

# The Prevalence of Cervical Rib found during chest Radiography in the Population of Khyber Pakhtunkhwa, Pakistan

Shazia Iftikhar<sup>1</sup>, Zainab Rehman<sup>1</sup>, Falak Naz<sup>1</sup>, Waqar Ahmed<sup>1</sup>, Parkha Rehman<sup>2</sup>, Mahvish Javed<sup>1</sup>, Shagufta Sultana<sup>1</sup>

<sup>1</sup> Department of Anatomy, Khyber Medical College, Peshawar, Khyber Pakhtunkhwa

<sup>2</sup> Department of Pathology, Nowshehra Medical College, Nowshehra, Khyber Pakhtunkhwa

## ABSTRACT

### Objective:

To find out the prevalence of cervical rib in the population of Khyber Pakhtunkhwa.

### Materials and Methods:

Study was conducted on data collected from various private practices of Khyber Pakhtunkhwa, of 1038 postero-anterior chest radiographs where the patients were investigated for various conditions.

### Results:

A total of 1038 chest radiographs that satisfied the inclusion criteria were examined in the current study. The study included 515 chest radiographs of males and 523 of females, aged 15 to 75 years. Out of the 1038 cases, a total of 04 cases (0.38%) were found to be having cervical rib. The frequency of CR among males was found to be 01 (0.09%) and that among females was 03 (0.28%).

### Conclusion:

In the current study the prevalence of CR was 0.38% and was found mostly in females. As previous researches on cervical rib have shown that occurrence of cervical rib is due to mutations in Hox genes, so more studies need to be planned to confirm this connection. Also, the presence of cervical rib needs to be well thought-out in different medical specialties to avert its complications.

### Keywords:

cervical rib, somite, Hox gene

### \*For Correspondence

#### Dr. Shazia Iftikhar

Anatomy Department,  
Khyber Medical College,  
Peshawar,  
Pakistan

Email:  
shaziaijaz28@yahoo.com

## INTRODUCTION

In a human body, normally there are twelve pairs of ribs arising from the twelve thoracic vertebrae. Normally, there are seven cervical, twelve thoracic, five lumbar, five fused sacral and four fused coccygeal vertebrae. The twelve ribs are numbered according to the respective thoracic vertebrae from which they arise. Occasionally, a person may have additional rib arising from the seventh cervical vertebra labeled as cervical rib. This may be delineated as an abnormal, surplus or redundant rib which may arise from either seventh cervical or from fifth or sixth cervical vertebrae.<sup>1</sup> These may develop due to abnormal growth of costal element of the transverse process of the seventh cervical vertebra. The cervical rib was identified for the first time by Greek physician Galen in the second century. Gruber classified cervical rib into four groups in 1869. The first group include slight enlargement of transverse

process. In the second group, the transverse process elongates to a range to touch the first rib. In the third variety, the cervical rib joins the first rib via fibrous cartilage. The fourth variety is also called a complete cervical rib as it completely fuses the first rib. The cervical rib is also called the Eve's Rib. The complete cervical rib can be seen extending out at first laterally then curves anteriorly and descends between the Scalenus Anterior and Medius muscles of the neck and finally joins the costal cartilage of the first rib. The Brachial plexus channels above it while the Subclavian artery curves backwards and laterally above the CR as it courses downwards. This may be either unilateral or may be bilateral and are more common in females.<sup>1,2,3</sup>

The Paraxial Mesoderm gives rise to skeletal system. Somites develop from mesodermal cells on either side of neural tube. At times, they divide into sclerotome anteriorly and dermatome posteriorly. As the fourth week of

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development ends, the cells of sclerotome changes into mesenchymal cells which give rise to ribs. The genes responsible for the formation and shaping up of axial skeleton are called Hox genes. Any mutation in these genes may give rise to the cervical rib.<sup>1,4</sup> The features observed on a cervical rib are head, neck and tubercle along with occasional presence of shaft. The two types of cervical rib include the complete and incomplete types. Incomplete type may be seen ending freely in the adjacent soft tissues while the complete variety articulates posteriorly with the first rib.<sup>4</sup> Various populations have their particular prevalence of cervical rib e.g. in Turkish population, its prevalence is 6.2%. In United Kingdom and United States of America, there are increased proportions of immigrants. After assessment of chest x-rays of a population in London, the prevalence of cervical rib was found to be 0.74%. In a similar study in USA, the prevalence was found to be 0.5-1%. The prevalence of cervical rib in other populations varies.<sup>5</sup> In majority of cases, the presence of cervical rib is devoid of any symptoms and does not need any surgical intervention. However, the symptoms encountered by cervical rib can be neurological and vascular.<sup>6</sup> The neurological manifestations have been found to be more predominant than vascular and are mainly due to compression of Brachial plexus. In case of incomplete cervical rib, only brachial plexus is compressed while complete cervical rib also compresses the subclavian artery.<sup>7</sup> The neurological manifestations experienced by patients having cervical rib include periodic pain in the affected upper extremity along with apathy in the ulnar region of the forearm of the same side. Along with compression of the nerves of brachial plexus, the motor strength of muscles of forearm and hand is also mildly reduced to an extent that patient may find difficulty in holding a pen. The compression of brachial plexus due to cervical rib can be accurately diagnosed once the other neurological disorders like Carpel tunnel syndrome, ulnar nerve neuritis or prolapsed cervical disc etc. are ruled out. The vascular manifestations of cervical rib include weakened distal pulses e.g., diminished Radial pulse, perpetuation of replenishment of capillaries or even gangrene of tips of fingers. The patient may experience lameness or giddiness. In case of compression of the subclavian artery by cervical rib, the Adson test may be positive during hyper abduction of the limb.<sup>1,5,8</sup>

Generally, chest radiographs are the best means of detecting cervical rib in a patient. Almost 74.5% of cases having cervical rib are not noticed in CT (computed tomography) of cervical spine. The treatment of complaints associated with cervical rib may be either conservative or

surgical. Conservative treatment includes pain relief by giving analgesics, muscle relaxants, physiotherapy etc. Surgical treatment involving resection of the cervical rib is recommended once the conservative management fails to improve the condition.<sup>1,3,8</sup> The objective of the current study was to find out the prevalence of cervical rib in the population of Khyber Pakhtunkhwa.

## MATERIALS AND METHODS

It was an observational study of the data carried out over a six month period from August 2019 till January 2020. The data was collected from various private practices of Khyber Paktunkhwa. This study was conducted on 1038 postero-anterior chest radiographs where the patients were investigated for various conditions. The details of the patients regarding age, sex, presence or absence of cervical rib, either on one side or both, and symptoms if any were also collected. The criteria for identifying the cervical rib, that it must adjoin the transverse process of the seventh cervical vertebra and directs horizontally from the spine rather than arising obliquely upward as the transverse process of the first thoracic vertebra. Also, there should be no connection of the rib with the manubrium sterni, however it may fuse with the first rib due to which it can be distinguished from the rudimentary first rib.<sup>5,6</sup>

## RESULTS

A total of 1038 chest radiographs that satisfied the inclusion criteria were examined in the current study. The study included 515 chest x-rays of males and 523 of females, of ages from 15 to 75 years. Out of the 1038 cases, a total of 04 cases (0.38%) were found to be having CR. The frequency of CR among males was found to be 01 (0.09%) and that among females was 03 (0.28%). All variables along with their percentages are shown in Table-1.

Variable	CR frequency	Prevalence
Male (n=515)	01	0.09%
Female (n=523)	03	0.28%
Total (1038)	04	0.38%

Table-1: Frequency and prevalence of cervical rib in males and females

## DISCUSSION

There are twelve pairs of ribs in a normal human body. Occasionally a person may have additional rib arising from mostly the seventh cervical vertebra that is labeled as cervical rib. The cervical rib is considered to be a developmental defect. The genes responsible for the development of axial skeleton are called Hox genes. Mutations in this gene lead to the development of CR.<sup>1</sup> In most of the cases, cervical rib is found accidentally in patients being investigated for certain other conditions. Mostly the patients do not experience any symptoms and hence do not require any treatment. However, in some cases the rib may be responsible for neurological or vascular manifestations in patients. However, these manifestations may also be due to other conditions like prolapse of cervical disc, clavicular fracture, rheumatoid arthritis, kyphosis, scoliosis, etc. Hence, chest x-rays are advised to exclude other causes for the neurological and vascular symptoms.<sup>1,7,8</sup>

In the current study, the prevalence of cervical rib among 1038 patients, who had their chest radiography done in various hospital of Peshawar was 0.38%. This is similar to a study carried out by Brewin et al. which found out that the prevalence of cervical rib in London population was 0.74%.<sup>9</sup> Another study carried out by Ebite et al found the prevalence in Malawian population to be 0.58%.<sup>10</sup> This is similar to a study carried out by Gupta et al in which the prevalence was 0.6%.<sup>11</sup> Our result was in contrast to the study carried out by Erken et al who found the prevalence in Turkish population to be 6.2% which was higher than our percentage.<sup>12</sup> Another study carried out by Bokhari et found the prevalence in Saudi Arabian population to be 3.4%.<sup>6</sup> Another study carried out by Sharma et al found out the prevalence of cervical rib to be 1.22%.<sup>13</sup> In majority of the studies the prevalence of cervical rib was more common in females.

It has been observed in different studies that different regions and various ethnic groups of the world have difference in prevalence of cervical rib.<sup>3,5,9</sup> The patients having symptoms are mostly due to the nerves or blood vessels being pressed by the rib. These symptoms are together called Thoracic Outlet Syndrome. The most common sensory symptom is pain and numbness in forearm and hand. This is mainly due to pressing of nerves of Brachial Plexus by the cervical rib. The patients having vascular effects mostly experience mild staining of hand, claudication, weak distal pulses at wrist and gangrenous changes at tips of fingers. The patients are treated according to the symptoms experienced by them. Initially,

the patients are given conservative treatment to relieve pain by giving them pain killers, muscle relaxants, physiotherapy etc. However, when conservative treatment fails to improve the condition, then treatment plans are switched over to surgical management.<sup>14,15,16</sup>

## CONCLUSION

The prevalence of cervical rib in a population varies largely and has been found to be dependent on ethnicity. In the current study the prevalence was 0.38% and was found mostly in females. As previous researches on cervical rib has shown that occurrence of cervical rib is due to mutations in Hox genes, so more studies need to be planned to confirm this connection. Also, the presence of cervical rib need to be well thought-out in different medical specialties to avert its complications.

## CONFLICT OF INTEREST

None

## AUTHORS CONTRIBUTION

### Conception and design:

Shazia Iftikhar, Zainab Rehman

### Acquisition, Analysis and interpretation of Data:

Shazia Iftikhar, Zainab Rehman, Falak Naz

### Manuscript writing &Approval:

Waqar Ahmed, Parkha Rehman, Mahvish Javed, Shagufta Sultana.

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