

A Morphological Study of First Rib Anomalies

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ABSTRACT

Aim: The present study was undertaken to observe the variations of the first rib and understand the significance of such variations.

Materials and methods: Fifty first ribs obtained from the Museum of Anatomy Department of Rohilkhand Medical College & Hospital, Bareilly, Uttar Pradesh, India, were studied to see if any anomaly was present and check its incidence in the Indian population sample and draw clinical and other significances of such variations.

Results: The findings are discussed and conclusions are drawn. Variations detected include absence of scalene tubercle, vascular groove on the superior surface, rudimentary head and tubercle of the rib, oblique ridge, and exostosis. Their incidence and significance are discussed.

Conclusion: The findings are of considerable clinical, regional, and racial significance.

Clinical significance: Structural malformations of first rib are common, and when present may lead to compression of the neurovascular bundle at the root of the neck. Awareness of such anomalies is important for anatomists, radiologists, and thoracic surgeons dealing with this region.

Keywords: First rib, Morphological study, Oblique ridge, Scalene tubercle, Vascular groove.

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INTRODUCTION

The first rib is an atypical rib and is an important anatomical landmark. It is one of the borders of the superior thoracic aperture and also forms the medial boundary of the inlet of the axilla.

The first rib has a head, neck, and shaft, but lacks a discrete angle. The shaft is indented laterally by the groove for the subclavian artery, which contains the lower trunk of the brachial plexus trunk as well as the subclavian

artery. Anterior to the scalene tubercle is another groove for the subclavian vein. It has two tubercles:

1. *Tubercle:* Present posterior and lateral to the neck; bears an articular facet for the transverse process of first thoracic vertebrae.
2. *Scalene tubercle:* Present anteriorly between the grooves for the subclavian artery and vein; scalenus anterior muscle inserts here.

Ribs, like any other part of the body, may show variations, which may be of clinical, racial, or regional significance. Ribs are essential components of the bony thoracic cage. Anomalous ribs are rare anatomical findings usually discovered as an incidental finding on a routine chest radiograph, or as a part of systemic disease or syndrome. Around 22 syndromes are described that involve the rib anomalies.¹

Anomalies of the first rib are commonly associated with postfixed brachial plexus, with main contribution from the second thoracic nerve. Both first and second thoracic nerves may be stretched over the shaft resulting in neurological problems.²

Some first rib anomalies create a space through which the brachial plexus and the subclavian vessels pass, like fusion of cervical and first rib or fusion of first and second ribs. In this, there is compression of the neurovascular bundle.³

Coastal exostosis of rib can cause a hemothorax due to direct traumatic injury to the pleura.⁴⁻⁸ Certain anomalies of first rib like presence of cervical rib, hypertrophic scalenus anterior, and other factors, such as obliterate interscapular space or costoclavicular space lead to thoracic outlet syndrome.^{9,10}

The present study focused on first rib variations in the light of available literature to draw conclusions and significances. Abnormalities of first rib were detected in this study that included certain features like:

- Variations of scalene tubercle.
- The grooves for vessels on the superior surface.
- The tubercle and the head of the first rib.
- Oblique ridge on the posterior part of superior surface of the first rib.

MATERIALS AND METHODS

Fifty first ribs of the Museum of Anatomy Department of Rohilkhand Medical College & Hospital, Bareilly, Uttar Pradesh, India, were studied for anomalies of:

- Variation in scalene tubercle.

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Table 1: Incidences of anomalies of first rib in this study (n = 50)

Variation of scalene tubercle		Vascular grooves on superior surface – insignificant or absent	Rudimentary tubercle	Rudimentary head	Oblique ridge prominent	Exostosis
Rudimentary	Absent					
n = 10	n = 23	n = 14	n = 6	n = 12	n = 17	n = 1
20%	46%	28%	12%	24%	34%	2%



Ill-defined scalene tubercle
Fig. 1: Ill-defined scalene tubercle



Vascular grooves absent
Fig. 2: Vascular grooves absent

- Vascular grooves on the Superior surface of the first rib and the ridge separating them.
- Tubercle of the rib, head of the rib, or any growth or injury on the ribs.
- Oblique ridge on the posterior part of superior surface of the first rib.

RESULTS

Findings are mentioned in Table 1. Also presented in Figures 1 to 3.

DISCUSSION

Rib anomalies are traditionally classified into (1) numerical and (2) structural. Numerical anomalies include supernumerary (e.g., cervical rib, lumbar rib) and deficient

pair of 11th ribs. Structural defects include short rib, bifid or forked rib, fused or bridged ribs, and pseudoarthrosis of first rib.¹¹

There have been studies on anomalies of ribs including first rib. Many of these studies are clinical and radiological.

One of the most extensive studies was done radiologically in 40,000 cases by Etter.¹² These studies mentioned many variants, such as congenital rib anomalies in 1.4% and cervical rib in 0.2%. The most frequent anomaly that Etter found was the forked rib in 0.6%. This most often involved the fourth rib. The fusion of bone bridging in 0.3% most often involved the first and second ribs. The rudimentary or hypoplastic rib usually involved the first rib and was found in 0.2% cases. Pseudoarthrosis of first rib was present in 0.1% – this anomaly may stimulate a healing fracture.¹³

Others include

- The exostosis – benign and malignant growth
- Osteomyelitis
- Notched ribs, etc.

The present study detected only one case of trauma/growth (2% incidence).

In our study, the scalene tubercle was found to be absent or very ill defined in a significant 46%; rudimentary was present in 20%.

Number of cases of vascular grooves on the superior surface which were insignificant or absent was 28%.

Incidence of rudimentary tubercle was 12% and rudimentary head was 24%; the oblique ridge of 34% was also seen in the present study.

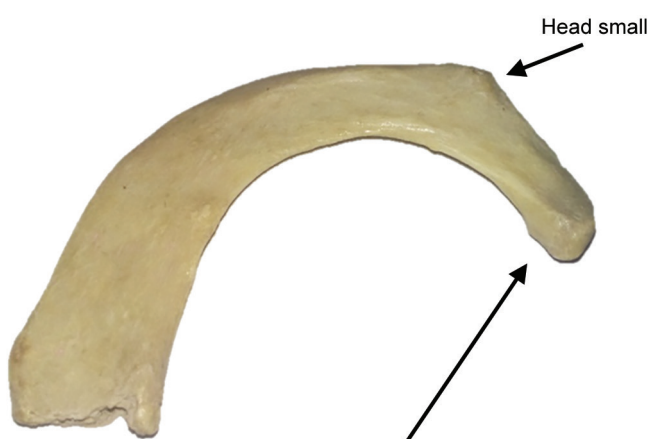


Fig. 3: Head small and tubercle small

CONCLUSION

The incidence of absence of both ill-defined scalene tubercle and vascular grooves separated by ridge was found to be surprisingly higher in our study besides the incidences of rudimentary tubercle and head of the first rib.

Findings are of considerable racial, regional, and clinical significance.

The incidence and significance are of considerable clinical importance. It may cause musculoskeletal pain, intercostal nerve entrapment, or vascular compression. Awareness of these anomalies is important for the radiologist for diagnostic purposes and for surgeons for performing various clinical and surgical procedures.

CLINICAL SIGNIFICANCE

Structural malformations of first rib are common. When present, they may lead to compression of neurovascular bundle at the root of neck causing thoracic outlet syndrome. Awareness of such anomalies is important for anatomists, radiologists, and thoracic surgeons dealing with this region. The first rib anomalies can cause compression of structures, as they create a narrow space through which the brachial plexus and subclavian vessels pass.

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