

A Radiological Study on Cervical Rib and Associated Chest Wall Anomalies

Khadija Iqbal, Ibad-ur-Rehman, Samra Asif

ABSTRACT

Objective: To reveal the association of cervical rib with chest wall anomalies.

Methods: Observational study conducted at the private radiology clinics Rawalpindi & Islamabad from January 2015 to December 2017, which included Patients coming for X-RAY chest. The patients were selected through convenience sampling. Radiographs were discussed with a consultant radiologist to diagnose the cervical rib and associated anomalies of sternum and rib cage. The age groups were from one to thirty-five years.

Results: The study comprises one hundred and fifty patients. Fifty-eight were female and ninety-two were male patients. The ages of patients were between 10-35 years. The cervical rib was detected in 8.69% male patients and 5.17% female patients. Bifid ribs, Diaphyseal aclasis, fused ribs and Rachitic rosary was found in 1.008% of the cases. No sternal anomaly was detected.

Conclusion: Association of Rib anomalies with cervical rib is more common as compared to sternal and vertebral anomalies.

Key words: Cervical rib, transverse process rib, radiographs

This article may be cited as:

INTRODUCTION

Cervical rib is one of those congenital anomalies which is not very common but is associated with other congenital anomalies [1,2,3]. It can be seen originating from the cervical vertebrae or the first rib in the form of a band [4,5,6]. It is present bilaterally but more common on the right side [3]. It remains unnoticed in some individuals unless it is related to the brachial plexus [7,8]. Pin pricking sensations produced in the arm and forearm can cause disabling pain. Prolonged pressure on the lower trunk of the brachial plexus leads to loss of nerve supply to the small muscles of the hand. Involvement of the subclavian artery can cause ischemia to the muscles of arm and forearm [9]. Many studies have shown that brachial plexus can be compressed beneath the clavicle, close to pectoralis minor and in axilla [3]. A combination of paresthesia's, wasting of muscles or weakness with existing cervical rib is seen thoracic outlet syndrome [4]. In this

syndrome there is compression of nerves and vessels and may cause pain in arm and forearm. The involvement of subclavian artery can lead to ischemic changes in brain and heart leading to life threatening situations [10]. In some case reports interruption with blood supply can lead to attacks of unconsciousness and transient ischemic attacks also occur and lead to diagnose the cervical rib for the first time [11,12,13]. Association of one congenital anomaly with other is quite common [4]. Similar biological processes are controlling the development and so lead to the development of one or more anomalies [7,8]. ribs and sternum develop from the sclerotome compartments of the somites and mesenchymal modifications regulate the developmental process [9,10,11]. The diagnostic tools for identifying the cervical rib are chest X-ray and X-ray of cervical region(neck). Other imaging techniques like MRI scan or CT scan can also help [2]. Special tests called nerve conduction studies may sometimes be suggested [13]. These tests can help to reveal the associated anomalies of vertebral column and sternum with the cervical rib. Objective of this study was also to show the association of sternal and vertebral column variations and anomalies in subjects with cervical rib.

Department of Anatomy, Al Nafees Medical College, Isra University, Hyderabad

Correspondence: Dr Khadija Iqbal

Email: Khadijaiqbal1972@gmail.com

METHODS

An observational study done from January 2015 to December 2017 aiming to include patients coming to these clinics for X-RAY chest. An informed consent was taken to the voluntary participants. The study comprised one hundred and fifty patients. Fifty-eight were female and ninety-two were male patients and were included through the convenience sampling technique. Poor quality x rays were not included in this study. These X-Rays were consulted with a radiologist to detect cervical rib and associated anomalies of sternum

and rib cage. The ages of patients were between 1-35 years.

RESULTS

The cervical rib was detected in 8.69% male patients and 5.172% female patients (Fig1a, b). One case of bifid ribs, Diaphyseal aclasis, fused ribs and Rachitic rosary was found in 1.008%. No sternal anomaly was detected (Fig 2 a,b,c,d).

Table1: Association of cervical rib with sternal and vertebral anomalies

Gender	Cervical rib	Associated anomaly			
		Bifid ribs	Diaphyseal Aclasis	Fused ribs	Rachitic rosary
Male (92)	8 (8.69%)	1.08%		1.08%	1.08%
Female(58)	3 (5.172%)		1.08%		

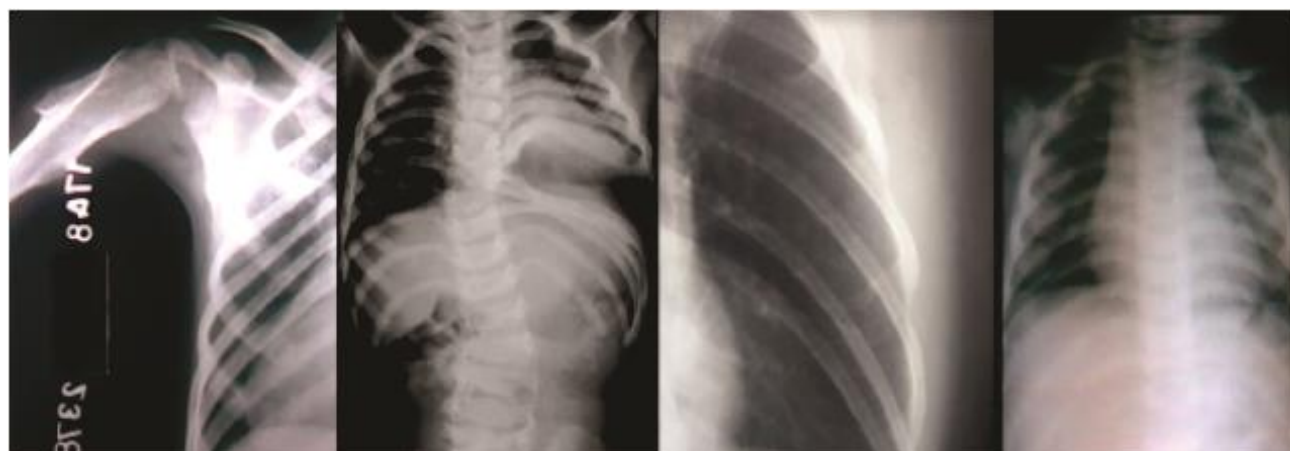


Fig 1 (a): Diaphyseal aclasis (b) fusion of ribs (c) Bifid ribs (d) Rachitic rosary



Fig 2 (a): Bilateral cervical rib (b)Right cervical rib

DISCUSSION

Early Diagnosis of congenital anomalies may save the patients from permanent disabilities and may help in

prevention for the future. Some anomalies are never reported by the patients and they remain undiagnosed. Cervical rib is one such condition which remains

undiagnosed for years although it is a common congenital condition [10]. Prevalence of cervical rib is controversial. In most of studies it is 1-2% of the population [2]. The diagnosis may be confused with carpal tunnel syndrome, cervical disc prolapsed and neuritis of the ulnar nerve supplying part of the forearm and hands [12]. Many cases are reported only when the patient has some discomfort in performing routine work. But now this condition is associated with many other anomalies. Occurrence of Bifid rib has been reported more often in females as compared to males [14]. Ribs were short and underdeveloped in some reports. Sternal variations may encompass different parts of this bone like manubrium was completely fused with body and xiphoid process was double [15]. Diagnosis of cervical rib is associated with other anomalies as is seen in our study. Some interesting reports have been seen in which the cervical rib was discovered with absence of low order ribs commonest being the first and eleventh ribs which were absent. In another study absent eight and tenth ribs on the right side, along with a double faced anterior end of the left sixth rib was observed [16]. Fused posterior ends of right fifth and sixth ribs, and bilateral underdeveloped 12th ribs have also been reported [17]. More abnormalities were discovered on the right than on the left side. In our study, bilateral cervical rib was also observed and out of 8 five cases of cervical rib were also on the right side (Fig. a, b). These findings were consistent with the literature. The detection rate of cervical ribs unilateral as well as bilateral was higher in north Indian population than the previously reported data in available literature [18]. Association of chromosomal abnormalities with Cervical ribs were observed in six fetuses with 45X karyotype [19]. The demonstration of an anomaly of axial skeleton development adjacent to the developmental field of structures that are frequently abnormal in 45, X is interesting for several reasons [20]. An association between cervical ribs and some childhood malignancies has been described with the tumors of neural crest-derived tissues [21]. Malformed, short and defective ribs are also one of the least common structural congenital abnormalities of the ribs. In our study, these were not found but one case of bifid rib and one case of fused ribs were found [22]. In past studies, sternal variations have also been found frequently in association with cervical rib but in our study no sternal variation was found. In other studies, following types of sternal variations have been found. Suprasternal bone,

suprasternal tubercle, manubriosternal fusion, complete sterno xiphoidal fusion, sternal foramen and sternal sclerotic band [17]. In our study one case of Rachitic rosary and Diaphyseal achalasia were also found in addition to cervical rib (Fig 2a,d). In addition to defective skeletal maturation vitamin D deficiency is a cause which leads to severe muscle weakness and muscle aches and pains, which can have devastating consequences to the child health [23]. The association of diaphyseal aclasis and neurofibromatosis with malignant neoplasms has been variously reported [24]. Cervical rib and these anomalies are quite rare but in our study, these have been reported. Congenital vertebral anomalies include alterations of the shape and number but these were also not seen in our study.

CONCLUSION


Association of Rib anomalies with cervical rib is more common as compared to sternal and vertebral anomalies.

REFERENCES

1. Sanders RJ, Hammond SL. Management of cervical ribs and anomalous first ribs causing neurogenic thoracic outlet syndrome. *J Vasc Surg* 2002 Jul;36: 51-6.
2. Wise R. Seventh cervical rib associated with subclavian artery occlusion and multiple infarcts: case report. *J Neurosci Nurs*. 2008 Jun;40(3):169-72.
3. Morbidelli A, Miani S, Bortolani E. Complete cervical rib. Possible neurovascular implications of the upper limb. *Minerva Chir*. 1989 Apr 15;44(7):1167-72.
4. Merks JHM, Smets AM, Van Rijn RR, Kobes J, Caron HN, Maas M. et al. Prevalence of rib anomalies in normal Caucasian children and childhood cancer patients. *Eur J Med Gen* 2005 Apr-Jun;48:113-29.
5. Plaza Aulestia N, Rodríguez Montero S, Velloso Feijoo ML. Double cervical rib: A case report. *Reumatol Clin*. 2017 Jul;31. pii: S1699-258X(17)30175-4.
6. Song WC, Kim SH, Park DK, Koh KS. Bifid rib: anatomical considerations in three cases. *Yonsei Med J* 2009 Apr;50: 300-3.
7. Kamano H, Ishihama T, Ishihama H, Kubota Y, Tanaka T, Satoh K. Bifid intrathoracic rib: A case report and classification of intrathoracic ribs. *Intern Med* 2006;45:627-30.
8. Chang KZ, Likes K, Davis K, Demos J, Freischlag JA.

- The significance of cervical ribs in thoracic outlet syndrome. *J Vasc Surg.* 2013 Mar;57(3):771.
9. Samarasam I, Sadhu D, Agarwal S, Nayak S. Surgical management of thoracic outlet syndrome: a 10-year experience. *ANZ J Surg.* 2004 Jun;74:450–4.
 10. Sanders RJ, Hammond SL, Rao NM. Diagnosis of thoracic outlet syndrome. *J Vasc Surg.* 2007 Sep;46:601–4.
 11. Pollack EW. Surgical anatomy of the thoracic outlet syndrome. *Surg. Gynecol Obstet.* 1980 Jan;150:97–103.
 12. Khan A, Rattihalli RR, Hussain N. Bilateral thoracic outlet syndrome: An uncommon presentation of a rare condition in children. *Ann Indian Acad Neurol.* 2012 Oct;15(4):323-5. doi: 10.4103/0972-2327.104349.
 13. Yekeler E, Tunaci M, Tunaci A, Dursun M, Acunas G. Frequency of sternal variations and anomalies evaluated by MDCT. *AJR Am J Roentgenol.* 2006 Apr;186(4):956-60.
 14. Verna E, Piercecchi-Marti MD, Chaumoitre K, Bartoli C, Leonetti G, Adalian P Discrete traits of the sternum and ribs: a useful contribution to identification in forensic anthropology and medicine. *J Forensic Sci.* 2013 May;58(3):571-7.
 15. Yekeler E, Tunaci M, Tunaci A, Dursun M, Acunas G. Frequency of sternal variations and anomalies evaluated by MDCT. *AJR Am J Roentgenol.* 2006 Apr;186(4):956-60.
 16. El-Busaid H, Kaisha W, Hassanali J, Hassan S, Ogeng'o J, Mandela P. Sternal foramina and variant xiphoid morphology in a Kenyan population. *Folia Morphol (Warsz).* 2012 Feb;71(1):19-2.
 17. Macaluso PJ Jr, Lucena J. Estimation of sex from sternal dimensions derived from chest plate radiographs in contemporary Spaniards. *Int J Legal Med.* 2014 Mar;128(2):389-95.
 18. Kjaer I, Fischer-Hansen B. Cervical ribs in fetuses with Ullrich-Turner syndrome. *Am J Med Genet* 1997;71:219– 221. 5.
 19. Rushton DI, Faed MJW, Richards SEM, Bain AD. The fetal manifestations of the 45XO karyotype. *J Obstet Gynaecol Br Cwlt* 1969;76:266–272.
 20. Chandrakanth HV, Kanchan T, Krishan K, Arun M, Pramod Kumar GN. Estimation of age from human sternum: an autopsy study on a sample from South India. *Int J Legal Med.* 2012 Nov;126(6):863-8.
 21. Weaver AA, Nguyen CM, Schoell SL, Maldjian JA, Stitzel JD mage segmentation and registration algorithm to collect thoracic skeleton semiland marks for characterization of age and sex-based thoracic morphology variation. *Comput Biol Med.* 2015 Dec 1;67:41-8.
 22. Ramadan SU, Türkmen N, Dolgun NA, Gökharman D, Menezes RG, Kacar M, Koşar U. Sex determination from measurements of the sternum and fourth rib using multi slice computed tomography of the chest. *Forensic Sci Int.* 2010 Apr 15;197(1-3):120.
 23. Rajakumar M. Vitamin D, Cod – Liver Oil, Sunlight, and Rickets: A historical Perspective. *Pediatrics* 2003;112(2):e132-e135 4.
 24. Tsirikos AI, Ramachandran M, Lee J, Saifuddin Assessment of vertebral scalloping in neurofibromatosis type 1 with plain radiography and MRI. *Clin Radiol.* 2004; 59(11):1009-17.

AUTHORSHIP AND CONTRIBUTION DECLARATION

No	Author Name	Contribution to paper	Signature
1	Principal author Khadija Iqbal	Introduction, material and methods, discussion	
2	Second Author Ibad-ur-Rehman	Data collection and conclusion idea	
3	Third Author Samra Asif	Abstract, references, formatting	