

A unique presentation: rectus sternalis

Shrestha S,¹ Basnet LM,¹ Shakya S,¹ Ghosh SK¹

¹Department of Human Anatomy, Nepal Medical College, Jorpati, Kathmandu.

Corresponding Author: Sunara Shrestha, Department of Human Anatomy, Nepal Medical College, Jorpati, Kathmandu, E-mail: sunara.shrestha@gmail.com

ABSTRACT

Rectus Sternalis is a rare flat slip of muscle present parasternally in the thoracic wall. During the regular dissection of pectoral region, three slips of Sternalis muscle were observed bilaterally in an adult male cadaver. On the right side there was a single slip (RS1) while on the left side two slips (RS2 and RS3) were present. All three slips were present anterior to the Pectoralis Major muscle of respective side and each muscle had fleshy origin and tendinous insertions. RS1 had two heads arising from the aponeurosis of External Oblique and Rectus Abdominis. RS2 had a single origin from aponeurosis of Rectus Abdominis and RS3 took its origin from the aponeurosis of Pectoralis Major muscle. Indistinct tendinous intersections were noted in both RS1 and RS3 slips proximal to fusion of both Sternalis muscle (RS1 and RS3) with each other. Out of three slips, right Rectus Sternalis was largest with breadth 3.8cm near its origin while the second slip of Rectus Sternalis on the left was longest with length of 12.5cm. RS2 was smallest and shortest among the three slips. The RS1 even presented a flattened tendon running upwards which fused with the membranous origin of right Sternocleidomastoid muscle.

The Rectus Sternalis when present arises from hypomeres as longitudinal group of muscles which usually disappears in the thoracic region. The knowledge about Sternalis muscle and its variations is important for anatomists and clinicians (radiologists and surgeons) to avoid any confusion and misdiagnosis as well as anthropologists.

Keywords: Rectus Sternalis, Pectoralis Major, Tendinous intersection, Variation.

INTRODUCTION

Rectus Sternalis is a slip of muscle occasionally present vertically on the outer surface of sternum. It is a derivative of hypomeres as flat ribbon shaped muscle lying anterior to Pectoralis Major.¹ It may be of single or multiple slips usually originating from either lower costal cartilages or aponeurosis of external oblique, sheath of Rectus abdominis or fascia of Pectoralis Major. It's typical description suggests that it blends with sternocleidomastoid or attaches to the upper sternum or costal cartilages.² It was first observed by Cabrolus in 1604 (*Anatomes elenchus accuratissimus*), while Du Puy gave the full description of its bilateral form in 1726 (*Histoire de l'Acad. Royale des Sciences*) and was named **Thoracicus** by Sandifort (*Exercitationes Academicae-1783*) on description of Boerhaave K.³ It was given different names at different times by various authors such as sternalis, musculus sternalis, episternalis, presternalis, rectus thoracis, sternalis brutorum, etc and seen in both sexes without any priority.⁴ The variety of presentation and its evolutionary importance and rarity has always invoked interest among anatomists and anthropologists equally.

MATERIALS AND METHODS

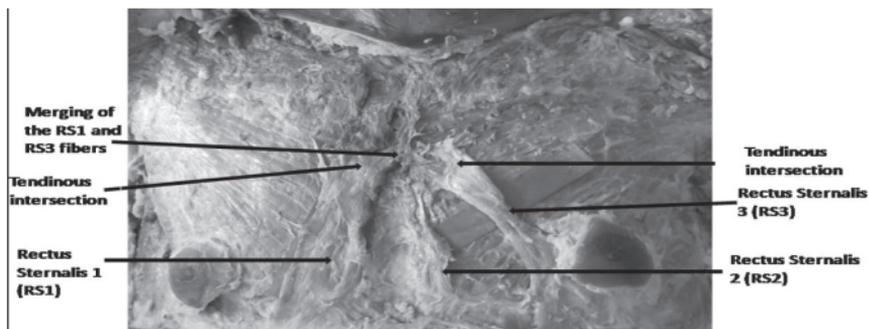
On routine dissection, Rectus Sternalis was observed bilaterally present lying superficial of the sternal origin

of the Pectoralis Major in an adult male cadaver. It was dissected and the attachments and nerve supply of the muscle were traced. The different measurements of the muscles were taken; muscle was then photographed for academic purpose. The probable developmental explanations were discussed.

RESULTS

In the present case, it was accidentally seen after dissection of 30 cadavers over 3 years in the Department of Anatomy, Nepal Medical College, Kathmandu. On the right side, there was a single large fleshy slip of muscle, Rectus Sternalis 1(RS1) lying parasternally, and on the left side, two small separate slips were noted. One parasternally and the other near the medial side of left nipple (RS2 and RS3) as displayed in Figure 1.

RS1 had two heads of origin: from the aponeurosis of External Oblique at the level of 6th rib and the other from the aponeurosis of Rectus Abdominis at the level of 5th rib. Then, both of them fused shortly after their origin and form a single belly running upwards. The muscle fibers of RS1 were at right angle to the muscle fibers of Pectoralis Major muscle, and lying superficial to that. Both the slips (RS1 and RS3) turned medially and blended with the each other anterior to sternum. RS1 exhibited a flattened tendon running upwards and finally fused with the right Sternocleidomastoid's membranous



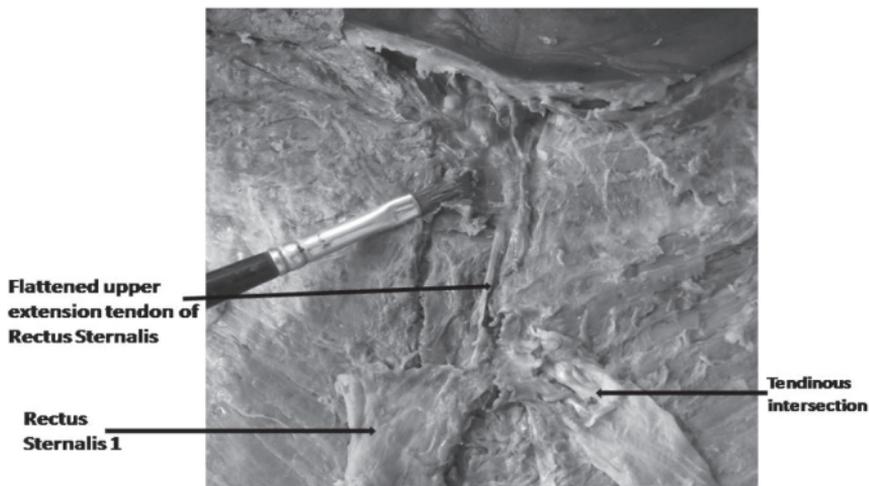
origin. Proximal to the fusion of Sternalis from both sides, indistinct tendinous intersections were noted on the right Sternalis muscle.

The length and breadth of the muscular slips of both sides were measured, by putting a thread and then spreading the thread over a plastic scale. The lengths of the longest slip were taken into consideration and the maximum breadths were measured. The length of RS1 muscle was 10.5cm and breadth about 3.8cm near its origin and 2.0cm prior to its insertion. Among all the three Rectus Sternalis noted, RS1 was found to be the largest with flattened tendon and fleshy belly.

Second Rectus Sternalis (RS2) (Figure 1) was the smallest among the three and was placed parasternally. It lacked any tendinous intersection. It had fleshy origin

and tendinous insertion. It took its origin from the sheath of the Rectus Abdominis, 1 cm lateral from the mid saggital plane at the level of 5th costal cartilage. It was 7cm long and 1cm wide. The flattened tendon then inserted within the fused tendinous part of the two other sternalis from beneath.

The third Rectus Sternalis (RS3), as shown in Figure 1, of the left side was the longest (12.5 cm) with width 1.2 cm. It shared its origin with the aponeurotic origin of the Pectoralis Major, originating just superficial to Pectoralis Major at the level of left 6th rib and 5.5 cm lateral to the midline. Then it ran straight upwards for a short distance and turned medially to join the tendons from RS1 below the sternal angle. Before merging with the tendons from the RS1, it also had a tendinous intersection as displayed in Figure 2.



The nerve supply of these muscles was observed. It was pierced by two small twigs of nerves on right side (RS1) and a twig for RS3 which could not be traced to their origins, since they pierced the Pectoralis Major and reached the deep surface of these muscular slips. The nerves to the Rectus Sternalis were present but were broken before we could clean and locate its proximal continuity.

DISCUSSION

Rectus Sternalis is an exceptional band of muscle present in the pectoral region which varies in length and width and is located close to and generally parallel to the sternum.⁵ Various anatomists have reported its presence in both male and female, in different races and nationalities, in various forms and present unilaterally or bilaterally. The unilateral presence of this muscle is reported in different populations while bilateral presence in a few others.^{4,8,10-12}

The reported prevalence of the muscle was also diverse in different literatures. Turner found the prevalence of this muscle in 3% with equal proportion in both male and female, while in the Filipino population it was 3.6%, 0.5% in the Taiwanese population, 2.9% in the Bulgarian population, 10.5% in the Japanese population and seen more in females whereas 5.8% in the Chinese population and seen more in males.^{2,13-17} In a mammographic study in America, on cross sectional imaging, authors reported seeing it in 0.2% of the investigated population.¹⁸ The prevalence of Sternalis muscle in this study was 3%, which was one out of 30 in three years.

The origin and insertion of Rectus Sternalis is still disputable. Many authors considered upper attachment of the muscle as its origin while others took lower attachment as its origin.⁸ The upper attachment of this muscle is either with origin of Sternocleidomastoid muscle or at jugular notch and even in some cases fused with each other.^{5-7,11,12,14} While its lower attachment is from the aponeurosis of either Rectus Abdominis or External Oblique or even from Pectoralis Major.⁵⁻¹⁵ However, in the present case, the muscle took its origin from both External Oblique and Rectus Abdominis' aponeurosis inferiorly and inserted just below the sternal angle by fusing with each other similar as reported by Sarkcoglu, Vaithianathan and Jeng and then a small tendon reached for the origin of right Sternocleidomastoid as an extension of insertion similar to that reported by Bhat *et al.*^{5,6,12,14} The presence of tendinous intersection in the Sternalis muscle as observed in this study is frequently not noted.

The length of the Rectus Sternalis has been noted ranging from 7cm to 17cm by various authors. In Japanese

population mean length noted was 7.79cm and Chinese population 11.11cm, while several authors noted in single observation the length either 10cm, 12cm, 13cm, 14cm and 15 cm for long slips. In this study the length of the longest slip was noted 12.5cm and shortest with 7cm which is noted frequently.^{6,12,14-17}

Rectus Sternalis is considered to be related with Panniculus Carnosus found in quadrupeds like horse, cow, dog, etc. Since the Panniculus carnosus attaches to subcutaneous tissue while the Sternalis attachments are different which makes the Sternalis corresponding to Rectus Abdominis and Infrahyoid muscles.¹⁹

While embryologically the presence of this muscle was explained by Sadler as the ventral longitudinal column, arising from ventral tip of hypomeres, giving rise to longitudinal group of muscles which normally disappears in thoracic region. If it was present, it was noted as Sternalis muscle.²⁰ The nerve supply is from ventral primary rami via Intercostal nerve, which might have been the case in the present scenario.

Since the presence of this muscle is relatively unknown to the clinicians, when present, it may be mistaken for tumor in radiological studies.¹⁰ It appears as focal dense line along the side of sternum and causes difficulty in interpretation of mammograms by radiologists. It may also appear as hernia of Pectoralis Major muscle and may confuse the examining physician and may cause abnormalities in ECG.¹⁸ During breast surgeries, it may appear either as a mass requiring surgical resection or is mistaken for recurrence of malignancy at a later stage. The muscle must be excised if it is encountered during modified radical mastectomy because part of the mammary gland may be presented deeper to it.⁶ This muscle is helpful in the plastic and reconstructive surgeries of head and neck, thoracic wall and breast. Studies suggest that awareness of this variation is essential for radiologists, oncologists, plastic surgeons and even cardiologists.

Sternalis is an unusual slip of muscle present vertically in the pectoral region with some dispute regarding its attachments and also whether it is of Panniculus group of muscle or related to the longitudinal group of muscles on the ventral wall.

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