

**Original article:**

## **Prevalence of 'Cervical Rib' and its association with gender, body side, handedness and other thoracic bony anomalies in a population of Central India**

**DK Sharma, Vishnudutt, Vandana Sharma, Mrithunjay Rathore**

Name of the Institute/college: Department of Anatomy , All India Institute of Medical Sciences (AIIMS), Raipur, Chhattisgarh, India

**Corresponding author:** Dr. DK Sharma ; Email id: dhyanesh.sharma@gmail.com

---

### **Abstract**

Objectives of this study were to see the prevalence of cervical rib in people of Central India and its association with gender, body sides, handedness and other thoracic bony anomalies; and correlate with the studies already reported. Total 5000 consecutive plain radiograms of chest of patients (2500 males and 2500 females directed by various departments) were examined in the Department of Radiology, Pt. J. N. M. Medical College, Raipur during January to September 2013. Skiagrams of persons below 15 years of age, belonging outside the Central India and with obvious pathology obstructing the bony shadows to be examined, were excluded from the study. We found 61(1.22%) persons with cervical rib among 5000, out of which 22 (0.44%) bilateral and 39 (0.78%) unilateral, so statistically there was a little unilateral predominance. Overall and unilateral incidences were little more common in males (M-0.68% : F-0.54% and M-0.48% : F-0.3%) whereas bilateral incidence was little more common in females (M-0.2 : F-0.24), however these associations were statistically insignificant. Unilateral cases showed little predominance towards males and left side but statistically it was not evident. Amongst 61 persons with cervical rib only 3 were left handed and rest right handed. All 3 left handed (1 male and 2 females) presented cervical rib on their right side. Any association between the presence of cervical rib and other thoracic bony anomalies could not be established except parallel finding of 'elongated transverse process of 7th cervical vertebrae' in 2 cases with right sided cervical rib and 'thoracic scoliosis' in other 2 cases, one with bilateral and another with left sided cervical rib. Conclusively the study drew attention towards little higher prevalence of cervical rib (1.2%) than general claims for Indians (less than 1%) with its little more unilateral predominance but no any association with gender, body sides, handedness and other thoracic bony anomalies in Central Indian Population.

**Keywords :** Supernumerary, Compression, Neurovascular

---

### **Introduction**

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 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. 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. Perhaps no more than 10% of people who have cervical ribs develop TIS and the syndrome may well occur in the absence of ribs.<sup>1</sup> Diagnosis may be difficult, as a fibrous band that acts like a rib but if not calcified, it is not seen on skiagrams. There is also considerable controversy in the literature as to whether the condition actually exists. Some authors claim that it is under-diagnosed whilst others say that it is over diagnosed.<sup>2,3</sup>

Cervical ribs or fibrous bands are just one feature that predisposes to narrowing and compression at the outlet. Poor posture, shoulders droop and large breasts etc can cause the thoracic inlet to narrow and compress the neurovascular structures.<sup>4</sup> Trauma at inlet, fracture of clavicle, excessive callus, hematoma or pseudo aneurysm, sleep disorder, estrogen or thyroid deficiency, inflammatory disease including rheumatoid arthritis, fibromyalgia, kyphosis and scoliosis, thrombosis, embolism and nerve entrapment in other places can cause this syndrome too. It is necessary to exclude thrombosis, embolism and nerve entrapment in other places. This includes Pancoast's syndrome, where lung cancer infiltrates the brachial plexus. Paget-Schrötter syndrome is thrombosis of the subclavian vein following heavy exercise of the upper limb.<sup>5</sup> X-ray, MRI and CT can distinguish cervical rib or fibrous band, elevated first ribs due to tight anterior or middle scalene muscles, displaced fractures of clavicle, non-union and excessive callus, cervical spine degenerative, malignant lesion in the chest, degenerative spurs, herniated discs or other causes. Doppler and plethysmography studies can show impediment of blood flow. Occlusion can occur in

normal subjects but is unusual and is not related to age.<sup>6</sup> Objectives of this study were to see the prevalence of cervical rib in people of Central India and its association with gender, body sides, handedness and other thoracic bony anomalies; and correlate with the studies already reported.

#### **Material and methods**

The authors carefully examined the total 5000 plain skiagrams of chest of 2500 males and 2500 females of Central India who underwent this investigation in the Department of Radiology Pt. J. N. M. Medical College Raipur during period from January to September 2013. X-rays of persons below 15 years of age and belonging outside the Central India were excluded from the study. The skiagrams with obvious pathology obstructing the bony shadows to be examined were also excluded from the study. The age, sex and presence of unilateral or bilateral cervical ribs were noted. Persons with cervical rib were re-examined for their handedness and any other associated bony deformity of thorax. Chi-square / Fisher's exact tests were used with statistical setting at  $P < 0.05$ . The observation findings were tabled, analyzed and finally correlated with the previous studies.

#### **Observations and Results**

We found 61(1.22%) persons with cervical rib among 5000, out of which 22 (0.44%) bilateral and 39 (0.78%) unilateral so statistically there was a little unilateral predominance.

Overall and unilateral incidences were little more common in males (M-0.68% : F-0.54% and M-0.48% : F-0.3%) whereas bilateral incidence was little more common in females (M-0.2 : F-0.24), however these associations were statistically insignificant. Unilateral cases showed little predominance towards males and left sides but statistically it was not evident. Among 61 persons with cervical rib only 3 were left handed and rest

right handed. All 3 left handed (1 male and 2 females) presented cervical rib on their right side, so association of cervical rib with the handedness was also statistically insignificant.

Any association between the presence of cervical rib and other thoracic bony anomalies could not be

established except parallel finding of 'elongated transverse process of 7th cervical vertebrae' in 2 cases with right sided cervical rib and 'thoracic scoliosis' in other 2 cases, one with bilateral and other with left sided cervical rib.

**Table No 1-** Shows the various parameters undertaken for the study

Cases with cervical rib	Total	Males= Rt handed+Lt handed	Female= Rt handed+Lt handed	Right side	Left side
Overall	61	34=33+1	27 = 25+2	#	#
Bilateral	22	10	12	#	#
Unilateral	39	24	15	17	22
Unilateral right-side	17	11	06	17	#
Unilateral left- side	22	13	09	#	22

### Discussion

It is believed that anatomical variation cervical ribs or fibrous bands can cause narrowing of the supracostoclavicular space and render the adjacent nerves more susceptible to external trauma. In brachial plexus pathology in infants, cervical ribs may aggravate the mechanism of injury in two ways, firstly by stretching the nerves around the cervical rib and secondly by concentrating pressure on the nerve roots when the shoulder region is forced against the cervical spine.

A cervical rib is present in only about 1 in 500 (0.2%) of people and in rare cases an individual may have two cervical ribs.<sup>7</sup> It is under scientific debate to what degree children born with cervical ribs develop early childhood cancer at a higher rate than the general population. The *Hox* genes that control the development of cervical vertebrae are believed to play a role in suppressing cancer. 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. The prevalence of cervical rib in a population of London was 0.74% with a higher rate in females than males (1.09%:0.42%) and of elongated C7 transverse processes 2.21% again with higher rate in females than males (3.43%:1.13%).<sup>8</sup> Values in the control population were generated for the occurrence of six major rib anomaly categories; cervical rib in 6.1%, aplasia in 6.6%, lumbar ribs in 0.9%, bifurcations in 0.7%, synostosis-bridging in 0.3%, and segmentations nil. In childhood cancer patients a significantly higher prevalence of cervical rib anomalies was demonstrated in patients with acute lymphoblastic leukemia, astrocytoma, and germ cell tumors.<sup>9</sup> Rakan F Bokhari et al claimed a higher prevalence of cervical rib as 3.4% with female male ratio 2.01:1 and prevalence of elongated transverse process of 7th cervical vertebra as 23% in a population in Jeddah, Saudi Arabia.<sup>10</sup> Cervical rib prevalence in Indian population around Lucknow UP was 0.6% with bilateral predominance. Here female male incidences were in ratio of

0.73%:0.49%. Unilateral incidence was more on the left side in males and on the right side in females.<sup>11</sup> 0.2 to 0.7% population has an additional cervical rib, more common in females than males in ratio of 2:1.<sup>12,13,14</sup> Prevalence rate of cervical rib was less than 0.5% in general population with unilateral and left side predominance.<sup>15</sup> Musculoskeletal sonography may offer a reliable method for diagnosing cervical ribs without the need for ionizing radiation.<sup>16</sup>

We found 61(1.22%) persons with cervical rib among 5000, out of which 22 (0.44%) bilateral and 39 (0.78%) unilateral, so statistically there was a little unilateral predominance. Overall and unilateral incidences were little more common in males (M-0.68% : F-0.54% and M-0.48% : F-0.3%) whereas bilateral incidence was little more common in females (M-0.2 : F-0.24), however these associations were statistically insignificant. Unilateral cases showed little predominance towards males and left sides but statistically it was not evident. Our finding overall prevalence (Unilateral and bilateral) of cervical rib 1.22% is more than the result of Galis F, Brewin J et al, Antima Gupta et al, Schein CJ et al and Kurihara Y et al, but less than the finding by Merks JH et al and Rakan F Bokhari et al. We did not find any correlation with the result of gender and body side association of cervical rib, claimed by Rakan F

Bokhari et al, Antima Gupta et al and Cornell JL et al.

European studies have reported an increased prevalence of cervical ribs in patients with childhood cancer, and in stillborn fetuses. A study at Primary Children's Medical Center, Utah between 2006 and 2009 on 225 stillborns ( $\geq 20$  weeks) showed significant associations with cervical ribs. The overall prevalence of cervical ribs was 43.1% with no statistically significant association with gender or congenital anomalies. They claimed to support the hypothesis that cervical ribs are markers for disadvantageous developmental events occurring during blastogenesis and have been subject to strong negative selection during evolution.<sup>17</sup> Present study felt considerable controversy in the literature as to whether the condition actually existed, as some authors claimed that it is under-diagnosed whilst others said that it is over diagnosed.

### Conclusion

In conclusion, the study drew attention towards higher prevalence of cervical rib (1.2%) than general claims for Indians (less than 1%) with its little higher unilateral predominance but no association with gender, body sides, handedness and other thoracic bony anomalies in Central Indian Population.

### References

1. Leffert RD. Thoracic outlet syndromes. *Hand Clin.* 1992 May; 8(2):285-97.
2. Roos DB. Thoracic outlet syndrome is under diagnosed. *Muscle Nerve.* 1999 Jan; 22(1):126-9, 137-8.
3. Wilbourn AJ. Thoracic outlet syndrome is over diagnosed. *Muscle Nerve.* 1999 Jan;22(1):130-6,136-7.
4. Urschel HC, Kourlis H. Thoracic outlet syndrome: a 50-year experience at Baylor University Medical Center. *Proc (Bayl Univ Med Cent)* 2007 Apr; 20(2):125-135.
5. Feugier P, Chevalier JM. The Paget Schroetter syndrome. *Acta Chir Belg.*2005May-Jun;105(3):256-64.

6. Colon E, Westdorp R. Vascular compression in the thoracic outlet. Age dependent normative values in noninvasive testing. *J Cardiovasc Surg (Torino)*. 1988 Mar-Apr; 29(2):166-71.
7. Galis F. "Why do almost all mammals have seven cervical vertebrae? Developmental constraints, Hox genes, and cancer". *J. Exp. Zool.* 1999; 285 (1): 19–26.
8. Brewin J, Hill M, Ellis H. The prevalence of cervical ribs in a London population *Clin Anat.* 2009 Apr; 22(3):331-6.
9. Merks JH, Smets AM, Van Rijn RR, Kobes J, Caron HN, Maas M, Hennekam RC. Prevalence of rib anomalies in normal Caucasian children and childhood cancer patients. *Eur J Med Genet*, Vol. 48, No. 2. (n 2005), pp. 113-129.
10. Rakan F Bokhari, Mohammad J Al-Sayyad, Saleh S Baesa. Prevalence of cervical ribs and elongated transverse processes in Saudi Arabia, *Saudi medical journal (impact factor: 0.52)*. 01/2012; 33(1):66-9.
11. Antima Gupta, Gupta DP, Saxena DK, Gupta RP, Cervical Rib: It's Prevalence in Indian Population around Lucknow (UP). *J. Anat. Soc. India* 2012 Dec 61(2) 189-191
12. Schein CJ, Hamovici H and Young H. 'Arterial thrombosis associated with cervical rib: Surgical consideration' *Surgery* 1956 Vol.40 no.2: pp428-443.
13. Kurihara Y, Yakushiji YK and Matsunoto J. The ribs: anatomic and radiologic consideration, *Radiologic Jan* 1999, 19 (1) pp105-119.
14. Cornell JL, Doyle JC and Gurry JF. 'The vascular complication of cervical ribs' *Australian and New Zealand Journal of Surgery* 1980 Vol.50 no.2: 125-130
15. Lee McGregor's synopsis of surgical anatomy: Peripheral nerves, 3rd Indian reprint 1999, Varghees publishing house, Dadar Bombay, pp383-384.
16. Mangrulkar VH, Cohen HL, Dougherty D. Sonography for diagnosis of cervical ribs in children. *J Ultrasound Med.* 2008 Jul; 27(7):1083-6.
17. Larissa VF, Harshwardhan MT, Lance KE, Brian HS, John O. Cervical Ribs are More Prevalent in Stillborn Fetuses than in Liveborn Infants and are Strongly Associated with Fetal Aneuploidy. *Pediatric and Developmental Pathology*. June 28, 2011: 10.2350/11-01-0974-OA.

Date of submission: 22 January 2014

Date of Provisional acceptance: 05 February 2014

Date of Final acceptance: 27 February 2014

Date of Publication: 04 March 2014

Source of support: Nil; Conflict of Interest: Nil