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INCIDENCE OF BIFID RIBS AND ITS CLINICAL IMPLICATION

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ABSTRACT

Background: There are twelve pair of ribs along with sternum and thoracic vertebrae that forms thoracic cage. The occurrence of structural congenital anomalies of ribs are rarely reported. The bifid rib is occasionally encountered as a radiological observation during thoracic skiagrams or clinical examinations of patient. It is sometimes also find out during postmortem examination. In the literature, very little information was found related to the clinical significance of bifid ribs. **Aims:** The aims of the study was to find out rate of occurrence of various kinds of rib anomalies. **Material and methods:** 360 pairs of thoracic ribs including right and left side were studied in Department of Anatomy, AIIMS Patna. The various parameters in the variant ribs were studies such as incidence of variant rib, distance from the posterior end of rib to start of bifurcation, length of the bifurcated part of rib, distance between the bifurcated end of bifid rib, length of rib along upper and lower borders and side of the variant rib. **Results:** Out of 360 pairs of ribs, only 2 bifid ribs were found. One was found on right side 4th and 5th ribs. There was no incidence of presence of any rib with spur or fused rib. **Conclusion:** there was a 0.28% of detection rate bifid rib. It was mainly found on right side. The knowledge of such rare observations may prevent erroneous interpretation of skiagrams and performance of unnecessary procedures, including exploratory surgery.

KEYWORDS: Bifurcated rib, chest wall anomaly, intrathoracic rib.

INTRODUCTION

Thoracic cage is made up of twelve thoracic vertebrae, twelve pairs of ribs & costal cartilages (CC) and a sternum, which protects the thoracic viscera and some abdominal organs. Ribs articulate anteriorly with sternum through the hyaline type of CC. The first seven pairs are connected to the sternum by costal cartilages and are referred to as the true ribs. The remaining five are the so-called false ribs: the cartilages of the eighth to tenth usually join the superjacent costal cartilage, whereas the eleventh and twelfth ribs, which are free at their anterior ends, are sometimes termed the 'floating' ribs. The tenth rib may also be a floating rib.[1]

The ribs may present with abnormalities related to their shape, length, and number in addition to fractures and unusual articulation at anterior or posterior ends. Numerical and structural variations of ribs are well documented. The Numerical variations are more commonly seen in cervical or lumbar ribs.[2] The occurrence of structural variation in the rib is about one percent of the population but the intrathoracic rib is a rare congenital anomaly. Lutz (1947) was first to describe an unusual 4th rib, based on radiological observations.[3] The overall prevalence of the bifid rib is estimated at 0.15-3.4% (mean 2%) and it accounts for up to 20% of all congenital rib anomalies. Rib anomalies are noted in 0.31% of routine chest radiographs.[4]

The congenital anomalies of cervical and lumbar ribs are relatively common than bifid ribs.[6,10] As the structural abnormalities, the bifid rib is usually asymptomatic.[11] The ribs variations are usually clinically insignificant and occasionally can be palpated at a clinical examination or detected incidentally at chest radiography. Most commonly it occurs in 4th rib.[12]

Ribs usually develop from a costal element in association with the thoracic vertebrae. Each rib originates from lateral sclerotomal populations. The proximal portion of the rib forms from the caudal half of one sclerotome and the cranial half of the next subjacent sclerotome. The head of the rib develops from somitocele cells from one somite, which migrates with the caudal half of the sclerotome without any mixing of cells of origin. The distal portion of the rib develops from both caudal and cranial halves of sclerotome with mixing of cells of origin as the rib extends into the ventral body wall and segmentation diminishes.[5]

MATERIAL AND METHODS

About 360 pairs of ribs including right and left side were studied in Department of Anatomy. The various parameters in the variant rib were studied such as length of rib along upper (A) and lower (B) borders, distance from the posterior end of rib to start of bifurcation (a), length of the bifurcated part of rib (C), distance between the bifurcated end of bifid rib (D), thickness of the bifurcated part of rib (E) and side of the variant rib.

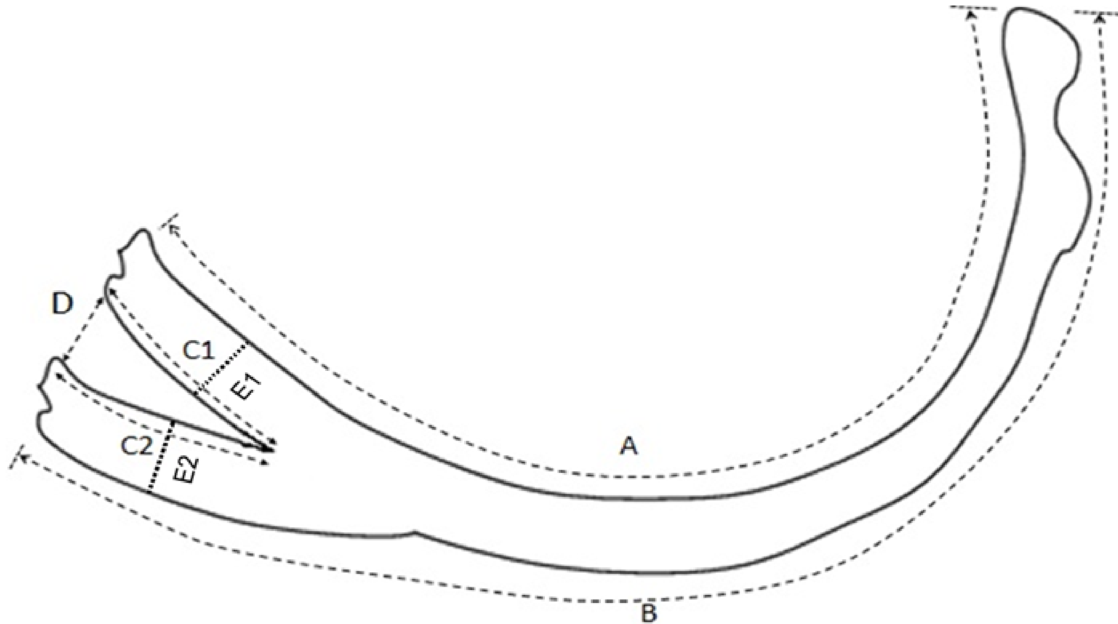

Figure 1: showing the bifurcation near the ventral ends of the ribs

RESULTS AND DISCUSSION

During the routine study of 360 pair of thoracic rib bones in Department of Anatomy, we found two right sided ribs with a bifurcation at the ventral end of the bone as shown in Figure 1. One of them was 4th rib and another was 5th rib. There was no incidence of presence of any rib with spur, fused rib.

The incidence of variant rib was found to be 0.28% in our study. The various parameters studied in variant ribs are as seen in table 1.

Table 1: Various parameters in the variant rib.

Parameters	Measurements (cm)	
A	23.6	28.5
B	22.8	26.7
a	18	22.8
C1	5.6	5.6
C2	4.8	3.8
E1	0.6	1.7
E2	0.6	1.5
D	1.8	2.8
Side of bifid rib	Right 4th rib	Right 5th rib

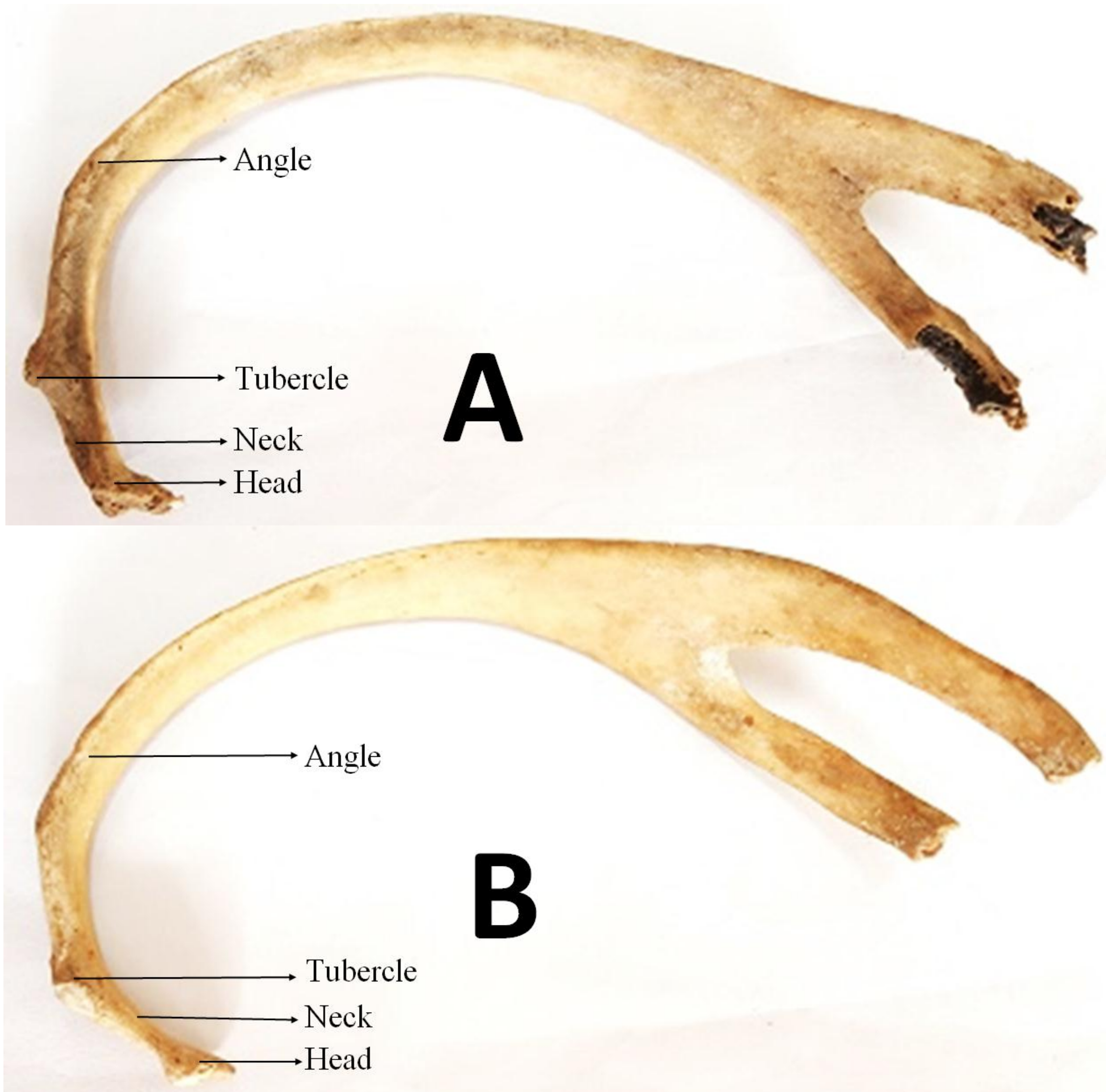

Figure 2: Showing the right side 4th (A) and 5th (B) bifid rib.

In the Bifid ribs head with articular facets, tubercles, angles, and costal groove as of a typical rib as shown in [Figure 2].

The intrathoracic ribs was first classified by Kamano et al[13] in 2006 as shown in table 2. The bifid ribs as found in the present study were having characteristics similar to type II of the classification of the intrathoracic ribs proposed by Kamano et al.

Table 2: Classification of intrathoracic ribs.

Type	Intrathoracic ribs
Type Ia	Extra normal rib originating from vertebral body.
Type Ib	Supernumerary intrathoracic rib originating from a portion of rib next to vertebral body.
Type II	Intrathoracic rib originating from a bifid rib.
Type III	Rib depressed inside the thoracic cavity.

The knowledge of bifid ribs is necessary for the differential diagnosis with other diseases, such as tumors of the chest wall or costal fracture, because the various types of the bifid rib are present with diverse appearances on normal chest X-rays.[14] The incidence of bifid ribs is more frequent in males than females. It is more common in the third and fourth ribs (degree of incidence - third > fourth > fifth > sixth > second) (Song et al., April 2009). Comparatively it is more prevalent on the right side of the chest than on the left side (Osawa et al., 2002).

There is little information in the literature about the clinical significance of bifid ribs. Rib anomalies can occur in isolation or as part of vertebral malformations. The presence of an additional rib and intercostal space can mislead in rib and intercostal space counting during the postmortem examination.[15]

The erroneous interpretation of skiagrams and non-calcification of the costal cartilage of the rib resulting in the broadened bony sternal end of the rib in skiagrams can be misdiagnosed as a bifid rib.[16] Very rarely, It has also been seen in association with Gorlin-Goltz[17], Job's syndrome[18], Kindler syndrome[19], neuroblastoma among the childhood tumors.[20]

CONCLUSION

The bifid ribs incidence was found to be 0.28%. It was found in right side. It may present with diverse appearances on plain skiagrams. So, knowledge of bifid ribs is necessary while making differential diagnosis such as tumors of the chest wall or costal fracture. Such observations may prevent the performance of unnecessary procedures, including exploratory surgery.

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