

# Anomalous musculoskeletal morphology of anterior chest wall: a case report

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**Submitted:** 13 September 2006

**Accepted:** 2 October 2006

Arch Med Sci 2006; 2, 4: 289-291

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## Abstract

The combination of rectus sternalis muscle, anomalous attachment of pectoralis minor muscle and supernumerary ribs in a single individual has not been reported by any research study, to the best of our knowledge. We report a left-sided rectus sternalis muscle, altered attachment pattern of the pectoralis minor muscle and the presence of a right-sided supernumerary rib in the third intercostal space of a 42-year-old male cadaver. Anatomical knowledge of rectus sternalis muscle may be important for radiologists who may misinterpret it to be a bulging mass in routine mammography and for surgeons performing reconstructive surgery. Variations of pectoralis minor muscle may influence the kinematics around the scapula and may be important for biomechanical studies. The shadow of the supernumerary rib may overlap and confuse radiologists interpreting roentgenograms. The aim of the study was to highlight the complex musculoskeletal defects and discuss their academic and clinical significance.

**Key words:** rectus sternalis, sternalis, pectoral muscles, variations, supernumerary, ribs, musculo-skeletal defects.

## Introduction

The additional slip of the pectoralis major muscle from the rectus sheath reaching up to the sternocleidomastoid muscle, upper part of the sternum and upper costal cartilages is usually termed “sternalis” or “rectus sternalis” [1]. The earliest description of rectus sternalis was by Cabrolus in 1604 [2]. Since then there have been various studies on the existence, morphology, incidence, ethnic prevalence and clinical importance of this peculiar muscle and it has formed an important topic for debate [3].

The incidence of sternalis muscle has been reported to vary between 3 and 6%, without any sexual prevalence [2]. Its reported incidence in the white population is about 4-7%, the black population about 8.4%, and in the Asian population about 11.5% [4]. Thus the sternalis is more frequently found in the Asian continent but it needs to be explored in detail with a larger group study. Unilateral and bilateral presence of this muscle have been found in an equal number of cases [5]. The anatomical existence of the sternalis muscle lies in the fact that it has often been misdiagnosed as a breast tumour in mammography. Radiologists must be aware of the existence of such a muscle, which appears as an unusual bulge in the sternal



**Figure 1.** Dissected anterior wall of thorax (left side); s – sternum, rs – rectus sternalis, sk – skin reflected from the anterior wall of thorax



**Figure 2.** Dissected anterior wall of thorax (right side); s – sternum, 3 – third rib, 4 – fourth rib, sr – supernumerary rib

area, thereby resulting in erroneous interpretation of mammograms.

Deformities of pectoral muscles are not uncommon and an underlying cause of Poland's syndrome may often be present [6]. One should look for associated developmental defects especially when an anomalous pectoral muscle is detected. The presence of anomalies of the pectoralis minor may have an effect on scapular kinematics [7].

Presence of supernumerary ribs is rare and may not be detected unless symptomatic. Their presence in the thoracic region in the present case may be regarded as an extremely rare entity. The supernumerary ribs may produce neurological and vascular symptoms in the cervical region but in the thoracic region they may produce a deformity. Such extra ribs are often detected only in roentgenograms.

The present study reports a left-sided rectus sternalis muscle, supernumerary rib on the right side and different attachment pattern of the pectoralis minor muscle, and discusses the embryological and clinical implications. Presence of a combination of such variations may be important for anthropological, surgical and radiological studies.

### Case report

During routine cadaveric dissection of anterior thoracic wall, an anomalous rectus sternalis muscle, variation in attachment of pectoralis minor muscle and presence of a supernumerary rib were detected in a 42-year-old male Indian cadaver of Caucasian origin. The anomalous musculoskeletal defect was

studied in detail and appropriate photographs were taken (Figures 1 & 2).

### Observations

The pectoralis major muscle on the left side, other than its usual attachment, had additional slip from the rectus sternalis ("rs" in Figure 1). The slip from the rectus sheath measured 3 cm at its maximum width and traversed an upward oblique course to attach to the upper sternum. No such variation was found on the right side. The lower attachment of the pectoralis minor muscle was from the 2<sup>nd</sup> to 4<sup>th</sup> ribs and 3<sup>rd</sup> to 5<sup>th</sup> ribs, on the right and left sides respectively. On both sides, the upper attachment of the pectoralis minor was to the coracoid process, as usual.

Another finding was the presence of a supernumerary rib which was situated on the right side, in the anterior end of third intercostal space ("sr" in Figure 2). Sternal attachment of the supernumerary rib was between the 3<sup>rd</sup> and the 4<sup>th</sup> costal cartilages. Lateral attachment was 5 cm lateral to the costo-chondral junction to the lower border of the third rib. The nerve supply to the pectoralis minor muscle was from the lateral and median pectoral nerves.

### Discussion

The sternalis muscle has been defined as a small supernumerary muscle located in the anterior thoracic region, superficial to the sternum and the sternocostal fascicles of the pectoralis major muscle [8]. According to standard textbooks of anatomy, any additional slip of the pectoralis major muscle arising from the lower costal cartilage and rectus sheath may

sometimes reach the sternocleidomastoid muscle or the upper part of the sternum and the upper costal cartilage and is thus known as the sternalis or rectus sternalis [1]. Different terms by different authors include: musculus sternalis, presternalis, rectus sternalis, sternalis brutorum and thoracicus [2]. The rectus sternalis muscle in human beings is considered to be a result of atavism of the fascicles of the pectoral cutaneous muscle of lower animals [2].

The pectoralis minor muscle is reported to originate from the upper margin and outer surface of the 3<sup>rd</sup> to 5<sup>th</sup> ribs or 2<sup>nd</sup> to 4<sup>th</sup> ribs as per standard anatomical textbooks [1]. The pectoralis minor muscle inserts into the medial border and upper surface of the coracoid process or may cross the coracoid process to attach to the coracoacromial ligament or even cross the coracohumeral ligament to attach to the humerus [1]. Thus, it is quite common that the pectoralis minor muscle may have a normal lower attachment from the 2<sup>nd</sup> to 5<sup>th</sup> ribs [1]. Pectoral muscle anomalies have received more attention because of Poland's syndrome.

In the present case, the pectoralis minor muscle displayed variations in the attachment to different ribs on the left and right sides and these suggest that there may be a development defect in intra-uterine life.

It has been reported that an anomalous insertional anomaly of the pectoralis minor muscle may cause rotator cuff syndrome [9]. Interestingly, a relationship between the length of the pectoralis minor muscle and posture dysfunction and impairment has been found [7]. Thus, scapular kinematics are altered in the case of deficiency of pectoralis minor muscle length [7].

Earlier research reports depict that only one percent of individuals have variation in the normal pattern of twelve pairs of thoracic ribs [10]. In the present case, we observed the supernumerary thoracic rib only on the right side, which may be considered as a rare case. The segmental sclerotomes divide into cranial and caudal parts and the caudal half of one sclerotome fuses with the cranial half of the sclerotome below to form a vertebral analogue and a lateral process develops from the vertebral analogue to form a rib, and if there is incomplete fusion of the adjacent parts of the sclerotome then there is formation of two lateral processes which may give rise to two ribs [10]. In the present case also, the same might have happened on the right side to give rise to such an anomaly. Unlike previous research reports, in the present case the additional rib was not attached to the vertebral body, which is a rare finding. Admittedly, we did not perform any histological study of the rib in the present case. In routine roentgenograms, the shadow of the supernumerary rib may be confused with other surrounding structures, resulting in

investigational errors. Prior anatomical knowledge may be significant for radiologists and surgeons.

## Conclusions

The present case may be a developmental defect involving the musculoskeletal system in the Caucasian male. In the absence of clinical history of the patient it is difficult to comment on the clinical implications that would have arisen. However, anatomical knowledge of such musculoskeletal defects may certainly be of great academic interest for anthropologists, surgeons and radiologists in day-to-day clinical practice.

## Acknowledgements

The article was accepted for poster presentation in the 21<sup>st</sup> Congress of the Polish Anatomical Society held at Kielce, Poland, in June 2005 and the authors wish to express their sincere thanks to the organisers of the Congress.

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