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Original Article

Anatomy Section

The Bilateral Sternalis: An Uncommon Anatomical Variant

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ABSTRACT

In the present era of the medical practice, an increased alertness for a thorough knowledge of the anatomical variants with a clinical significance has been recorded, in order to minimize the risks of misdiagnosis and the surgical complications thereof. We are reporting a series of 50 cadaveric dissections of the pectoral region with a 2% incidence of the sternalis muscle. The existence of the sternalis muscle and its location, orientation and early identification are necessary in breast surgeries. So also in the imaging of the chest wall by CT and MRI and the mammographic evaluation of breast lesions.

Key Words: Sternalis, Pectoralis major, Cadaver

INTRODUCTION

The sternalis muscle is an uncommon anatomical variant. It is located on the human anterior pectoral wall, superficial to the pectoralis major [1]. This muscle has been described in both sexes, with an equal incidence. However, it has a variable frequency in different ethnic groups [2].

Although the importance of this muscle is still a mystery, various different interpretations have been made.

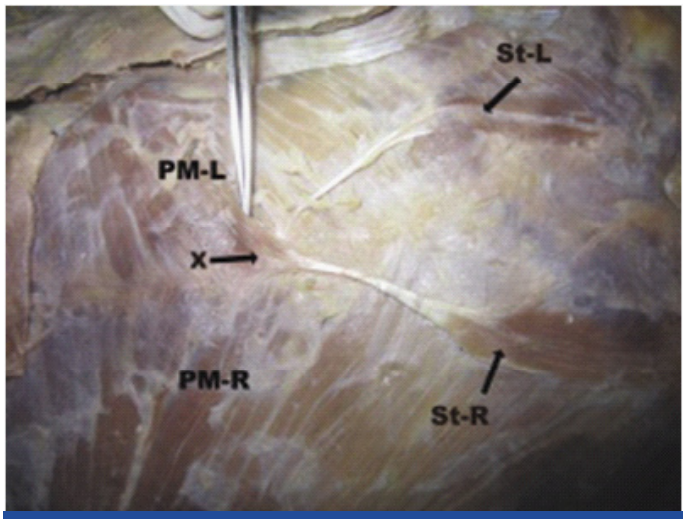
Clemente (1985) considered the sternalis to be a misplaced pectoralis major [3]. Some embryologists have viewed it as a part of a ventral lip of the hypomere (Sadler, 1995). Sadler claimed that this muscle was represented by the rectus abdominis in the abdominal region. In the thorax, this layer usually disappears but it occasionally remains as a sternalis muscle [4]. Ruge considered the sternalis muscle to represent a vestige of the cuticular muscle of the mammal that constitutes the great subcutaneous muscle of the trunk. It is also present in man in the form of the axillary arch [5]. Barlow claimed that the sternalis muscle represented the remains of the panniculus carnosus [6].

Although it is an uncommonly described muscular variation, it merits a special mention in the anatomical archives, owing to its propensity in simulating a soft tissue mass on the radiological evaluation of the pectoral region [7].

MATERIALS AND METHODS

A detailed cadaveric study of the pectoral region was carried out on 50 formalin fixed, adult cadavers for the medical students in the Department of Anatomy of JNMC Sawangi (Meghe), Wardha, Maharashtra, India, over a period of 3 years.

The pectoral regions were carefully dissected to demonstrate the anatomy of the pectoral skin, superficial fascia and the intercostal nerves and their anterior cutaneous branches. The sternal region of an adult male cadaver of an Indian origin revealed an unusual supernumerary muscle during the dissection class. The superficial fascia was cleared to visualize the traces of the muscle. We encountered a supernumerary muscle in the subcutaneous plane



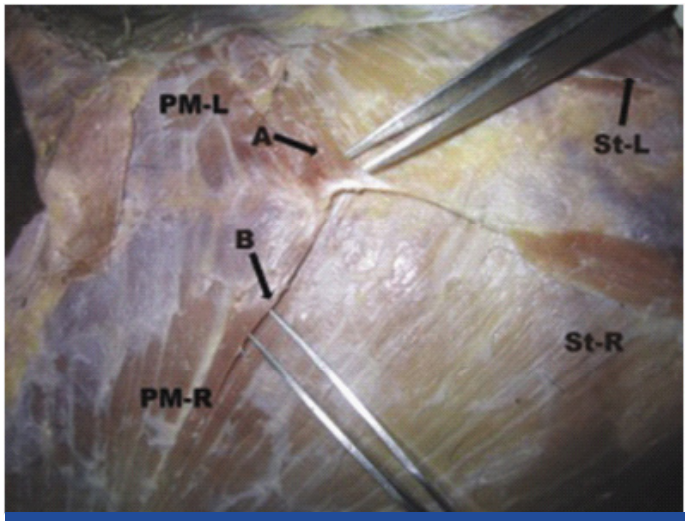
[Table/Fig-1]: St-L – Sternalis (Left), St-R- Sternalis (Right), X – Sternal attachment

on both the sides of the thoracic wall of a male cadaver. This muscle was strap like and it extended from the sternal end of the seventh rib to just below the sternal angle.The inferior attachment of the muscle was to the external oblique aponeurosis. At its origin, the medial margin of the muscle followed the lateral border of the sternum. The superior attachment was to the anterior surface of the sternum, just below the sternal angle. The muscle was wider at its inferior attachment and it tapered towards the sternum [Table/Fig-1].

Just below the sternal angle, the muscle belly became aponeurotic, which was seen to bifurcate into two diverging bands that blended with the pectoralis major muscles of both the sides [Table/Fig-2].

DISCUSSION

Bailey et al, in 1999, surveyed 65 physicians and medical students and documented a near universal lack of familiarity with the sternalis muscle. They further commented that the paucity of clinical encounters appeared to be incongruous with the reported incidence which was derived from cadaver studies [8].



[Table/Fig-2]: PM-L-Pectoralis Major (Left), PM-R- Pectoralis Major (Right)

Of the many interesting anomalies in human subjects, few have been more enigmatical than the sternalis. At various times and by various observers, since the days of Albinus and earlier, it has been regarded as a continuation of the rectus abdominis, it being perhaps the most prevalent view and that which was endorsed by Bardeleben as a part of the sternomastoid and as pertaining to the panniculus carnosus group; a view which the eminent anatomist, Turner has favoured [9].

The anatomical literature is studded with various synonyms for this muscle – the parasternal, rectus sternalis and the para-sternalis [10].

The sternalis is a flat, ribbon shaped muscle that begins from the lower part of the ribs and the rectus sheath and then courses upwards, finally inserting into the upper part of the sternum and the ribs or the sternocleidomastoid muscle [11]. According to Bergman et al, this muscle is present in humans only [12]. The sternalis muscle was first coined by Carbriolus in 1604 and subsequently by Du Puy in 1726. The first report which described it in alive subjects was made by Roubinowitch [13].

Jelev, in 2001, defined the characteristics of the sternalis muscle as follows.

1. Situation between the anterior thoracic superficial fascia and the pectoral fascia.
2. Origin – The sternum or the intraclavicular region.
3. Insertion – the rectus sheath, the costal cartilages, the lower ribs or the external oblique aponeurosis [14].

The present muscle on both the sides fulfilled all above criteria and hence it could be safely called as the “Sternalis Muscle”.

The unilateral sternalis has been reported in 4.5 % of the subjects, while the bilateral manifestation was found in only less than 1.7% subjects [15]. Baily PM (1998) reported an incidence of 2% in Europeans, 6% in Africans and 11 % in Asian descendants [8].An incidence of 4 to 8% has been reported in Indian subjects by Mishra B D and Shah AC [16, 17]. However, the present study reported a lower incidence of 2 % in the cadavers of Indian origin. This finding was consistent with that which was reported by Mehta et al. [18]. Kale S S et al., reported a greater preponderance in females (8.7%) as compared to that in males (6.4%) [19].

A debate has ranged since the 17th century, particularly about the homology and the innervation of the sternalis and there was an extensive review of the literature on this topic. The homology debate from the literature which was reviewed, revealed that the sternalis was classified by various authors under 4 main headings, as being derived (i) from the pectoralis major, (ii) from the rectus abdominis, (iii) from the sternomastoid and (iv) from the panniculus carnosus. An innervation pattern which was reported has narrowed the debate. The sternalis is either the pectoralis major which is derived with innervations from the thoracic or the pectoral nerves and the rectus is derived with innervations from the intercostal nerves. From the literature which was reviewed, it was observed that 55% of the muscles were innervated by the branches of the internal or the external thoracic nerves, that 43% were innervated by the branches of the intercostal nerves and that 2% were innervated both from the intercostal and the thoracic nerves [20].

It is true that the solitary existence of this accessory muscle may not present with clinical repercussions, but yet a notification of its association with several clinical conditions such as anencephaly in 48% of the cases and anomalies of the adrenal gland is unavoidable and hence they warrant documentation [21].

The sternalis is an anatomical variant with no known function. As to its clinical significance, this muscle is variable in mammograms and on C.T. and M.R imaging. It is important for clinicians, especially radiologists, to recognize and be familiar with the sternalis, to avoid confusing it with malignant lesions [22]. Awareness on the sonographic and the CT appearance of this muscle allows its accurate diagnosis and prevents further evaluation and biopsy.

It is necessary to record and discuss the unusual anatomical variants with the use of advanced diagnostic and therapeutic tools, as these variants could present a challenge to the radiologist or the surgeon in establishing a diagnosis.

The present study reported the bilateral sternalis muscle as a rare muscular variant of the anterior chest wall with an uncertain teleology, function and origin. Though it is a well known entity to the anatomists, still many clinicians are unaware of it. This trait must be familiar to the clinicians who intervene in the chest wall region, in order to avoid a diagnostic dilemma or a surgical malpractice such as an unnecessary mastectomy.

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