

Original Article

Cervical Rib-A Radiological Study In Indian Population

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Abstract

Background: Cervical rib is an extra rib present in neck in 1-2% of population. It is usually unilateral and in some cases bilateral. To determine if a cervical rib is present requires an X-ray. Knowledge of clinical appearance & radiographic characteristics of cervical rib would enable differential diagnosis in and around this area with aim of easier orientation and faster arrival at final diagnosis. In this study the focus is on different types of cervical rib radiographs which has been collected from department of radiology.

Material and Methods: 100 Chest x-rays with apical lordotic views and cervical spine were obtained from Department of Radiology. Complete and incomplete cervical ribs were observed in the study.

Results: Frequency of Cervical ribs in our study matched with the findings of general population.

Conclusion: Cervical rib may be an incidental finding in a small percentage of normal people. It is not necessary for this to cause any symptoms however an occasional patient may have symptoms pertaining to this.

Keywords: Cervical rib, Thoracic outlet syndrome, Brachial plexus

Introduction

A cervical rib is a supernumerary or accessory rib arising from the 7th cervical vertebra. This abnormality occurs in approximately 0.5% of the population and is more common in females than in males. A cervical rib is usually asymptomatic and is the important anatomic rib variant from a clinical view as it can cause thoracic outlet syndrome by compressing the brachial plexus or subclavian vessels. The cervical rib syndrome is usually associated with pain in the hand on elevation of arm, difference in pulse intensity between the two arms and Raynaud phenomenon. Angiography is helpful in the diagnosis and in the evaluation of this syndrome [3].

Radiograph of the chest and cervical spine, including the oblique view is the primary investigation for diagnosis of cervical and anomalous first ribs. Electromyography/nerve conduction velocity studies were performed to diagnose carpal or cubital tunnel syndrome [1].

According to Schein et al., a cervical rib is present in 0.5-0.7% of the population and appears more commonly in fe-

males than males, in a ratio of 2 : 1. The condition is bilateral in about two-thirds of cases, but often the two sides are asymmetrical. Although a cervical rib is a congenital anomaly, it is most often an incidental finding causing no problems. When symptoms do appear they are usually initiated by sagging of the shoulder girdle, thus occurring mainly after the onset of middle age. The main manifestations are either neurological or vascular or both. Sensory function is first disturbed (paraesthesiae, pain, and clumsiness) and later motor function. Signs are most often found in the ulnar nerve distribution, but other nerves may also be involved. Vascular complications usually follow a well-known course. Halstead (as cited by Connell et al. [4]) was the first to report that when an artery is subjected to incomplete pressure an aneurysm develops distal to the point of pressure. This is due to changes in the turbulence of the blood flow. While this aneurysm develops, thrombus formation may occur, which may lead either to multiple small emboli causing eventual gangrene of the distal parts or to eventual total blockage of the subclavian artery [6].

Many vertebrates especially reptiles have cervical ribs as a normal part of their anatomy rather than a pathological condition. Some sauropods had exceptionally long cervical ribs up to 4 meters long. In birds, the cervical ribs are small and completely fused to the vertebrae. In mammals the ventral parts of the transverse processes of the cervical vertebrae are the fused-on cervical ribs. 'Cervical or neck rib' refers to an extra or supernumerary small rib or fibrous band running from the 7th cervical vertebra to the first true rib or

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to the sternum but usually it is present posteriorly up to a short distance. It is usually diagnosed in the middle age group persons though present since birth. The cause is that by middle age, the shoulders start drooping which causes the cervical rib to get depressed and hence compressing the nerve root of the concerned region[10].

The number of cervical vertebrae in mammals is remarkably constant at seven. In other tetrapods, the number of cervical vertebrae varies considerably, and in mammals the number of vertebrae in more caudal vertebral regions is variable as well .Only manatees and sloths have an exceptional number of cervical vertebrae .Despite the extreme evolutionary conservation of the number of cervical vertebrae, intraspecific variation is not uncommon in mammals. The most common variation is represented by ribs on the seventh vertebra, so-called cervical ribs, which can be considered a partial or complete homeotic transformation of a cervical into a thoracic vertebra (involving a change in the activity of *Hox* genes. The strong conservation of the number of cervical vertebrae implies that there must be selection against intra-specific variation of this number. [9].

Material and Methods

100 Chest x-rays with apical lordotic views and cervical spine were obtained from Department of Radiology. Complete and incomplete cervical ribs were observed in the study. The following criteria were used to identify a cervical rib as described by Viertel et al.

1. The rib must abut the transverse process of the 7th cervical vertebra which is seen to project caudally or horizontally from the vertebra, rather than the transverse process of the first thoracic vertebra which extends diagonally upwards from its point of origin.
2. A well-developed cervical rib must be separated from but articulate with the transverse process of C7. If fused with the vertebra and longer than the T1 transverse process, was classified as poorly developed or incomplete.
3. It must have no connection with the manubrium sternum although it may form a synostosis with the first rib thus distinguishing a cervical rib from a rudimentary first rib

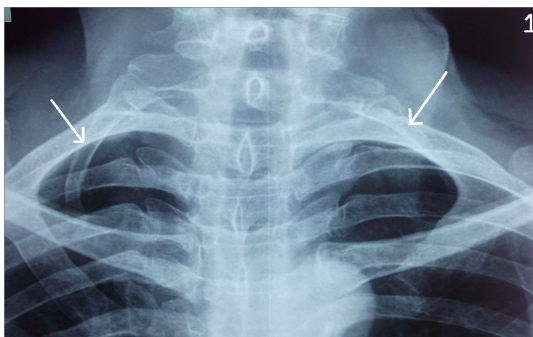
Results

Table 1:

	FREQUENCY OF CERVICAL RIBS OUR STUDY N=100	FREQUENCY OF CERVICAL RIBS IN INDIAN POPULATION %	MALE NO (%)	FEMALE NO (%)
Prevalence of cervical ribs	6	6%	4 %	2%
Bilateral cervical ribs	4	4%	-	-
Unilateral cervical ribs	2	2%	-	-
Complete cervical ribs	2	2%	-	-
Incomplete cervical ribs	3	3%	-	-

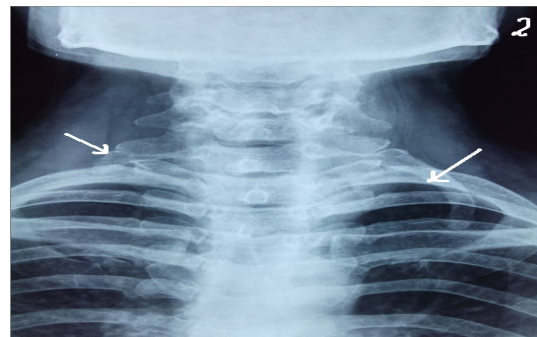
Radiograph 1 shows

Complete cervical rib on right side
Incomplete cervical rib on left side

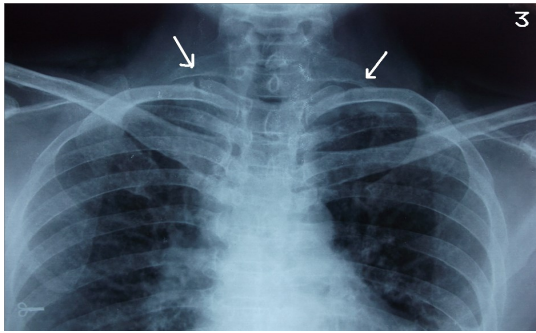


Radiograph 2 shows

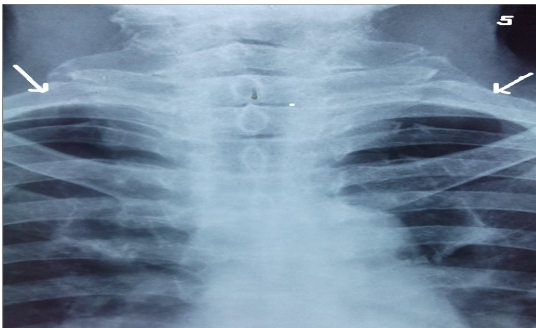
Incomplete cervical rib on right side
Complete cervical rib on left side



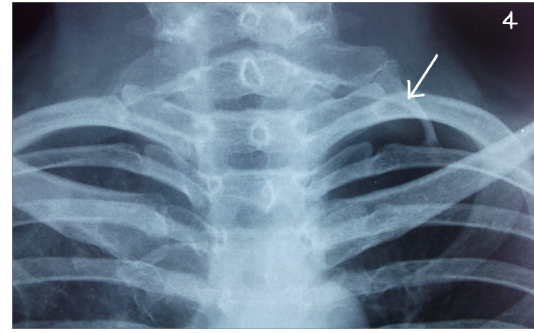
Radiograph 3 shows
Bilateral incomplete cervical rib



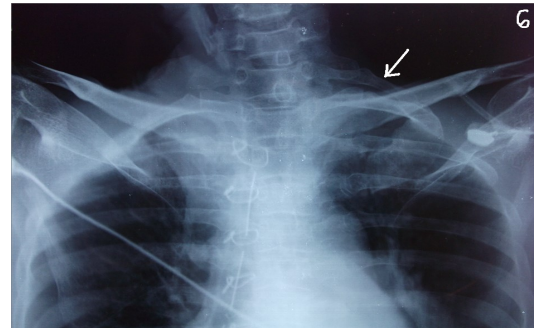
Radiograph 5 shows
Bilateral complete cervical rib



Radiograph 4 shows
Unilateral incomplete left cervical rib



Radiograph 6 shows
Unilateral incomplete cervical rib on left side



Discussion

Cervical ribs are an important cause of neurovascular compression at the thoracic outlet. Previous studies have shown the prevalence of cervical ribs to be between 0.05 and 3%, depending on the sex and race of the population studied. [1]

Cervical rib length was noted in 40 of the 47 operations for neurogenic TOS with cervical ribs in one of the studies. The ribs were 1 to 2 cm in 11 instances, 2 to 5 cm in 17 instances, and complete cervical ribs in 12 instances. Of the 12 complete ribs, three had a true joint at the first rib junction and the other nine had a fibrous attachment to the first rib[2].

Symptoms of cervical rib syndrome included pain in the neck, anterior chest wall, shoulder, arm, elbow, and forearm. The other findings were paresthesia in the fingers usually all five and often worse in the fourth and fifth fingers; occipital headaches; weakness in the hand and arm; aggravation of the symptoms with elevation of the arm; and coldness, color changes, and hand swelling. [2].

The presence of a cervical rib or anomalous first rib, by itself, is not an indication for surgery. Surgery is indicated only in the presence of symptoms that fail to respond to conservative therapy and produce disability. These are the same indications as for patients without rib abnormalities. Cervical ribs are objective findings, which all physicians seek in establishing a diagnosis. However, the surgical success rate for patients with cervical ribs is no better than the surgical success rate for patients with TOS without cervical ribs[2].

Supraclavicular or transaxillary approach can successfully deal with cervical and anomalous first ribs. The supraclavicular approach provides better exposure of the posterior portion of both ribs and allows complete and safer excision of both first and cervical ribs back to the transverse processes. [2].

In neurogenic TOS, the surgical failure rate is similar for patients with or without cervical ribs. Neck trauma was the cause of neurologic symptoms in patients with cervical or anomalous first ribs in 80% of patients, the same incidence rate as in patients without cervical or anomalous first ribs. [2].

Cervical rib with formation of pseudoarthrosis with the 1st thoracic rib causing a slightly tender supraclavicular mass is a relatively rare cause of neck swellings as in one of the case report. [3]

The management of cervical ribs can be medical or surgical depending on symptom and severity. Medical management is in the form of analgesics (NSAIDs) which was chosen by our patient. Surgical management includes rib resection with scalenotomy. [4].

Thoracic outlet syndrome in children is an extremely rare disorder. Isolated fracture of a cervical rib is a very rare entity and usually presents as a painless swelling or as thoracic outlet syndrome. [5,6].

Cervical rib fracture due to heavy backpack usage and blunt trauma is a new occupational hazard. Cervical rib fracture usually presents as a painless swelling or as thoracic outlet syndrome [7,8].

Cervical rib is an important cause of neurovascular compression at the thoracic inlet. Cervical ribs are the anomalies which lie with the lowest cervical vertebra but their relationship to the thoracic inlet syndrome (TIS) is not so constant.[10].

In 1912 Maurice Klippel and Andre Feil were the first to describe congenital fusion of the cervical spine, the Klippel Feil anomaly. An increased rate of cervical rib formation has been found in animals treated with Vigabatrin, butanol, boric acid and retinoic acid. Interestingly, This knowledge may alert the clinician to observe for both these entities in patients that present with either of these diagnoses[11].

Of the 3404 studies included in this study, cervical ribs were found in 2.0% (67/3404). The study included 1414 (41.5%) women and 1990 (58.5%) men. Women were found to have cervical ribs more than twice as often as men, 2.8% (39/1414) versus 1.4% (28/1990). Ninety-four cervical ribs in 67 patients were found. Moreover, 59.7% (40/67) of patients with cervical ribs had a unilateral rib, while the remaining 40.3% (27/67) of patients had bilateral cervical ribs [12].

In an Iranian study population of 170 patients, 94 (55.3%) were females and 76 (44.7%) were males. Evaluation of neurovascular symptoms showed that 14 patients (87.5%) had neurological complications and only 2 patients (12.5%) had vascular complications. In addition, out of total patients with neurological complications, 12 (85.7%) patients were female and all patients with vascular complications were male [13].

In our study prevalence of cervical rib was found to be 6% with higher prevalence in males compared to females. Bilateral cervical ribs were found in 4% of the population and unilateral cervical ribs were found in 2% of the population. Complete cervical ribs were found in 2% and incomplete cervical ribs were found in 3% of the population.

Conclusions

Cervical rib may be an incidental finding in a small percentage of normal people. It is not necessary for this to cause any symptoms however an occasional patient may have symptoms pertaining to this.

The presence of a cervical rib, by itself, is not an indication for surgery in patients with neurogenic TOS. Other indications include failure to respond to conservative therapy and some degree of disability. Surgery should include resection of the first rib and the cervical rib. The results of this study indicates that cervical ribs occurs more commonly in women compared to men and have different prevalence rates in different ethnic populations. Cervical rib is known to be associated with TOS and brachial plexus palsy and brachial plexopathy. Therefore, in patients with TOS symptoms, identifying the cause of these complications is significantly important.

References

1. Brewin J, Hill M, Ellis H. The prevalence of cervical ribs in a London population. *Clin Anat*. 2009; 22:331-6.
2. Sanders RJ, Hammond SL. Management of cervical ribs and anomalous first ribs causing neurogenic thoracic outlet syndrome. *Journal Of Vascular Surgery* 2002;36:51-6.
3. Kurihara Y, Yakushiji YK. The Ribs: Anatomic and Radiologic Considerations. *RadioGraphics* 1999; 19:105-119.
4. Chandak S, Kumar A. Usefulness of 3D CT in Diagnosis of Cervical Rib Presenting as Supraclavicular Swelling of Short Duration. *J Clin Diagn Res*. 2014;8(5):RD01-RD2. doi:10.7860/JCDR/2014/7977.4374
5. Martins RS, Siqueira MG. Cervical rib fracture: an unusual etiology of thoracic outlet syndrome in a child, *Pediatr Neurosurg*, 2007;43(4):293-6.
6. Dar RA, Wani SH, Mushtaque M. Isolated cervical rib fracture: a rare etiology of thoracic outlet syndrome. *Case Rep Surg*. 2011;2011:163792. doi:10.1155/2011/163792.
7. Kamath GS, Borkar S, Chauhan A, Chidanand B, Kashyap N, Warriar R. Isolated cervical rib fracture. *Ann Thorac Surg*. 2010 ; 89:e41-2.
8. Du Toit JG, De Muelenaere P. Isolated fracture of a cervical rib: a case report. *S Afr Med J*. 1982 ;62:454-6.
9. Reumer JW, Ten Broek CM, Galis F. Extraordinary incidence of cervical ribs indicates vulnerable condition in Late Pleistocene mammoths. *Peer J* 2014;2:e318. Published 2014. doi:10.7717/peerj.318
10. Sharma DK, Vishnudutt, Sharma V, Rathore M. Prevalence of 'Cervical Rib' and its association with gender, body side, handedness and other thoracic bony anomalies in a population of Central India. *Indian Journal of Basic and Applied Medical Research*. 2014;3:593-97
11. Tubbs RS, Salter EG, Oakes WJ. Klippel-Feil anomaly with associated rudimentary cervical ribs in a human skeleton: case report and review of the literature. *Folia Morphol (Warsz)*. 2006;65:92-94.
12. Viertel VG, Intrapromkul J, Maluf F, et al. Cervical ribs: a common variant overlooked in CT imaging. *AJNR Am J Neuroradiol*. 2012;33(11):2191-2194. doi:10.3174/ajnr.A3143
13. Dashti G, Ghasemi N. Evaluation of Neurovascular Complication of Ribs. *Anatomical Science* 2015;12:111-114.