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## Bilateral Sternalis Muscle: Clinical Significance Of This Rare Anatomical Variant.

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### ABSTRACT

Sternalis muscle is a rare variation of anterior thoracic wall and its incidence ranges from 2% to 8%, but its prevalence depends on sex, regions and populations. It may be found unilaterally or bilaterally. Sternalis is clinically important because it may be mistaken as a benign or malignant growth on anterior chest wall. Also, presence of this muscle may influence the interpretation of mammograms, CT, MRI and electrocardiograms. It can surprise surgeon during anterior wall thoracic surgery and may create confusion during surgery. It can be used as a flap in reconstruction surgery. Therefore, awareness of this variation is essential. Presence of sternalis may confuse surgeon during anterior wall surgery as well as radiologist while interpreting images. This report highlights the anatomical characteristics and clinical importance of this variant of bilateral Sternalis muscle. Precise knowledge of this muscle is essential in clinical practice.

**Key words:** Sternalis, anterior chest wall, manubrium, external oblique muscle, intercostal nerves

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## INTRODUCTION

Sternalis muscle (SM) is an uncommon variation of anterior thoracic wall. The incidence of SM has been evaluated by many anatomists and it ranges from 2% to 8%, but its prevalence depends on sex, regions and populations [1]. Various nomenclatures are used for SM in literature such as 'episternalis', 'presternalis', 'sternalis brutorum', 'rectus thoracis', 'rectus sterni', 'superficial rectus abdominis' [2]. Its presence ranges from a few short fibres to a well-formed muscle. It may found unilaterally (in 4.5%) or bilaterally (in 1.7%) [3]. Usually this muscle is discovered during the cadaveric dissection, anterior thoracic wall surgery or diagnostic imaging such as mammography<sup>3</sup>. In 1607 Cabrolus described SM initially and afterwards by Du Puy in 1726. Roubinowitch described SM in live subjects in 1888 [3, 4].

Origin of SM is still unclear because of different opinion by various researchers. According to some researchers it originates from the adjacent muscles such as the pectoralis major, the sternocleidomastoid and the rectus abdominis muscles [5, 6]. Other researchers hypothesize another theory after studying comparative animal study that it may be same as panniculus carnosus which is present in lower vertebrates as a ventral thoracic wall muscle [5, 7]. In spite of lot of recent research, there is controversy about the exact origin and developmental sequence of SM. The nerve supply of sternalis muscle is variable. It may be innervated by intercostal nerves or pectoral nerves. From its nerve supply different theories are assumed by researchers about its embryological origin. Variability of SM nerve supply indicates that it is not constantly derived from same source [8].

S M is clinically important for us because it may be mistaken as a benign or malignant growth on anterior chest wall [7]. Also, presence of this muscle may influence the interpretation of mammograms, CT, MRI and its presence alters the electrocardiograms (ECGs) [9, 10, 11]. SM can surprise surgeon during the thoracic surgery and may create dilemma during surgery [7]. Additionally, SM can be used as a flap in the reconstruction surgery of the breast, the head and neck, and the anterior chest wall [5]. Here, we describe a bilateral sternalis muscle which was proximally in continuation with sternocleidomastoid muscle and distally merging with the aponeurosis of external oblique muscle.

## Case report

A bilateral well defined muscle was detected during dissection of phase I MBBS students in a male cadaver of age sixty four years. Gross anatomical features were meticulously noted, photographed and measurements were recorded with digital Vernier calliper.

A single tendon originated from the anterior surface of manubrium which was in continuation with sternal tendons of sternocleidomastoids (Fig. 1). Single tendon bifurcated at level of 2<sup>nd</sup> costal cartilage into two separate tendinous bellies which run downwards and laterally (Fig. 2). Approximately at the level of 3<sup>rd</sup> costal cartilage these bellies became fleshy and attaching with the aponeurosis of external oblique muscle. Right SM was longer than left and had a length of 15.6 cm while the smaller left SM was 13.9 cm in length. Both sternalis muscles were innervated by intercostal nerves. We did not observe any other anatomical variation or abnormality in the pectoral region and the anterior thoracic wall appeared normal.

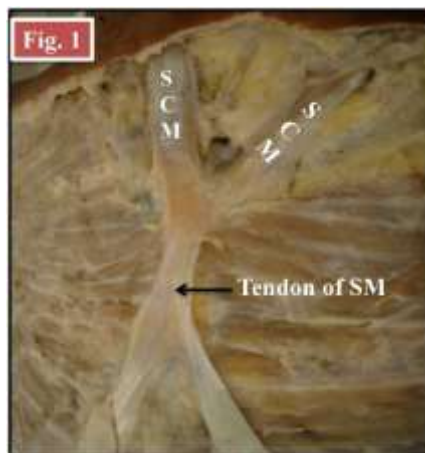
## DISCUSSION

While going through the literature, we observed that existence of SM show a great variation in its incidence. One of the important reasons for this variation may be its existence in the form of small, ill-defined muscle fibers or tendinous fibers which may or may not be accepted for a SM.

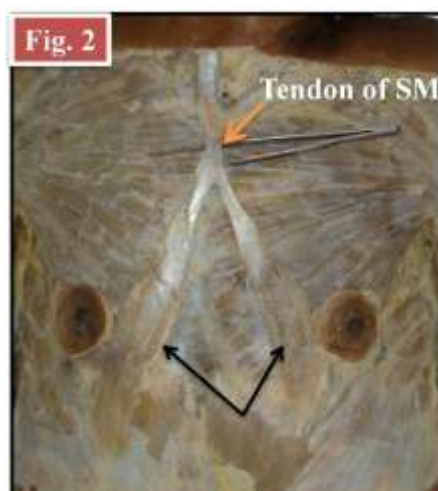
To overcome this problem, some important characteristics features of SM are described by Jelev et al. and these characteristics, features (irrespective of length and thickness) should be considered before considering it as SM. These characteristics features are: a. its location between the superficial fascia of anterior thoracic region and the pectoral fascia; b. origin from sternum or infra-clavicular region; c. insertion onto the lower ribs, costal cartilages, aponeurosis of external oblique abdominis muscle or the rectus sheath; d. innervation by pectoral and or intercostals nerves [2]. They classified it into two main groups- Type I:

Unilateral sternalis which was subdivided into other 4 types and Type II- Bilateral Sternalis which was subdivided into other 4 types.

**Figure 1: Showing the tendon of Sternalis Muscle (SM) in continuation with sternal head of right and left sternocleidomastoid (SCM) muscles.**



**Figure 2: Showing fleshy bellies of Sternalis Muscle (SM -black arrows) attaching with the aponeurosis of external oblique muscle.**



We came across two most recent classifications of SM. Ge et al. proposed classification of SM in 2014 and they categorized SM into 3 types: Type I- SM is single-banded, Type II is multi-headed and Type III is multi-banded<sup>1</sup>. Snosek et al. classified SM into three types: “simple type”, “mixed type” and “other” with 15 subtypes [3]. The SM which we observed in present case didn’t fit accurately into any of the above types described by various authors.

In 2012, Single and Sachdeva observed bilateral sternalis muscle which was extending from sixth costal cartilage to anterior surface of manubrium and superiorly it was giving six slips on left side and on right side five slips. SM was supplied by intercostal nerves in this case report [11]. Bhagat M et al. found bilateral branched sternalis muscle. Each muscle has two slips medial and lateral [12]. Borthakur et al. identified two cases of SM. They observed a long flat bi-tendinous muscle on right side in male cadaver and in female cadaver right sided SM with tripartite configuration [13].

Sternalis muscle is also demonstrated in live patient and its presentation may be symptomatic or asymptomatic. In 2016, Gruber et al. observed an interesting case of clinically symptomatic sternalis muscle in a female patient [14]. Victoria et al. observed symmetrical, well-defined soft tissue masses over the postero-medial aspect of both breasts in 23-year-old patient who came for painless bilateral breast enlargement since adolescence after mammography [15].

It is said that SM is frequently present with other coexisting anomalies. Shekhawat et al. observed bilateral SM with the absence of unilateral sternocostal part of the pectoralis major and variation of pectoralis minor muscles [16]. Boadum and Lu in 2024 noted asymmetrical bilateral extensor carpi radialis intermedius muscle along with bilateral SM [17].

## CONCLUSION

Sternanalis muscle is an occasional muscle of anterior chest wall which has tendency to present bilaterally or unilaterally. It shows a wide variation in its morphology. Therefore, clinicians and radiologists may not be aware about this muscle. Presence of this muscle may confuse surgeon during anterior wall surgery as well as radiologist while interpreting images. Precise knowledge of this muscle is essential in clinical practice.

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