

Surgical Management of Thoracic Outlet Obstruction: Trans-Axillary Route

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Abstract: ***Objective:** This study is mainly intended to review the results of surgical management in thoracic outlet syndrome (TOS) with clinical symptoms. **Method:** A retrospective study was conducted in patients with TOS who were treated surgically through axillary route in Sankers hospital and DM wims during a period of 2011 to 2018 by the first author. All cases were having neurological symptoms of lower brachial plexus and were treated with first rib resection and scalenotomy (FRRS) and cervical rib resection in cases with cervical rib. Cases selected for operative procedure were subjected to nerve conduction velocity (NCV) studies and clinically assessed pre and post operatively. All cases were given 3-6 months physiotherapy prior to taking for surgical management. **Result:** During a period of 7 years 62 cases were performed and 25 cases were subjected to cervical rib resection 2 cases were having bilateral cervical rib and were treated surgically in different settings. The preferred surgical approach was through axillary route. All cases presented with pain parasthesia and difficulty in doing manual work and without vascular complications. **Conclusion:** FRRS and cervical rib resection if any can result in relief of symptoms in 96.8% of cases.*

1. Introduction

In general population the incidence of cervical rib is 0.22 to 1%. Many of them don't have any compressive symptoms. TOS can present in different ways due to compression of Neurovascular bundle in the root of neck like pain, parasthesia and weakness mainly in the distribution of the C8T1 nerve roots. 10% of TOS can also present as subclavian vessel compression. In the management there are many newer advances for diagnosis and treatment This study we have conducted evaluated the outcome of surgical managed patients presented with neurological symptoms. Thoracic outlet is formed by 1st rib, thoracic vertebrae and manubrium sternum. The scalene triangle is formed by 1st rib below, anterior and middle scalene muscles in front and behind¹. The associated congenital anomalies in this triangle through which the nerves and blood vessels pass can lead to development of symptoms.

Four types of symptoms described²

- Upper brachial compression patterns
- Lower brachial compression pattern
- Vascular compression pattern
- Mixed variety (Neuro vascular)

Sometimes it can be confused with angina as it can produce atypical pain in the anterior chest wall and back of chest^{3,4}. Ulnar neuropathy can mimic TOS but excluded by nerve conduction velocity studies^{5,6} and Tinel's sign at elbow and sensory changes in the ulnar aspect of ring finger, absence of involvement of abductor polices brevis.

Nerve conduction velocity studies are confirmatory if the values are less than 60m/s^{3,7}

Strengthening of shoulder muscles and analgesics were tried in cases where NCV values were above 60m/s Conservative line is initially instituted in these cases. Surgery is done in cases of persistent Neuro vascular symptoms even after physiotherapy and having significant reduction of NCV. Surgery was mainly focused on removal or release of

structures involved in compressive pathology like FRRS, cervical rib or band excisions or disarticulations from first rib in case of complete cervical rib^{2,5,7,8,9,3}

2. Materials and Methods

This study involves 62 cases operated for TOS from 2011 to 2018 (7years) in Sankers hospital and DM wims Medical college. In all cases surgery was done through axillary route and FRRS cervical rib and band excision if present were also done.

Inclusion Criteria

Patient with C8T1 root compression as evidenced by physical examination and NCV studies. Patient with no relief of symptoms after physiotherapy were also included if NCV is <60 m/s.

Exclusion

Cervical degenerative disease of vertebral disc.

Clinical examination

Symptoms: pain and numbness in the upper arm, forearm and in the distribution of ulnar nerve. Roos test positive. Adson and Tinel positive, weakness and wasting of first dorsal interosseous muscle and abductor pollicis brevis

Investigations

X-ray chest PA view, cervical spine AP and lateral, MRI cervical spine to detect cervical rib or fibrous band, NCV confirms the diagnosis

Table 1: Clinical presentation

Symptoms	Number of patients
Neck pain	62
Paraesthesia	60
Sensory deficit	12
Motor deficits	0
Waisting	0

Table 2: Sex and age distribution

Sex	Age 28-30	Age 31-40	Age 41-48	Total
Male	1	7	2	10
Female	18	30	4	52

Duration of clinical symptoms:

It varied from 1.5 years to 6 years and all selected patients pre-operative NCV was performed and showed values less than 60m/s. These 62 patients were taken for surgical decompression through trans axillary route

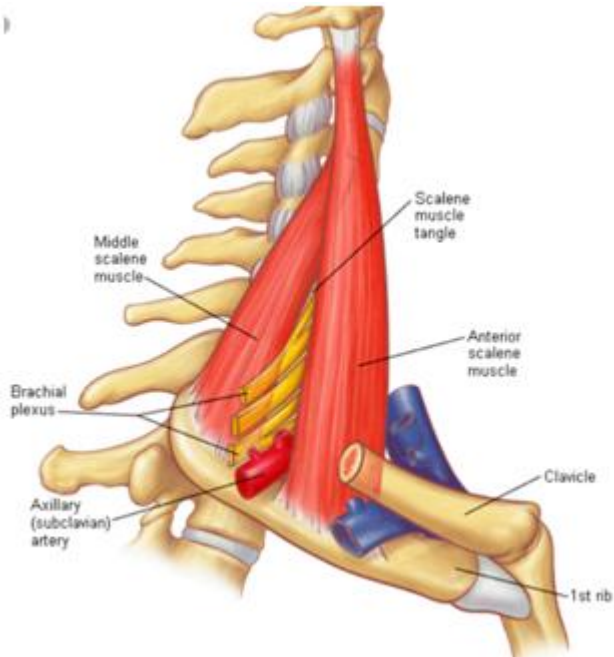


Figure 1: Anatomy of scalene triangle



Figure 2: X-ray neck with cervical rib

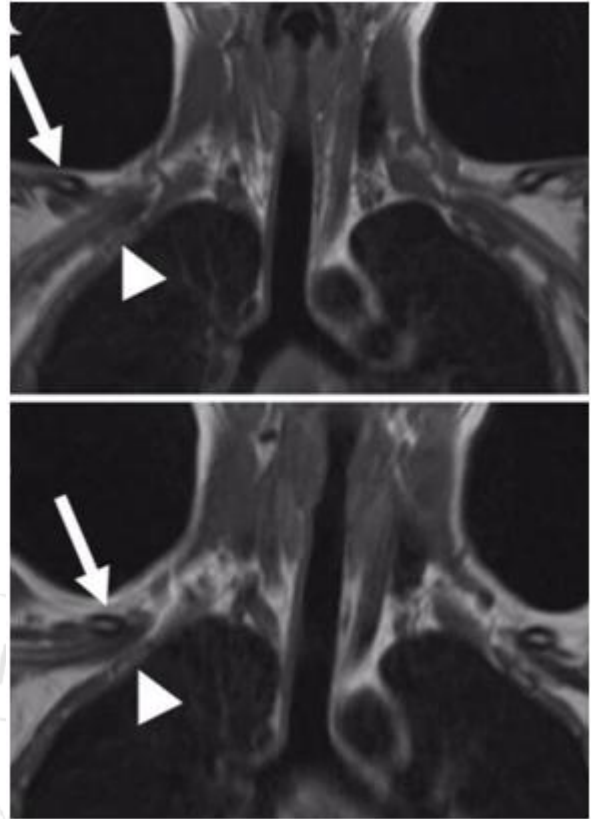


Figure 3: MRI showing cervical rib



Figure 4: Positioning of limb for surgery

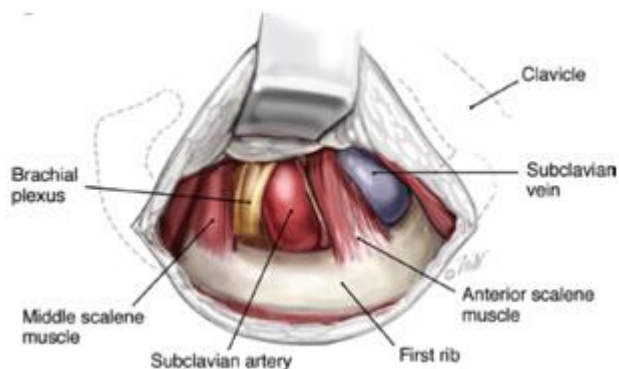


Figure 5: Diagram of important structures

3. Operative Technique

Under GA the patient is positioned in supine position with a sand bag on the back of the shoulder. The affected upper limb was draped abducted and hanged with a drip set so that the axilla is fully exposed. Since lengthy surgery can result in ischaemia of the upper limb, especially with retraction, SPO₂ was used to monitor the limb perfusion. Rest of the area was draped after cleaning with betadine and alcohol. An incision is made for a length of 5cms in the crease of the axilla between pectoralis major and latissimus dorsi. The skin incision is deepened to reach upto the chest wall. Intercostobrachial nerve will not come in the field, if the incision is made on the upper crease of the axilla. Blunt dissection is made along the loose areolar tissue of the chest wall to reach the first rib. This is facilitated by traction of the pectoralis major and minor muscle. Using a Kelly's retractor, the nerve plexus and blood vessels were kept away from the field of dissection.

First rib is identified as it is broad in the anterior area than the other ribs. Extra perioestial resection of the rib is done by stripping the intercostal muscles facilitated by cauterisation upto the posterior aspect of the rib without injuring the pleura. The scalenotomy is done on the superior medial aspect of the first rib by nibbling it away with cauterisation, fibre by fibre. The upper border of the first rib is delineated and the rib is cut into two pieces at its middle. The anterior half is excised close to the sternal cartilage and the posterior half disarticulated from vertebra. During the procedure care is taken not to injure the first intercostal vessels and nerve, if injured the vessel can be ligated on either side.

Cervical rib in 25 cases Fibrous band 8 cases were also excised along with FRRS and disarticulated at its base. Plural injury in 4 cases (6.4%) were managed with primary repair of the pleura after expanding the lung. (If not possible a chest tube need to be introduced with 5th intercostal space in the mid auxiliary line of the concerned side)

Hemostasis is attained and wound closed in layers with a ready vac suction drain of 14F. There is no need for any tissue approximation except subcutaneous suture and skin sutures. Duration of surgery was 1 ½ to 2 hours. Blood loss was minimal and no need for transfusion in all the cases. Post operatively patients were given antibiotics and analgesics. The limb were kept elevated for the first 48

hours. All cases selected didn't have any local infection. Drains removed on second day.

4. Results

All patients were followed up for a period of one year at intervals of second week, one month, 6 month, one year. Post operative NCVs were done to assess the outcome. Patients were also seen clinically assessed for symptomatic relief.

Post operative assessment

Complications

Patients were instructed not to bear weight and to do exercises against resistance at the same time they were encouraged to do passive exercise and also for doing forearm muscle exercises. There were no axillary vein thrombosis, detected in this study. There was no need for heparin injection in this immediate post operative period. Few patients (<5%) complained of paraesthesia in the shoulder region which were controlled with NSAIDs.

Clinical outcome – assessment

1) Functional assessment

Table 3

	Male	Female
Pain relief	100%	100%
Back to normal work	98%	98%
Paraesthesia and numbness	99%	96%
Shoulder pain	99%	98%

2) NCV studies

Grade. Excellent	>70m/s
Good	>65m/s
Fair	>60 m/s

Table 4

NCV studies	Male.No Patients	Female	No of patients
Excellent	7		16
Good	2		28
Fair	1		8

5. Discussion

In majority of cases good results were obtained in view of improvement of symptoms and most of the manual workers could returned to their work for daily livelihood. There were no complications in this study conducted. In all the Cases included in this study, we could do a complete resection of the cervical rib and first rib. Samamerazan at all ¹⁰ has performed 63 operations for decompression of TOS

He had performed transaxillary approach for all cases out of which 16% transaxillary and supra clavicular com-pained approach was done. He had an operative complication of pneumothorax in 4 patients and managed with chest tube insertion. Brachial pluxes neuropraxia in two patients which improve with conservative management. 12 month follow up surgery 93% had complete or partial relief of symptoms and 6.6% had no relief of symptoms.

In our study 98-99% of patients had excellent/good results and there was no major post operative complications like neuropraxia, bleeding or major blood vessel injury. Minor complications like plural injury which occurred in 4 cases (6.4%) were treated with primary closure of plura without tube thoracostomy. Post operatively X-ray showed no residual hemothorax/pneumothorax.

Other major references studies conducted showed good results like Nizadatal¹¹, Altobeliatal¹², Sanders Hammond atal¹³.

Our results also matches with the above study

6. Conclusion

Auxiliary route approach for TOS is difficult to learn but once it mastered it carry excellent results. Our results are in par with any other surgical approach. This procedure of auxiliary approach has the advantage of having the scar in a hidden area which is cosmetically appreciable for young patients. In our study that is no complications of neuropraxia or major blood vessel injuries. The heparin was not used in any of the 62 cases that we have done nor they had auxiliary vein thrombosis. Nerve conduction studies is a good evaluator for pre operative and post operative study of TOS and good results were obtained in our study which has regain to 65m/s to >70m/s in 83.9% of cases. Almost all cases except one could return to their usual job.

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