

## Costoclavicular Compression- Radiology and Treatment

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**Abstract:** Thoracic outlet syndrome is described as the compression of one or several neurovascular structures that cross the thoracic outlet. The syndrome often appears overlooked and misdiagnosed because objective findings are scarce leading to persistent pain, impaired function and emotional distress. The aim of this study was to identify normal and abnormal anatomy of thoracic outlet using computed tomography scan in symptomatic costoclavicular compression syndrome and to plan them for surgery there after. This was a prospective hospital based study. All the symptomatic cases of costoclavicular compression syndrome admitted in the department of Cardiovascular and thoracic surgery, SKIMS, Srinagar from May 2011 to May 2013 were taken up for the study. A total of 30 cases of symptomatic costoclavicular compression syndrome were reported from May 2011 to May 2013. Mean age of presentation was 26.3 years. The most prevalent age group was 21-30 years (46.67%,n=14).Majority of patients were females(83.3%,n=25) with male female ratio of 1:5. 66.67%(n=20) had bilateral cervical rib, more in females(72%) than males(40%).96.7%(n=29) had neurogenic thoracic outlet syndrome and 3.3%(n=1) had vascular thoracic outlet syndrome.34.4%(n=10) of cases with neurogenic thoracic outlet syndrome had subclavian artery compression on CT Angio of thoracic outlet. All the patients with subclavian artery compression were subjected to surgery. Costoclavicular compression syndrome affects mainly young females.CT Angio is complementary in finding vascular compression in cases presenting mainly with neurogenic symptoms of thoracic outlet syndrome.

**Keywords:** Costoclavicular compression syndrome, CT Angio, Vascular thoracic outlet syndrome, neurogenic thoracic outlet syndrome.

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### I. Introduction

Peet et al coined the term thoracic outlet syndrome in 1956 to describe compression of one or several neurovascular structures, brachial plexus, subclavian artery or vein that crosses the thoracic outlet[1].It has also been referred to as scalenus anticus syndrome, cervical rib syndrome, costoclavicular syndrome and hyper abduction syndrome[2].Thoracic outlet syndrome is categorized into two specific clinical entities: vascular thoracic outlet syndrome and neurological thoracic outlet syndrome and further divided into arterial and venous thoracic outlet syndrome under vascular heading and true neurological thoracic outlet syndrome and symptomatic thoracic outlet syndrome under neurological heading[3].90% to 97% of cases present with neurological thoracic outlet syndrome while as vascular thoracic outlet syndrome is present 5% to 10% of thoracic outlet syndrome[4].The diagnosis of thoracic outlet syndrome is essentially based on history and clinical examination. Technical investigations can be helpful to confirm the suspected diagnosis, but a negative test does not rule out the syndrome [5].Treatment options vary from lifestyle changes, conservative approach, surgical approaches and more recently minimally invasive treatments. To analyse CT Angio in the evaluation of thoracic outlet syndrome provides the basis for this study.

### II. Aims:

To identify normal and abnormal anatomy of thoracic outlet using computed tomography scan in symptomatic costoclavicular syndrome.

To make a plan of surgery after computed tomography scan.

### III. Methods:

We analysed all the patients of symptomatic costoclavicular compression syndrome admitted in the department of cardiovascular and thoracic surgery, SKIMS, Srinagar during 2 consecutive years from May 2011 to May 2013.Diagnosis was based on results of clinical evaluation using various dynamic maneuvers and special investigations like x ray cervical spine (AP view), nerve conduction velocity of upper limbs and CT Angio. While subjecting to CT Angio, 0.6mm thick slices were taken and three dimensional reconstructions were also done. Images were obtained using pressure injector and automated trigger. During arterial phase 100ml of non-ionic contrast (Iohexol) was injected through intravenous canula of appropriate size. After identifying the cause of compression over costoclavicular tunnel, patients were subjected to surgery. Through a hairline incision, first rib was excised from its anterior end including its periosteum towards posterior end till its maximum part was removed followed by excision of scalene muscle and part of costoclavicular ligament.

**IV. Results**

It was observed that majority of the patients were females numbering 25(83.3%) and 5 patients (16.67%) were males with male to female ratio of 1:5 .Most of the patients were in the age group 21 to 30 years (46.67%,n=14) with mean age of 26.3 years. 96.7%(n=29) patients had neurogenic thoracic outlet syndrome and 3.3%(n=1) patients had vascular thoracic outlet syndrome. Main symptom of presentation was paresthesias(70%,n=21).Second most common symptom was pain(63.3%,n=19).On clinical examination, weakness was present in 32%(n=10) mainly affecting fingers(57%,n=6),loss of sensation to touch/pain in 32%(n=10) mainly affecting little finger and ulner aspect of hand(42%,n=4),atrophy in 30%(n=9)mainly affecting thenar eminence(60%,n=5),gangrene and cyanosis of fingers was present in 3.3%(n=1),supraclavicular mass in 3.3%(n=1),ptosis in 3.3%(n=1) and miosis in 6.67%(n=2).After subjecting to provocation test, upper limb tension test was positive in 93%(n=28),Adson’s test in 73%(n=22),hyper abduction test in 23%(n=7) patients.66.67%(n=20) patients had bilateral cervical rib on x ray cervical spine(AP view) followed by left cervical rib(20%,n=6),right cervical rib(10%,n=3).Elongated C7 transverse process was found in 3.3%(n=1) patients. Most common electrophysiological abnormality was deranged ulner nerve conduction velocity.34.4 % (n=10) patients had subclavian artery compression on CT Angio of thoracic outlet, 20 % ( n=2) had right subclavian artery compression and 80 % ( n=8) left subclavian artery compression.

Age(yr)	Male		Female		Total	
	N	%	N	%	N	%
10-20	0	0	10	40	10	33.3
21-30	4	80	10	40	14	46.67
31-40	0	0	3	12	3	10
41-50	1	20	2	8	3	10

**Table 1:Age and gender distribution of the studied subjects**

Neurogenic thoracic outlet syndrome	Total number of patients		Subclavian artery (SCA)compression		Right SCA compression		Left SCA compression	
	n	%	n	%	N	%	n	%
	29	93.3	10	34.4	2	20	8	80

**Table 2:SCA compression in patients presenting with neurogenic thoracic outlet syndrome**

**V. Discussion**

Thoracic outlet syndrome (TOS) is a clinical phenomenon resulting from compression of neurovascular structures at the superior aperture of thorax presenting with varying symptoms. The reported incidence of TOS in the general population is approximately 0.3% to 0.7% [6,7].The affected typically range 25 to 40 years(mean 34.6) and a higher incidence (4:1) has been reported in females[8,9].Where a cervical rib is present, CT may demonstrate not only the bony abnormality but also its relationship with arterial compression[10].

A total of 30 patients were admitted in the department of cardiovascular and thoracic surgery SKIMS, Srinager in 3 consecutive years. Commonest age group involved were young adults between 21 and 30 years of age, with mean age of 26.3+ 9.3 years. Majority of patients were females (83.3%) which are similar to other reports [9].

TOS is a symptom complex characterized by pain, paresthesias, weakness and discomfort in upper limbs which is aggravated by elevation of arms or by exaggerated movements of the head and neck. In our study 70% of cases presented with paresthesias affecting mainly fingers(38%,n=8).Second most common symptom was pain (63%,n=19) mainly affecting shoulders(58%,n=11) followed by arms(31.5%,n=6),neck(21%,n=4),forearm(21%,n=4) and fingers(16%,n=3).Weakness was present in 32%(n=10) patients affecting mainly fingers in 57% cases followed by arm(52%),forearm(21%) and shoulder (15%).Atrophy was present in 30% cases affecting mainly thenar eminence(60%) followed by Interossei(44%) hypothenar(38%),finger(27%),forearm(27%),arm(11%) and shoulder(11%).These observations are similar to those reported in previous study by Daryll M Baker and Andrew J Lamerton[11] and Bronson S. Ray, Robert Hardy and Herbert Parson[10].Bronson S. Ray et al(12) reported miosis in 7% of cases and ptosis in 2% in their study which is comparable to our study. Gangrene and cyanosis of fingers was noted in 12% cases which is higher than our study(3.3%).This can be explained by smaller sample size of our study.

Cervical rib occurs in less than 1% population and 70% are women. It is a predisposition to neurogenic TOS following neck trauma, most often whiplash injuries [13].Symptomatic cervical rib usually produces symptoms of neurogenic TOS but a few will press against subclavian artery and result either in stenosis or aneurysm formation. In our study, 96.7 % ( n=29) patients had neurogenic TOS and 3.3 % ( n=1) vascular TOS.Similar results were found by Sanders R J et al [14]) in their study.

66.67%(n=20) patients had bilateral cervical rib more so in female patients(72%) than males(40%).Right side cervical rib was more common in females .Antima Gupta et al[15] in their study observed that bilateral cervical rib was more common in both males and females and right side cervical rib was more common in females.

Clinical diagnosis is often difficult in TOS requiring the use of imaging procedure.34.4 %( n=10) patients with neurogenic TOS had subclavian artery compression on CT Angio of the thoracic outlet after postural maneuver. Martine Remy Jardin et al[16] conducted a prospective study based on the analysis of helical CT angiogram obtained between Jan 1997 to Jan 1998 in a population of 79 patients with clinical symptoms of TOS.The study group was based on 61 female patients(group 1) and 18 male patients(group 2) with a mean age of 38 years. A slight indentation of the anterior wall of the SCA was observed in 31 %( n=19) patients in group 1 and 33 %( n=6) in group 2 after postural maneuver.

Analysis of data from this prospective study clearly shows the importance of radiological investigations (CT Angio) in understanding the pathophysiology of TOS, preoperative planning and subsequent surgical management.

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