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Original Research Article

Sternalis Muscle Profile: A Cadaveric Study

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ABSTRACT

Background: Sternalis muscle is an additional muscle of anterior chest wall present in the superficial plane occasionally. It can be unilateral or bilateral. It is attached below to ribs or costal cartilages and above to the upper part of sternum. Its fibres may fuse with pectoralis major, sternocleidomastoid muscle or external oblique aponeurosis.

Purpose of study: To study the profile of sternalis muscle in cadavers.

Material and methods: During a time period of ten years, 50 adult cadavers were dissected in the dissection hall of Anatomy department of Maharaja Agrasen Medical College, Agroha. During the dissection of anterior chest wall a bilateral strap like muscle was found in one male cadaver. Morphometry of this muscle was done. The nature of muscle fibres, length, distance from the midline and angle with the midline was measured.

Results: Bilateral sternalis muscle was found in one male cadaver. It was extending from the fifth rib 3 cm lateral to the lateral border of sternum to the sternal angle on both the sides. Lower part of the muscle was fleshy while its upper part was tendinous. On the right side, its tendon was bifurcating into medial and lateral lamina in the upper part of the muscle. The fleshy part of the muscle was 8 cm, medial lamina 4.5 cm and lateral lamina was 3 cm in length. On the left side, muscle was 13 cm in length with a single tendon.

Conclusion: The early detection is essential in regular mammogram screening to differentiate it from the malignant lesions. This muscle is a matter of interest for anatomists, radiologists and surgeons for doing surgeries on anterior chest wall.

KEYWORDS: Mammography, lamina, Pectoralis major muscle, Sternalis muscle, Sternocleidomastoid muscle, Sternum.

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INTRODUCTION

Sternalis muscle on the anterior chest wall is occasionally detected in humans. Its appearance is in the form of superficial strip of muscle, which is sternal or parasternal in position [1]. It is also known as episternalis, pre-sternalis, rectus thoracic or rectus sterni [2]. According to Turner, it was first identified by cabrolius in 1604 as a longitudinal band like muscle but its proper description was first made by Du Puy in 1726 [3].

Variation in its incidence has been reported in different ethnic groups. Incidence of this muscle varies as low as 1% in Taiwenese to 11% in Asian population [4]. It is found slightly more in females than males [5].

Sternalis muscle has variable attachments. According to some authors, it may attach proximally to sternum or clavicular region and distally attached to rectus sheath, costal cartilages or lower ribs [3, 6].

It may have additional attachments to neighbouring muscles such as pectoralis major muscle, rectus abdominis muscle, sternocleidomastoid muscle and external oblique muscle of abdomen [3, 7].

Since this muscle is present superficially on the anterior chest wall in relation to the breast its identification when present, is important during mammography and surgery for the breast [8]. Therefore the present study was undertaken to study the profile of sternalis muscle in cadavers.

MATERIALS AND METHODS

During a time period of ten years, 50 adult cadavers (40 males and 10 females) embalmed in 10% formalin were dissected in the dissection hall of Anatomy department of Maharaja Agrasen Medical College, Agroha. Pectoral region was dissected following the dissection steps given in Cunningham's manual [9].

After the removal of subcutaneous tissue, the region was cleaned with the help of blunt forceps. The region was looked for presence of sternalis muscle or any other additional muscle. The region was further dissected to find out the nerve supply of muscle and whether muscle fibres were merging with any other muscle. Length of the muscle was measured with the help of vernier caliper (minimum count 01 mm). The angle of sternalis with midline was measured with Goniometer (minimum count 1°).

Aim and objectives

Aim: To study the profile of sternalis muscle in Cadavers.

Objectives:

· To study the attachment of sternalis muscle.

· To study the morphometry of sternalis muscle.

OBSERVATIONS

A bilateral strap like muscle was found in one male cadaver superficially. The right sided muscle was having two laminae while left sided muscle was having single lamina [Fig 1]

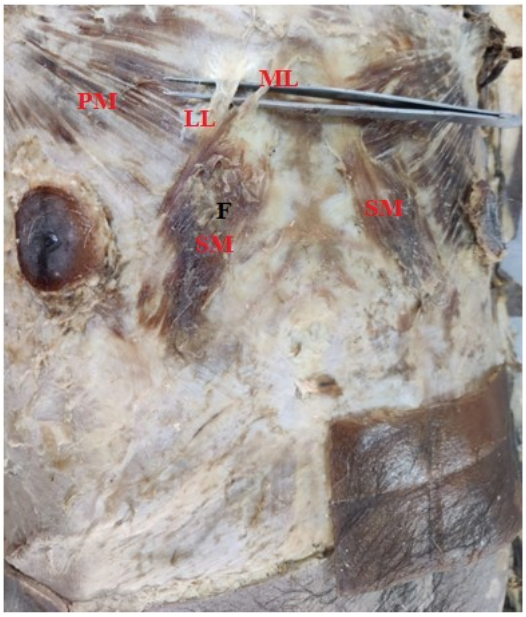

Fig. 1: Bilateral sternalis muscle(SM), Showing distal fleshy end(F), Right side two laminae; LL –lateral lamina and ML- medial lamina, PM- pectoralis major muscle.

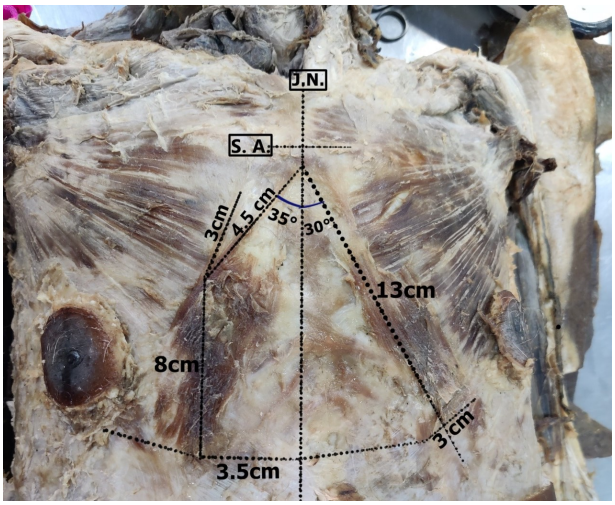

Fig. 2: Showing measurements of sternalis muscle on both sides. 3.5 cm lateral to midline, 3cm wide bilaterally. JN- jugular notch, SA- sternal angle, Right side: fleshy part-8 cm, ML-4.5 cm, LL- 3 cm, angle with the midline-35°Left side: total length -13 cm, angle with the midline 30^0

Bilaterally, the muscle was present obliquely extending from fifth rib medial to and below the nipples to the sternal angle. The converging proximal ends were attached at the sternal angle and were converging while distal ends were attached to fifth rib 3.5 cm lateral to the median plane. Maximum width at the distal end was 3 cm. Muscle bellies were neither fused with pectoralis major muscle nor with sternocleidomastoid muscle [Fig 2]. Muscles were not found to be supplied by any

Table 1: Morphometric profile of sternalis muscle.

Features	Right side	Left side
Extent	Fifth rib to sternal angle	Fifth rib to sternal angle
Distal end	Fleshy and 3 cm wide	Fleshy and 3 cm wide
Proximal end	Tendinous with two laminae	Tendinous with single lamina
Angle of muscle with vertical plane	35˚	30˚
Length of muscle	8 cm from lower end till bifurcation of tendons. Lateral lamina- 3 cm Medial lamina- 4.5 cm	13 cm

nerve supplying pectoralis major muscle, therefore it was speculated that it may be getting its nerve supply from neighboring intercostal nerves.

On right side: Muscle was bifurcating into medial and lateral tendinous laminae after 8 cm from the distal fleshy end. The length of medial lamina was 4.5 cm which was attached to sternal angle whereas the lateral lamina was 3 cm long while was reaching to the medial end of second intercostal space merging with the deep fascia covering pectoralis major muscle. Medial border of the muscle with its medial lamina was making an angle of 35^{0} with the midline [Fig 2 and Table 1].

On left side: Distal end was fleshy while its fibres at proximal ends were tendinous. Its length was 13 cm from the fifth rib to the sternal angle. Medial border of the muscle near the sternal angle was making angle of 30^{0} with the midline passing through centre of sternum [Fig 2 and Table 1].

DISCUSSION

Sternalis muscle is an additional muscle present on the anterior chest wall occasionally. It may be unilateral or bilateral. In the present study, the muscle was bilateral. [1, 2, 6, 8, 10]. It has been mentioned in the Gray's anatomy that this muscle is a superficial vertical strip of skeletal muscle with arrangement of fibers in form of thin vertical strip or in the oblique manner [4, 5]. In the present study, the muscle was present obliquely. L.Jelev et al described the characteristic features of this muscle and classified it on the basis of its morphology of the muscle bellies. For a muscle to be accepted as sternalis, it should be unilateral or bilateral muscle and it should have following characteristics irrespective of length and thickness:

1. Location between the superficial fascia of the anterior thoracic region and pectoral fascia
2. Origin from sternum or infraclavicular region
3. Insertion onto the lower ribs, costal cartilages, aponeurosis of the external oblique abdominis muscle or sheath of rectus abdominis muscle
4. Innervation by anterior thoracic or intercostal nerves.

They classified sternalis into type I (unilateral) and type II (bilateral). Each type was further classified into 1 to 4. The present case, falls under type II 2 as it is present bilaterally and on the right side in the middle, tendon of sternalis was dividing into two lamiae which made it asymmetrical [11].

Devepomentally, Sternalis is a part of a ventral, longitudinal column of muscles which arise at the ventral tips of hypomere. This muscle is represented by the rectus abdominis muscle in the abdominal region and by infrahyoid muscle in the cervical region. In the thoracic region, this layer usually disappears but occasionally remains as sternalis muscle [12]. It could be the separated fibres of pectoralis major muscle, as indicated by its nerve supply from twigs of pectoral nerves. Depending on its development it may get its nerve supply from lateral or medial pectoral nerves. During the dissection, attempts were made to find out the innervation of this muscle. It was found that it was not supplied by nerve supplying pectoralis major and pectoralis minor muscles. An assumption was made that it would have been supplied by anterior cutaneous branch of the neighboring intercostal nerves. It has been suggested that the sternalis could be an upward prolongation of the rectus abdominis or a downward

extension of the sternocleidomastoid [3, 7]. In this case, the sternalis muscle appeared to be continuation of the rectus abdominis muscle.

During routine mammography it can give rise to diagnostic dilemma with breast cancer. So it must be excluded radiologically. Existence of this muscle is important for surgeons also as during surgery of the anterior chest wall, particularly mastectomy where it is encountered in the dissection plane [8, 13]. It can also be used as a flap in reconstruction surgery of head and neck, anterior chest wall and breast [8,14].

For the above reasons, knowledge and identification of sternalis muscle is important for radiologists, surgeons and anatomists.

Author Contributions

Parul K: Dissection, Capture of images, Reviewed the literature, Design of manuscript
Dalb ir Kaur: Dissection , Drafting the manuscript and design of manuscript
Lovesh Shukla: Manuscript design and drafting, critical analysis
Abhey Chawla: Manuscript design and drafting.

Conflicts of Interests: None

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