namely from the pectoralis major (if supplied by

the pectoral nerves) or the rectus abdominis (if supplied by intercostal nerves). The studies by Morita [12] and Kida et al. [10] sided with the pectoral origin of the sternalis, as Morita [12] (using a large number of cadavers) never found intercostal innervation. Nevertheless, it is possible that fewer instances of intercostal innervation were observed by Morita [12] as a result of the frail nature of the supplying branches to the sternalis from those nerves, causing them to be overlooked.

Again, not to overstate its seeming unimportance as a functional muscle, the only claimed clinical significance of the sternalis is its potential to cause misdiagnoses of breast tumours in routine mammograms. For instance, in a report by Bradley et al. [5], 4 women out of approximately 32,000 who had undergone mammograms had an irregular structure visible on imaging studies (this being the sternalis), leading clinicians to a dilemma in making a diagnosis. It seems the culmination of all current knowledge of the potential presence of the sternalis in a mammogram patient is to enable the clinician who suspects a tumour of the breast to have the wherewithal to eliminate such a possibility from the differential diagnosis by subsequently performing a CT scan or MRI [3]. The utilisation of CT or MRI allows easy identification of a muscle in the area, whereas routine mammography may show an unusual bulge in the median breast (the sternalis), which, if seen, could be mistaken either for a tumour on initial investigation or as a recurrence of cancer during post-treatment checkups [5].

Furthermore, a recent study by Kumar et al. [11] is described in the literature, in which the bilateral presence of the sternalis muscle was accompanied by an absence of the sternal head of the pectoralis major. This could indicate the potential partial replacement of the pectoralis major by the sternalis muscle. This kind of rare variation is very likely to be missed by surgeons and radiologists and diagnosed as a tumour.

With such blatantly unusual and variable presentation and weak clinical significance, it appears that sternalis will remain shrouded in mystery by virtue of its very nature. Strangely, a large proportion (48%) of anencephalic fetuses examined by Eisler (noted by Schaeffer) [16] presented with the sternalis muscle. This would seem to indicate either a neurological or embryological answer to the problem of the sternalis. However, the prevalence of sternalis in normal human fetuses was not reported as being so prevalent (Eisler, noted by Schaeffer) [16], al-

though anatomical variations in patients diagnosed with neurological disorders are not unheard of. Alas, sternalis may be nothing more than misplaced developed muscle tissue, arising from variable sources in a localised region of the anterior thorax, and serving no apparent function but to befuddle diagnosticians.

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