

EVALUATION OF CORRELATION BETWEEN CERVICAL RIB AND CERVICAL PLEXOPATHY: A PROSPECTIVE STUDY OF CLINICAL AND RADIOLOGICAL DIAGNOSIS, MANAGEMENT AND OUTCOMES

Research Article Orthopaedics

Rajendraprasad Butala¹, Vinit vimal Karn², Dynaesh Patil³, Piyush Ranjan Singh⁴

¹ - Associate Professor, Department of Orthopaedics & Trauma, Dr. D.Y Patil Medical College & Hospital, Navi Mumbai

² - Registrar, Dr. D.Y Patil Medical College & Hospital, Navi Mumbai

³ - Assistant Professor Department of Physiotherapy, Dr. D.Y Patil Medical College & Hospital, Navi Mumbai

⁴ - Junior Resident, Department of Orthopaedics & Trauma, Dr. D.Y Patil Medical College & Hospital, Navi Mumbai

Corresponding Author:

Dr Vinit Vimal Karn
Registrar, Dr. D.Y Patil Medical College & Hospital,
Navi Mumbai
Email: drvinitkarn@gmail.com

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Abstract:

Introduction: A prospective study was conducted in the department of Orthopaedics & Traumatology in D.Y Hospital, Navi Mumbai from November 2014 to October 2016 to evaluate the correlation between cervical rib and cervical plexopathy and to study clinical and radiological diagnosis, its management and outcomes.

Materials & Methods: Approximately 500 patients with Cervical spine pain and sign and symptoms suggesting cervical rib were screened, out of which 55 patients were evaluated during our study with long follow of 1 year. Pain in cervical region with radiculopathy bilaterally or one sided with paraesthesia, numbness, pain over upper scapular region were the symptoms which was considered before screening the patients. All the symptomatic patients were subjected to x-ray cervical spine AP and lateral with first thoracic vertebra and cervical ribs were confirmed. Treatment was both medical and physiotherapy and personal counseling. Neck instability index was used to evaluate pre treatment and post treatment scores (Minimum to maximum score 0- 50 points).

Results: Out of 55 patients 4 were lost in follow and one was operated where cervical rib excision was done. Maximum patients were in age group of 35-45 years contributing to 68%. There were 31 female (62%) and 19 males (38%). Cervical rib was right sided in 8 (16%) cases, bilateral in 38(76%) cases, left sided in 4 (8%) cases. Bilateral symptoms were seen only in 9 patients (24%), however right sided symptoms were

present in 28 (62%) patients. Left sided symptoms were few in 7 cases. Maximum subjects were housewife approximating 52% followed by labourer class amounting 36 %. Cervical rib incidence was high among household, parous females and mechanical labourers and though prevalence of bilateral cervical ribs is more among general population, symptoms of plexopathy was found more common in right side. Neck instability index pre treatment reduced drastically from 42.5 to value of 8.7 and VAS score from average 76.5mm to 8.5mm.

Conclusion: Arriving at definitive diagnosis is more important as management for cervical spondylosis is different as compared to cervical rib or elongated transverse process. The key to management is to begin with NSAID'S and Pregabalin (as per patient tolerance) and Methylcobalamine to control radiculopathy and physiotherapy concerned with shoulder and neck muscle strengthening plus patient education pertaining to cervical rib and elongated C7 cervical process with life style modifications. All the patients responded to conservative treatment effectively once they were educated regarding their basic problem.

Key words: cervical rib, elongated transverse process, C7 vertebrae Neck instability index, life style modifications, physiotherapy

Introduction

Galen (150 AD) and Vesalius (1500 AD) and Francois-Joseph Hunauld (1700 AD) described cervical rib in detail as a supernumerary rib, arising from one of the cervical vertebrae, usually the seventh, rarely the sixth, and very rarely the fifth. Helkiah Crooke, in his *Microcosmographia* of 1651, described Bauhin finding of thirteen ribs on each side at necropsy. Sir Astley Cooper described arterial thoracic outlet syndrome in a young woman with arm ischemia, and demonstrated the relationship between a cervical rib and compression of the subclavian artery. In 1861, Coote was first to operate on cervical rib. Gruber in 1869 classified cervical ribs as :

- 1) Slight degree, rib reaching beyond the transverse process;
- 2) More advanced, rib reaching beyond the transverse process either with a free end or touching the first rib;
- 3) Almost complete, the connection with the cartilage of the first rib by a distinct band or by the end of the long body of the cervical rib;
- 4) Complete, the rib is complete and possessed of a true cartilage to unite with the cartilage of the first rib. Thoracic Outlet is a complex entity bounded by the first thoracic Vertebra posteriorly, superior border of manubrium sterni anteriorly, and the first rib and costal cartilage laterally. Thoracic outlet syndrome is a constellation of symptoms and encloses number of disorders producing neuropathy and vascular compression over this area. Cervical Rib is a congenital bony abnormality in which an extra rib is present

superior to first rib is attached to C7 vertebra of variable length. Of the many factors which can cause neurovascular compression like pectoralis minor, scalenes muscles, costoclavicular ligaments 30% of reported cases is due to bony abnormalities. Though presence of Cervical rib doesn't indicate its direct correlation with cervical plexopathy, it is one of the important bony factors which lead to thoracic outlet syndrome due to the displacement and compression of the neurovascular structures like Lower brachial plexus and subclavian artery while crossing the thoracic outlet to the upper limb and needs clinical and radiological assessment before it is considered as the etiology of thoracic outlet syndrome. Moreover as only a few percent of population suffers from thoracic outlet syndrome due to cervical rib we screened large population. The prevalence of bilateral cervical rib lies between 67 and 80% in different opinions. The cervical rib is found more often on the left side, but symptoms are more common on the right side. This is attributed to greater use of the right arm, because the right plexus is in closer connection with the corresponding rib than the left, and because there is a greater drop of the right shoulder in the right-handed persons. Symptoms are much more common in women than in men. Todd postulated that the greater movement of the upper part of the chest in women during respiration has

much to do with it. In many cases a cervical rib produces neither signs nor symptoms. Its estimated that only 0.6% population have symptoms due to cervical ribs. Symptoms are much more common in women than in men. Characteristic symptoms are one or more of the following: pain, paraesthesia, motor weakness, generalized discomfort, atrophy, circulatory abnormality. Pain is sharp shooting and may be brought on by sudden rotation of the head or by a forceful abduction of arm with supination of forearm.

In view of understanding the different causes of cervical pain with radiculopathy, with or without motor and sensory disturbance; where it may be treated as case of degenerative Spondylolysis, cervical spasm, shoulder pathology or fibromyalgia and presence of cervical rib may be overlooked, we have evaluated correlation between cervical rib and cervical plexopathy on basis of clinical and radiological grounds and provided physiotherapy and medical intervention to study final outcomes.

Materials and Methods

This prospective study was conducted in department of Orthopaedics and Traumatology D.Y Patil Hospital, Navi Mumbai. 500 patients presenting OPD with cervical pain with radiculopathy and tingling numbness, paraesthesia were subjected to x-ray cervical spine AP and lateral with inclusion of C7 and T1 and a total of 55 patients with cervical ribs of age group between 25 to 55 yrs were selected for our study with long follow of 1yr after taking necessary consent. Inclusion criteria:

1. Patient between 25 to 55 yrs of age with radiologically proven cervical rib.
2. Motivated patients who agreed to undergo regular physiotherapy.

Following sign and symptoms were considered:

Sensory Symptoms involving tingling in hands or fingers confined either to ulnar side or sometimes involve even whole hand. Pain radiating downwards from cervical spine to arm and forearm may or may not involving digits. Motor Symptoms including loss or decrease in gripping strength of hand, tendency of dropping things from the hand, wasting of palmar muscles which may be thenar or hypothenar or interossei muscles. Vascular symptoms consisting of Cold and clumsy extremities, skin color changes with trophic changes, radial pulse becoming feeble on examination or even absent.

Exclusion Criteria

1. Patients of degenerative Spondylolysis, traumatic spine, cervical spine instrumentation, Ankylosed spondylitis, fibromyalgia, Raynaud Syndrome, Vasospastic disorders were excluded from study.
2. Similarly other variables responsible for Cervical plexopathy like Pectoralis minor tightness, Scalenus muscles, Costoclavicular ligament, any congenital abnormalities and previously fractured clavicle were also excluded.

To identify patient as case of cervical rib following test were done and only symptomatic patients were included.

Adson’s test: the test is useful in identifying symptoms duet to both Cervical Ribs as well as Thoracic Outlet Syndrome.

Procedure: Patient is asked to breathe deeply, Neck is extended, and chin turned toward affected side. The examiner lifts the arm away to the side to 90 degrees and does external rotation of the shoulder. Here the radial pulse either gets feeble or disappears. Test is repeated with chin to opposite side.

Positive test finding is decreased Radial Pulse and/or Distal extremity pain. It suggests compression of neurovascular structure.

Figure A

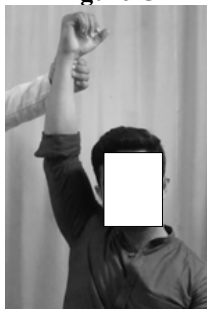


Figure B



Shoulder Abduction Test: is used to help diagnose a cervical nerve root injury or cervical disc herniation. It is performed by having the patient abduct their shoulder and place their hand on top of their head. A positive test will involve a decrease in radiculopathy or pain.

Figure C



Observation and results

During our study patient who presented with symptoms of pain in cervical region, shoulder and hand with numbness and tingling sensation were examined clinically and power and sensation of patients were assessed and clinical examination to confirm the presence of cervical rib was assessed.

Table 1. Maximum patients were in age group of 35-45 years contributing to 68%

Age group (years)	Number of Cases
25-35	6
35-45	34
45-55	10

Table 2. There were 31 female (62%) and 19 males (38%)

Sex	Number of Cases
Male	19
Female	31

Table 3. Cervical rib was right sided in 8 (16%) cases, bilateral in 38(76%) cases, left sided in 4 (8%) cases

Side	Number of Cases
Right	8
Left	4
Bilateral	38

Table 4. Bilateral symptoms were seen only in 9 patients (24%), however right sided symptoms were present in 28 (62%) patients. Left sided symptoms were few in 7 cases

Side with symptoms	Number of Cases
Right	31
Left	7
Bilateral	12

Table 6. Maximum subjects were housewife approximating 52%

Occupation	Number of Cases
Housewife	26
Office workers	6
Laborer	18

Results

Out of 500 patients selected on the

basis of symptoms 55 were found to have cervical rib out of which 4 were lost during follow up and one was operated where cervical rib excision was done. Maximum patients were in age group of 35-45 years contributing to 68%. There were 31 female (62%) and 19 males (38 %). Cervical rib was right sided in 8 (16%) cases, bilateral in 38(76%) cases, left sided in 4 (8%) cases. Bilateral symptoms were seen only in 9 patients (24%), however right sided symptoms were present in 28 (62%) patients. Left sided symptoms were few in 7 cases .Maximum subjects were housewife approximating 52% followed by labourer class amounting 36 %. Cervical rib incidence was high among household, parous females and mechanical labourers and though prevalence of bilateral cervical ribs is more among general population, symptoms of plexopathy was found more common in right side. **Neck instability index** pre treatment reduced drastically from 42.5 to value of 8.7 and VAS score from average 76.5mm to 8 .5mm.

Discussion

Though incidence of left sided and bilateral rib is high in general population which comes with complain of only neck pain without radiculopathy, however majority symptomatic patients had right cervical ribs predominance. This can be attributed to the greater use of the right arm, proximity of right brachial plexus with the corresponding rib, and because there is a greater drop of the right shoulder in the right-handed persons after age of 30 yrs. Symptoms are much more common in women than in men. Most cases of cervical rib are asymptomatic and age of presentation is variable with mean age being 37.7 yrs. In our study maximum subjects

were female above age of 30 with sign and symptoms more common in non working females. Characteristic symptoms are intermittent neck pain with radiculopathy, paraesthesia and disturbance of sensation. In our study atrophy, circulatory abnormalities were noticed in one case which was operated and cervical rib excision was done. Pain may be sharp and lancinating and may be elicited by sudden movement of head and right upper extremity which may mimic Adson's/shoulder hyperabduction test. Sensory alteration depends upon part of brachial plexus involved whether upper or lower.

Thoracic Outlet Syndrome may result from trauma, repetitive arm movements, tumors, pregnancy, or anatomical variations such as a cervical rib, scalenus anomaly, accessory rib, and tight pectoralis minor. The diagnosis may be supported by nerve conduction studies and 3D CT and MRI studies. Other conditions that can produce similar symptoms include rotator cuff tear, cervical disc disorders, fibromyalgia, multiple sclerosis, & complex regional pain syndrome. However by excluding these factors we can arrive at diagnosis of cervical rib plexopathy and medical and physiotherapy regimen can help patients who are misdiagnosed as cervical spondylosis. Apart from medical management Stretching exercises, chiropractic adjustments, occupational and physical therapy are commonly recommended in the treatment of cervical rib. The goal of stretching is to release compression in the narrow thoracic cavity, decrease blood vessel and nerve impingement, and realign the bones, muscles, ligaments, or tendons that are causing the problem.

Stretching includes moving the

shoulders anteriorly, then back to a neutral position, then extending them posteriorly, then back to neutral, followed by lifting the shoulders up as high as possible, and then back down to neutral, repeated in cycles as tolerated.

Tilting and extending the neck opposite to the side of the neuropathy with keeping the involved side down and wrapped around the back.

Occupational or Physical therapist trains passive and active range of motion exercises. Physical therapy usually consists of mobilization of the shoulder joint and girdle, incorporating the 1st rib. If required additional myo-fascial release (MFR) or Active Release Technique (ART) to the connected musculature can be done depending upon severity of symptoms.

TOS has been always associated with poor posture and active breathing exercises and ergonomic desk setup and motion practices can help maintain anatomical posture. Often the muscles in the back become weak due to prolonged hunching and lack of exercise and physical activity other poor postures.

Alternate hot and cold application can decrease inflammation of sore or injured muscles and relieve sore muscles by improving blood circulation.

Surgical approaches have also been used successfully in TOS. Neurolysis of the brachial plexus, excision of accessory rib, fibrous bands, release of pectoralis minor, scalenus and cervical rib in case of failure of conservative treatment or when only surgical intervention is can provide structural relief.

Sr no	Age/sex	Laterality	Symptoms	Cervical rib	NIS		VAS score	
					Pre	Post	Pre	Post
1	28/f	Bilateral	R/P	Right	45	5	80	15
2	37/f	Bilateral	R/P	Right	50	10	75	10
3	34/f	Bilateral	R/P/MS	Right	40	5	90	0
4	38/m	Right	R/P	Right	35	10	80	0
5	29/f	Bilateral	R/P/MS	Bilateral	40	5	85	15
6	40/m	Bilateral	R/P	Right	50	10	90	0
7	32/f	Bilateral	R/P/MS	Right	45	0	70	15
8	44/m	Bilateral	R/P	Bilateral	40	5	85	5
9	37/f	Bilateral	R/P/MS	Left	35	10	80	10
10	42/m	Right	R/P	Right	40	10	85	0
11	33/f	Bilateral	R/P/MS	Bilateral	35	5	70	10
12	42/m	Left	R/P	Left	50	10	70	15
13	45/f	Bilateral	R/P	Right	45	5	80	10
14	44/f	Bilateral	R/P/MS	Bilateral	40	10	80	0
15	34/m	Right	R/P	Right	35	10	90	10
16	38/f	Bilateral	R/P	Right	50	15	85	15
17	47/m	Left	R/P/MS	Left	45	15	75	10
18	39/f	Bilateral	R/P	Bilateral	50	15	75	15
19	40/f	Bilateral	R/P	Right	45	15	80	10
20	48/m	Right	R/P/MS	Right	40	10	85	0
21	50/f	Bilateral	R/P	Bilateral	35	10	75	10
22	44/f	Bilateral	R/P	Right	40	5	80	10
23	43/m	Bilateral	R/P/MS	Right	45	10	75	5
24	42/f	Bilateral	R/P	Right	40	10	80	5
25	49/m	Right	R/P/MS	Right	45	5	90	10
26	40/f	Bilateral	R/P	Bilateral	40	10	90	15
27	37/f	Bilateral	R/P	Right	35	15	70	20
28	51/m	Bilateral	R/P	Right	50	5	80	0
29	38/f	Right	R/P/MS	Right	45	10	80	5
30	39/f	Bilateral	R/P/MS	Bilateral	40	10	75	10
31	54/m	Bilateral	R/P	Right	35	10	80	15
32	43/f	Bilateral	R/P	Right	50	5	85	5
33	44/f	Right	R/P/MS	Right	45	10	70	10
34	45/m	Bilateral	R/P	Bilateral	50	15	80	0
35	54/m	Bilateral	R/P	Right	45	10	75	5
36	37/f	Bilateral	R/P	Bilateral	35	5	75	10
37	38/f	Left	R/P	Left	35	10	80	5
38	43/m	Right	R/P/MS	Right	45	15	75	10
39	46/f	Bilateral	R/P	Right	40	10	70	15
40	36/f	Bilateral	R/P	Bilateral	50	5	80	0
41	38/f	Bilateral	R/P/MS	Right	45	15	75	0
42	47/m	Left	R/P	Left	40	10	80	10
43	39/f	Bilateral	R/P	Bilateral	35	15	85	15
44	42/f	Bilateral	R/P	Right	50	10	75	5
45	51/m	Bilateral	R/P/MS	Left	45	5	90	5
46	38/f	Bilateral	R/P	Right	45	10	85	10
47	44/m	Bilateral	R/P	Right	40	15	70	15
48	37/f	Bilateral	R/P	Right	40	10	75	10
49	41/f	Bilateral	R/P	Left	45	5	70	5
50	45/m	Bilateral	R/P/MS	Right	40	5	80	10

R- Radiculopathy, P- Paraesthesia, MS-Motor Symptoms, NIS-neck instability Index, VAS-Visual Analogue score

Conclusion

Mainstay of treatment is conservative with initial pain relief by NSAID's and control of radiculopathy symptoms with Pregabalin (as per tolerance) and Methylcobalamine. Thiocolchiside is recommended in case of spasm and chymotrypsin and trypsin for additional anti inflammatory action. The role of physiotherapy depends upon symptoms of the patient. Once the pain has been effectively controlled active physiotherapy should be started. Basic fault is drooping of shoulder in patients above age of 30 years; hence exercise strengthening parascapular and neck muscle were advised. The important exercises are self resisted scapular elevation; self resisted scapular adduction, endurance training exercise for the shoulder girdle muscles, progressive resistance exercises for shoulder girdle muscles with weight. For pain relief short wave diathermy, Ultrasound was given. To improve distal circulation exercises of hand and finger was advised.

Patient education with lifestyle modifications like avoiding heavy weight, avoid handling bus over handles, carrying heavy objects and while walking avoiding drooping of shoulders and performing hyperabductory maneuvers. Most important aspect is educating the cause of pain which is reversible and can be controlled with exercises and life style modifications.

Figure- 1. 35 yr female with bilateral cervical ribs. Figure -2. 42 yr female with right cervical rib and left transverse process. Figure 3. 53 yr male with rt cervical rib and left transverse process



Figure 1



Figure 2



Figure 3

Figure 4. 46 yr female either right sided cervical rib. Figure 5.54 yr female with bilateral cervical rib



Figure 4



Figure 5

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