

# PREVALENCE OF CERVICAL RIBS IN A SAUDI POPULATION

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## ABSTRACT :

Cervical rib was the first aetiological factor to be described in thoracic outlet syndrome. Symptomatic compression of the neurovascular structures constitutes an indication for treatment. Prevalence of cervical rib in Saudi Arabia has not been previously reported. The present clinico-radiological reports a high prevalence rate in a Saudi population in the Makkah region. Of 1,300 chest radiographs of patients attending the outpatient clinics, cervical ribs were found in 25 (1.9%) and an elongated transverse process in 2 (0.15%). 76% were bilateral and 74% in females. Eleven of the 25 responded for review in a vascular clinic. Of these, 9 were symptomatic. Neurogenic compression was demonstrated in 9 and vascular compression in the other 2. Radiologists and physicians should be cogniscent of the higher prevalence of symptomatic cervical rib in the Gulf region.

## INTRODUCTION

Thoracic outlet syndrome consists of distinct symptom complexes in the neck and upper limb that are caused by compression of the brachial plexus, subclavian artery or vein as they pass over the apex of the lung through the thoracic outlet and costoclavicular space<sup>(1)</sup>. Symptoms vary depending on which structure is compressed. Coote (1861) first recognized that pressure on the brachial plexus in the root of the neck caused paraesthesiae in the hand<sup>(2)</sup>. Less than two decades later, Sir James Paget (1875) and von Schotter (1884) described venous compression by a cervical rib<sup>(3)</sup>. The term Paget-Schotter syndrome was coined. Since then, various other terms have been used until 1958 when Rob and Standeven also described arterial compression and introduced the term "thoracic outlet syndrome<sup>(4,5)</sup>."

Cervical rib was one of the first aetiological factor to be described in the literature<sup>(1)</sup>. Roos identified ten different types of anomalies including various types of cervical ribs<sup>(6)</sup>. If the presence of a cervical rib is documented in a patient with symptoms its excision is usually recommended<sup>(7,8)</sup>.

## SUBJECTS AND METHODS

Over 10 months period (excluding Haj months), starting in February 1994, one consultant radiologist (K.E.) reviewed the thoracic outlet x-ray films of 1300 adult candidates who attended the outpatient departments of Al Noor Specialist Hospital in Makkah, Saudi Arabia. These films were obtained especially for the purpose of this study, looking for the presence of cervical ribs (including elongated C7 transverse process, incomplete or full rib). All patients with evidence of a cervical rib were invited to attend the vascular clinic for further clinical evaluation by a member of the vascular team (H.Z. or A.A.). Among the 1300 x-ray films reviewed, 27 (2.0%) films were considered positive, however, only 11 patients have completed our study. This included detailed history and physical examination of (TOS) neurogenic and vascular manifestations. The neurological manifestations included paraesthesia, weakness, headache and the Elevated Arm Stress Test (EAST) as described by Roos<sup>(9)</sup>. In this regard, patients were further classified into 3 categories according to their symptomatology and distribution of neurological deficits: Patients with upper plexus symptoms, lower plexus symptoms or both<sup>(9)</sup>. Similarly, patients with vascular manifestations were categorized into patients with primarily arterial and/or venous complications. Vascular tests included Adson's maneuver<sup>(7)</sup>, Raynaud's phenomenon, digital ulceration, temperature changes and swelling on prolonged dependency of the limb. Blood pressure was measured and compared in both upper limbs followed by palpation of pulses. All patients studied underwent full blood count, blood chemistry and serology

tests followed by electromyogram (EMG). Angiography was considered in confirming the diagnosis in the vascular cases. All of the symptomatic patients with neurological manifestations were referred for a conservative 3-6 months programme which included weight reduction, physical therapy directed at shoulder girdle strengthening. Surgical removal of the rib was considered in all symptomatic patients who failed conservative measures or had evidence of vascular compression.

## RESULTS

Among the 1300 chest x-ray film reviewed, only 27 films (2.0%) were considered positive as they demonstrated the presence of cervical ribs in 25 (1.9%) patients and elongated transverse cervical process in the remaining two patients (0.15%). Twenty (74.0%) of the affected group were females and only seven were males (26.0%). In the cervical rib group (n = 25), 19 (76.0%) patients had evidence of bilateral ribs compared to 6 (24%) unilateral ribs. The latter was distributed equally on both sides. The total number of cervical ribs was therefore 44 ribs. Most of them were complete ribs (n = 29) articulating with the first rib (Figure 1). The length of the rib was measured and only 13 (29.5%) were considered long cervical ribs  $\geq 4.5$  cm.

Only 11 (40.7%) patients of the positive 27 cases attended for further evaluation and completed the study. Most (n = 9) were obviously symptomatic 81.8%. In the studied 11 cases, there were only two males (18.1%) and the remaining were females. The mean age of the whole group was 42.0 years (range 27-65 years). Nine patients were symptomatic (81.8%) and 5 of them had significant pain. In 10 (90.9%) patients a supraclavicular bony lump was easily detected. Motor deficits were found in 7 patients (63.6%). Lower plexus syndrome slightly predominated (n = 5) compared to 4 patients with upper plexus symptoms and one patient had combination of both. All the 9 symptomatic patients had therefore, evidence of neural compression. In addition 2 of the symptomatic patients had also vascular compression (18.1%). Although 3 patients had

positive Adson's test, only one patient had a bruit and was subjected for arteriography which was within normal limits. One case had evidence of venous impairment demonstrated by the congested swollen upper limb. Patient was not keen to be studied by venography. The EMG was negative in all cases except one. All the symptomatic cases were sent for the physiotherapy. The study is still going on to evaluate their response to conservative management.

## DISCUSSION

Anatomic variation at the region of the thoracic outlet has intrigued surgical anatomist from early descriptions of supernumerary ribs to modern studies of ultrastructural changes in the scalene muscles<sup>(10)</sup>. During development the C7 rib forms then regresses to the C7 transverse process. Various stages in this evolution range from a complete C7 rib to rudimentary forms associated with a fibrocartilaginous band<sup>(11)</sup>. The only radiologic indication of this residual band may be an enlarged C7 transverse process<sup>(2)</sup>. Among the several aetiological anomalies described in the literature<sup>(1,13)</sup>, a cervical rib with its various types represents an anomaly which was recognized more than a century ago and can be easily detected by a simple chest x-ray film (Figure 2). However, a thoracic outlet view may be needed in difficult cases. We choosed this modality of investigation as a screening test to identify the prevalence of cervical ribs in our Saudi population. Our prevalence rate of cervical rib was higher than reported prevalence rates in similar studies of the literature. We encountered 19.2 cases per thousand or (1.9%) compared to rates ranging between 0.17 - 1.0%<sup>(14,15,16)</sup> (Table 1). This variation in prevalence rates may be attributed to many factors including the genetic inheritance, the quality of the x-ray film and perhaps the experience of the radiologist. To overcome these deficiencies, all of the films in our study were interpreted by a consultant radiologist and therefore this may explain the slightly higher detection rate. Otherwise, the pattern of cervical ribs were not different with regard to the sex of affected patient and the



side/sides involved. Only 7 patients (26.0%) were males which is similar to other studies where men were affected in 28% of Mayo clinic study and 23.2% in the Russian study<sup>(5,15,16)</sup>. The vast majority of our cases were females (74.0%). In this series most ribs were bilateral (76.0%) which is similar to other studies in literature<sup>(15,16)</sup>. In contrast to Adson series who found left sides cervical ribs in 30% and 23% of right sided cervical ribs, our rate on both sides did not amount to that prevalence rate (12.0%) on each side. The mean age of the positive studied cases was 42.0 years. Similar to the others<sup>(5)</sup>, cervical ribs occurred in this series in young and middle-aged adults.

We noted that ten out of the eleven patients who attended our clinic were symptomatic. One may assume that the others who did not turn up for further evaluation were asymptomatic and therefore they were not bothered to respond to our invitation. In this case, (36.0%) of the 25 detected cases were symptomatic compared to rates of 5-10% mentioned in the literature<sup>(17)</sup>. We also noted as has been reported elsewhere<sup>(5,13,18)</sup>, that most of our cases had neurological manifestations as it occurred in 7 cases (63.6%) compared to only 2 cases who had evidence of vascular compression (1 venous, 1 arterial). The vascular complications are almost always confined to complete ribs<sup>(8)</sup>.

Brown and Charlesworth<sup>(8)</sup> found cervical ribs to be palpable in 15 out of 18 symptomatic cases they reported. Similarly, in most of our cases we could feel a bony lump in the supraclavicular region (n = 10). We believe, as the other authors do, that plain

thoracic outlet x-ray is diagnostic of the cervical rib in all cases<sup>(5,8)</sup>. Furthermore, other tests like Adson, (E.A.S.T.) or E.M.G. are of limited value in diagnosing and managing these anomalies. While the excision of a demonstrable cervical rib in a severely symptomatic patient is well accepted treatment<sup>(8)</sup>, surgical intervention based on clinical assessment is controversial<sup>(19,20)</sup>.

In view of the above mentioned high prevalence rate, we encourage our G.P.'s and radiology colleagues to search for the evidence of these anomalies in all young and middle-aged adults particularly women whenever the patient had a chest x-ray film. Early detection followed by referral of symptomatic cases to a vascular surgeon and/or neurologist will prevent some of the potential rare but serious vascular complications. Certainly, diagnosis of these cases depend on high index of suspicion and proper interpretation of radiology film. Unlike the other aetiological anomalies of T.O.S., surgical excision of a documented cervical rib in symptomatic patient is not debatable.

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**Table 1. Prevalence rates of cervical ribs in various literature studies**

Author	Country	Percentage
Etter et al <sup>(14)</sup>	U.S.A.	0.17 %
Adson <sup>(15)</sup>	U.S.A.	0.56 %
Haven <sup>(15)</sup>	U.S.A.	0.74 %
Firsov <sup>(16)</sup>	Russia	0.27 %
Al Zahrani, et al	K.S.A.	1.9 %

## LEGEND

**Figure 1 :** Schematic drawing of (a) a complete cervical rib articulating with first thoracic rib, and (b) an incomplete cervical rib connected to first rib by residual fibrocartilaginous radiolucent band. (Abbreviations : C7: Body of the seventh cervical vertebra, F: First rib, S: Sternum).

**Figure 2 :** Chest roentengogram demonstrating (a) a well-formed bilateral cervical ribs (arrow). (b) incomplete rib (c) elongated transverse process.