## ORIGINAL ARTICLE

# A RADIOGRAPHIC STUDY OF RIB ANOMALIES IN PATIENTS OF VARIOUS CHEST DISEASES BELONGING TO NORTH INDIAN POPULATION AT A TERTIARY CARE CENTRE

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## ABSTRACT

**Background:**Though congenital rib anomalies are reported to be of rare occurrence, these are now and then encountered as an incidental finding in chest X-rays, however in most of these cases patients are having other health issues rather than things directly related to the rib anomalies.

**Aims:** The aims of the study were to observe the detection rate of various kinds of rib anomalies, their association with gender, body side, other thoracic bony anomalies and associated symptoms.

**Material and methods:**5,000 plain chest skiagrams were studied including 2,628 males and 2,372 females from September 2013 to September 2015.

**Results:**Out of 5,000 total patients 82 patients (1.64%) were found with cervical rib, 22 patients out of 82 were having bilateral cervical rib(0.44%), bifid ribs were found in 59 patients(1.18%) out of which 3 patients (0.06%)were having both the anomalies, only one patient was seen with fused rib(0.02%),one with two ribs having less space in between(0.02%) and one patient was having rib with spur(0.02%). The occurrence (detection rate) of cervical rib on either side as well as bilaterally was higher in males. Bifid rib detection rate was higher on the right side in males and on left side in females.None of these patients were having any symptom related to their rib anomalies.

**Conclusion:** there was a little higher detection rate seen regarding the presence of cervical rib in north Indian population however it was observed that the symptoms reported in literature in relation to the rib anomalies seemed to be overreported.

**Key words:** Cervical rib,bifid rib,anomalies,supernumerary

## INTRODUCTION

Though congenital rib anomalies are reported to be of rare occurrence, these are now and then encountered as an incidental finding in chest X-rays, however in most of these cases patients are having other health issues rather than things directly related to the rib anomalies. "Cervical or neck rib" is an extra or supernumerary rib which is generally smaller and runs from 7th cervical vertebra to the first true rib or to the sternum but usually it is present posteriorly to a short distance. It is present since birth but is usually incidentally diagnosed until and unless it is a cause of neurovascular compression at the thoracic inlet with which it has an inconstant association of roughly 10%.[1] Sometimes diagnosis of cervical rib is difficult when just a fibrous band is present. Many times the treating clinician may miss this incidental finding as he is more focused towards his area of interest. "Bifid rib" or bifurcated rib or sternum bifidum is a congenital abnormality of rib cage in which muscles and nerves can also be involved although rarely and occurs in about 1.2% of humans.The sternal end is cleaved into two parts and it is almost always unilateral. In samoans *i.e* a polynesian ethnic group of the samoan islands sharing genetics, language history and culture the occurrence of bifid ribs was seen upto 8.4%.[2] Bifid ribs doesn't cause any symptoms usually and are often incidentally discovered like cervical ribs on chest skiagrams however very rarely effect of this neuroskeletal anomaly can include respiratory and

neurological difficulties. Another association of this anomaly has been seen with jaw cyst and may become a part of nevoid basal cell carcinoma syndrome. Other anomalies of the ribs may include fusion of adjacent ribs, supernumerary intrathoracic and transthoracic ribs have also been described previously although very little data and research is available. Purpose of the study was to study the detection rate of various kinds of rib anomalies, their association with gender, body side, other thoracic bony anomalies and associated symptoms in studied subjects.

## METHODOLOGY

After taking ethical clearance from institutional etical committee(IEC) of the institute, a careful thorough examination of 5,000 chest skiagrams was carried out inclusive of 2,628 males and 2,372 females.The subjects were patients who presented to the department of respiratory medicine for various chest related ailments or referrals during the period from September 2013 to September 2015. All the radiographs were seen thoroughly on a view box with systematic approach, the skiagrams were seen combinedly by chest specialist and radiologist (Department of Radiodiagnosis) from the same institute. Chest radiographs were especially seen for the presence of congenital rib anomalies, the other structural deformities secondary to the respiratory diseases were not included in the study however those patients were dealt carefully for their ailments. The data regarding age, sex and presence of cervical rib, bifid rib, fused ribs and any other suspected deformity was taken into account. The data analysis was done using Pearson's chi-squared test applying statistical setting at $p<0.05$ using SPSS.

**Settings and Design:**A hospital based cross sectional study

**Statistical analysis used:** Pearson's chi-squared test applying statistical setting at $p<0.05$ using SPSS.

## RESULTS

In 5,000 studied subjects, 82 patients (47 males and 35 females) were seen with cervical rib. Cervical rib was seen on right side in 28 patients (17 males and 11 females) and on left side in 32 patients (18 males and 14 females). Cervical rib was seen bilaterally in 22 patients (12 males and 10 females). A total of 59 patients out of all studied subjects were having bifid ribs. In these 59 patients, 33 patients were males while 26 patients were females. Bifid rib was seen on right side in 36 patients (22 males and 14 females) and on left side in 23 patients (11 males and 12 females). Only 3 patients were having presence of both the bifid and cervical ribs and all of them were males. One male patient was seen with fused rib on the right side and one male patient was seen with reduced intercostal space in between two ribs on right side in total studied population.One patient was having rib with spur in same population. The occurrence (detection rate) of cervical rib on both sides as well as bilaterally was higher in males(Table 1). Bifid rib detection rate was higher on the right side in males and on left side in females (Table 2).

**Table 1: Cervical rib analysis (N=5000)**

| Subjects with cervical rib | Number (%) | Male (%) (n=2628) | Females (%) (n=2372) | OR (CI) | p-Value |
|---|---|---|---|---|---|
| **Total** | 82(1.64) | 47(1.79) | 35(1.47) | 1.22(0.78-1.89) | 0.384 |
| **Bilateral** | 22(0.44) | 12(0.46) | 10(0.42) | 1.08(0.467-2.512) | 0.852 |
| **Right side** | 28(0.56) | 17(0.65) | 11(0.46) | 1.40(0.653-2.990) | 0.386 |
| **Left side** | 32(0.64) | 18(0.68) | 14(0.59) | 1.16(0.576-2.341) | 0.675 |

OR=Odds ratio, CI=Confidence interval

**Table2: Bifid rib analysis**

| Subjects with bifid rib | Number (%) | Male (%) (n=2628) | Females (%) (n=2372) | OR (CI) | p-Value |
|---|---|---|---|---|---|
| **Total** | 59(1.18) | 33(1.25) | 26(1.09) | 1.15(0.684-1.924) | 0.602 |
| **Right side** | 36(0.72) | 22(0.84) | 14(0.59) | 1.42(0.726-2.785) | 0.302 |
| **Left side** | 23(0.46) | 11(0.42) | 12(0.50) | 0.83(0.364-1.877) | 0.649 |

## DISCUSSION

Congenital rib anomalies are reported to be of rare occurrence [3]Cervical rib or neck rib is asupernumerary rib which arises from the costal element of the seventh cervical vertebra.[4-6]It is usually an incidental finding on chest skiagrams. The detection rate of cervical rib has been seen in different population like prevalence in a London population was 0.74% out of 1,352 chest radiographs examination.[7] In a chennai population based study the percentage of its occurrence was 1.16%.[8]Other studies done on central Indian population and

Population around Lucknow claimed the incidence to be 1.2%and 0.6%respectively.[9-10] According to the embryologists it is reported to be present always in fetuses and disappears just before birth.[11] Association of cervical rib with Thoracic Outlet Syndrome (TOS) is reported which is claimed to be overdiagnosed and underdiagnosed by few authors. In general the clinicians have a lack of knowledge regarding the rib anomalies, they may discover it incidentally but have least of idea as to what to do further and may probably correlate them with something they are not associated with, sometimes patients are referred from these practitioners giving a lot of undue importance to the anomalies making the patients unnecessarily anxious, coming to cervical rib which has been found to be associated with TOS which is a term used to describe a group of disorders occurring due to compression, injury or irritation of nerves and/or blood vessels in lower neck and upper chest area, this syndrome can be due to presence of an extra first rib or collarbone fracture, apart from these other risk factors include tumors or enlarged lymph nodes, injury to shoulder, neck or back, improper weightlifting, defective postures and sleep disorders. The signs and symptoms of TOS are pain, tingling and numbness. Pain of TOS is to be differentiated from angina pain which worsens on walking or exertion in the latter whereas increases on raising the affected arm in the former. TOS most commonly affect the nerves however uncommonly it may affect veins and arteries. The arterial TOS is least common but most serious. Most of the cases of neurogenic TOS, which is the most common of the three, respond to physiotherapy and pain relieving medications, surgery may be required in a few cases. Cervical ribs can also cause symptoms by compression of subclavian artery causing ischaemia of the arms and brachial plexus causing neurogenic symptoms.[4,5] Pain is the main symptom and treatment ranges from conservative to surgical resection depending on the severity and vascular symptoms like ischaemia.[5,6]Cervical ribs are reported to be associated with brachial plexus pathology in infants, studies are ongoing regarding the association of childhood cancer and cervical ribs. Bifid rib or sternum bifidum is a congenital abnormality of the anterior chest wall with the sternal end cleaved into two. It is frequently asymptomatic and like the cervical rib it is too an incidental finding on the chest skiagram however very rarely effect of this neuroskeletal anomaly can include respiratory and neurological difficulties. The estimated overall prevalence of bifid rib is 0.15% to 3.4% and it accounts for 20 percent of all congenital rib variations.[12]Since the rib has mesodermal origin, malformation in organs like heart and kidney may be associated congenital anomalies.[13] Another association of this anomaly has been seen with jaw cyst and may become a part of Gorlin-Goltz syndrome (nevoid basal cell carcinoma syndrome).[13,14] Apart from these well known rib anomalies there can be presence of supernumerary ribs, short ribs, defect in bone density and abnormal rib shapes.[15]We observed cervical ribs, bifid ribs, fused rib, rib with spur and ribs with lesser intercostal space in between in our study of 5,000 subjects. The clinical significance of the rib anomalies lies in the fact that though they are uncommonly related with neurogenic or vascular implications but their association can't be denied and if the patients presents to the clinician with symptoms as described above then one should look for these anomalies. Secondly this study gives an insight to the clinicians about the detection rate of rib anomalies and other very rare associations like that of bifid rib with the Gorlin-Goltz syndrome. Some other anomalies were also found which were probably seen for the first time and the previously reported literature doesn't give much detail about them.The patients presenting to the clinicians with rib anomalies are from different backgrounds, there are many patients in which it is incidentally discovered, these patients have come to consult the clinician for something else, some patients come to the doctor specifically questioning for the rib anomalies, these are the candidates who should be appropriately counselled,reassured and can be advised to avoid sports injuries and defective postures which apart from cervical rib are other risk factors for TOS.

## CONCLUSIONS

Few relevant conclusions were drawn from this study like the detection rate of cervical ribs unilateral as well as bilateral was higher in north Indian population(1.64%) than the previously reported data in available literature. Its possible explanation may be missing out of these incidental findings by the treating doctors who are rather more focused for their area of interest. Bifid rib detection rate (1.18%) co-related with the previously reported literature and was found mostly on the third and fourth ribs on the right side. No significant difference was observed in detection rate of cervical &bifid rib between studied male and female subjects. Rest of the congenital anomalies are extremely rare, none of the patients had any complaints in relation to the rib anomalies which suggests that the previous literature for association of cervical rib with thoracic outlet syndrome may be overreported so most of the times the patients who present to the doctor with the incidental rib anomalies may be simply reassured. No association of rib anomalies with other thoracic bony anomalies was observed except that both cervical rib and bilateral rib were found in 3 patients.

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