

## Bifid rib and an additional intercostal space: A case report.

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### Abstract

#### Introduction

Bifid rib with an additional intercostal space is quite rare anomaly. This may be due to defect in the process of segmentation of the developing somites. These anomalies may remain asymptomatic, can create misinterpretation during radiological or physical examinations.

#### Case Report

During the routine dissection of adult male cadaver for undergraduate medical students we observed a variation of bifurcation of anterior end of left fourth rib and corresponding costal cartilage. These bifurcated ends were joined together to form a small circular additional intercostal space. On close examination we found that it contained blood vessels and nerves derived from left fourth intercostals space and layers of intercostal muscles.

#### Conclusion

The knowledge about these variations will be helpful to reduce incidence of misinterpretation during radiological and physical examination.

### Introduction

Ribs provide information that aid in the interpretation of radiological image<sup>1</sup> and also used as an essential landmark during general physical examinations. There are normally 11 pairs of intercostal spaces are present in thorax. These intercostal spaces contain thin multiple layers of muscular fibres: intercostalis externa, interna and intimi from superficial to deep, intercostal nerves and vessels<sup>2</sup>. The overall prevalence of bifid rib is estimated to be 0.15% to 3.4%<sup>3</sup>.

The ribs develop from costal processes, which are small lateral mesenchymal condensations of the developing thoracic somites<sup>4</sup>. Bifurcation of distal ends of ribs are due to defect in the process of segmentation and resegmentation of costal processes. The knowledge of such variations is helpful for clinicians for the differential diagnosis and for surgeons operating on the anterior thoracic wall.

### Case report

During routine dissection for medical undergraduates, we found there was bifurcation of anterior end of left fourth rib and corresponding costal cartilage in an adult male cadaver of Indian origin. Two bifurcated ends joined

together creating a small oval additional intercostal space of 2 cm X 3 cm dimension, about 4.5 cm away from midline (Figure 1).

In this additional intercostal space we found layers of muscle fibres which are directed down and laterally representing internal intercostal muscle. This muscle layer covered superficially by thin fibrous layer representing external intercostal membrane. Posteriorly fibres of Sternocostalis muscle were extending over this region. The intercostal vessels were entering additional intercostal space from left internal thoracic artery. The 4<sup>th</sup> intercostal nerve running in costal groove was giving a twig to additional intercostal space (Figure 2). The anterior part of 3<sup>rd</sup> intercostal space at the level of additional intercostal space was narrow.

This work conforms to the values laid down in the Declaration of Helsinki (1964). The protocol of this study has been approved by the relevant ethical committee related to our institution in which it was performed. All subjects gave full informed consent to participate in this study.

### Discussion

The incidence of bifid rib accounts for 20% of all congenital anomalies of rib<sup>5</sup>. Bifid ribs are more common in males than females, and occur most frequently in the third and fourth ribs of right side than on the left. Bilateral bifid ribs can also be present. Incidence of costal abnormalities based on X-ray investigations was 2.8% in Koreans and 0.15-5.7% in other populations. 2 distinct morphological patterns of additional intercostal spaces are observed 1) long and slender (fissured) bifid spaces, 2) more rounded (hole type) bifid spaces<sup>6</sup>. The ribs and the intercostal spaces are very useful in surface marking for various physical examination procedures and clinical procedures. Hence it is essential that the radiologist and clinicians be

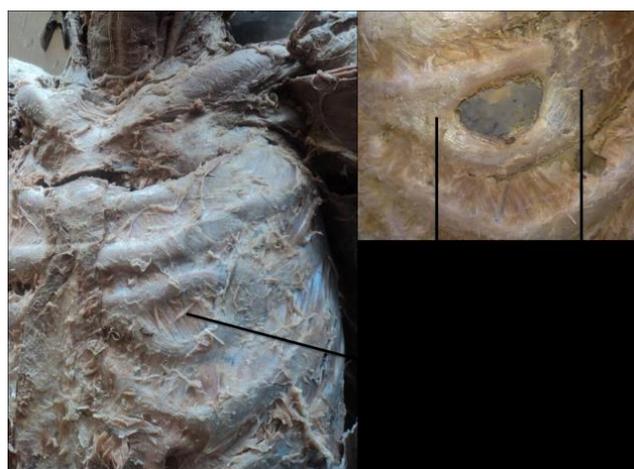
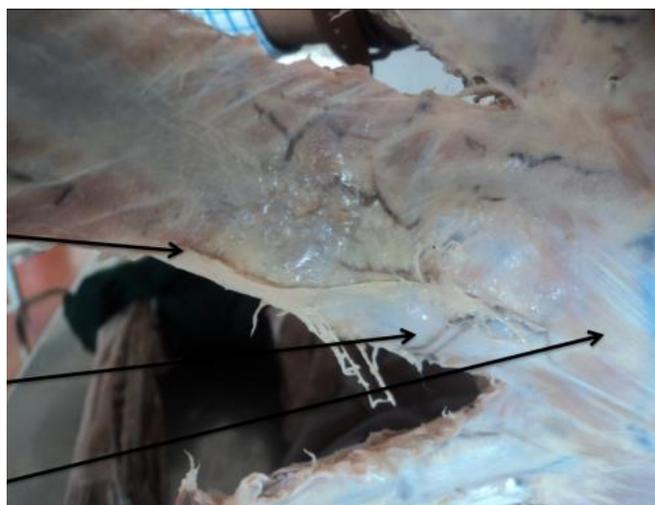


Figure 1: Anterior view of additional intercostals space.

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**Figure 2:** Posterior view of additional intercostals space.

familiar with incidence of rib variants, to prevent misdiagnosis<sup>1</sup>. Supernumerary intra thoracic rib is a rare variant of a bifid rib. It may be associated with deformities of a vertebral body<sup>7</sup>. Frequently remains non-symptomatic, but thoracic pain, dyspnea or even hemoptysis have been reported<sup>3</sup>.

In children, the bifid ribs are associated with pathologic malformations such as Gorlin-Goltz syndrome<sup>6,8</sup>, which is a rare, autosomal dominant syndrome. Other rib anomalies include cervical ribs, supernumerary ribs, short ribs, defect in bone density, abnormal rib shapes<sup>9</sup>.

The ribs develop from sclerotomal cells of somite. Each somite in the thoracic region forms the caudal part of one rib and the cranial part of the next caudal rib. The dermomyotome derived from one somite contributes to the intercostal muscle<sup>4,10</sup>. Rib anomalies probably occur during the process of segmentation and re segmentation of the developing of costal processes from the somites<sup>11</sup>. Additional intercostal space in our case gets nerve supply from 4<sup>th</sup> intercostal nerve. This indicates that the muscles of this additional space are originated from muscles of the fourth intercostal space.

### Conclusion

We believe that this case is worthy of consideration as the malformations like this, though is quite rare, might lead to serious misinterpretations in the physical examinations and clinical diagnosis. Reporting these kind of cases are also enlightening for the morphologists and anatomists.

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