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Corresponding Author: **Dr. Ramswaroop Sain,** Email: dr.rssain68@gmail.com

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SUPRACLAVICULAR RESECTION OF CERVICAL RIB ASSOCIATED WITH ARTERIAL THORACIC OUTLET SYNDROME: OUR EXPERIENCE

Krishan Kumar Mawar¹, Ramswaroop Sain¹, Nadeem Akhtar², Vinay Naithani³, Deepak Sethi⁴

¹Associate Professor, Department of CTVS, SMS Medical College Jaipur, Rajasthan, India.
 ²Assistant Professor, Department of CTVS, RNT Medical College, Udaipur, Rajasthan, India.
 ³Professor & Head, Department of CTVS, RNT Medical College, Udaipur, Rajasthan, India.
 ⁴Principal Specialist, Department of Surgery, RNT Medical College, Udaipur, Rajasthan, India.

Abstract

Background: Cervical rib resection through supraclavicular approach is safe and feasible treatment for thoracic outlet syndrome caused by presence of cervical rib or by an anomalous first rib. The objective is to evaluate the outcome of resection of cervical rib and/or first rib for arterial thoracic outlet syndrome (TOS) through supraclavicular approach. Materials and Methods: This was a retrospective study of 22 patients who underwent Supraclavicular resection of cervical rib and/or first rib for treatment of arterial thoracic outlet syndrome. Results: Supraclavicular decompression procedures were performed on 22 patients (8 men) with Arterial TOS. The mean age was 30 years (range: 20-40). The most common presenting symptom was ischemic pain and coolness in upper extremity. All patients underwent supraclavicular decompression, which included anterior and middle scalenectomy, cervical ribs and partially first rib resection. Functional outcomes were excellent, good, fair, and poor in 60%, 30%, 10%, and 0% of cases respectively. In two patients' vascular reconstruction surgery performed using reverse saphenous vein graft. In 10 patients embolectomy was performed. There was no death. The mean duration of hospital stay was 4.5 days. The mean follow-up was 6 months. Conclusion: Supraclavicular approach is easy and appropriate for excision of cervical rib and/or first rib for treatment of arterial thoracic outlet syndrome. The supraclavicular approach has several advantages, including complete anterior and middle scalenectomy, resection of cervical and first rib and vascular intervention in the same sitting.

INTRODUCTION

Thoracic Outlet Syndrome (TOS) is a condition where major vessels and nerves of the upper extremity while travelling from the thoraco-cervical region to the axilla, are compressed due to narrowing of the spaces in the thoracic outlet. A number of different causes produce symptoms. Common etiologies include scarring of the scalenus anticus muscle because of previous trauma, hyper abduction, cervical rib, fibrous bands and an anomalous first thoracic rib.

Thoracic outlet syndrome (TOS) is divided into three groups, Neurogenic which is most frequently encountered (90%-95%), venous (5%) and least commonly arterial (1%). Neurogenic TOS is due to compression and irritation of brachial plexus nerve root within scalene triangle or underneath the pectoralis minor muscle tendon. Neurogenic symptoms included hand and arm pain, paresthesia, and weakness. Venous TOS is due to repetitive

compression of the subclavian vein between the first rib, clavicle and associated muscles leads to venous wall thickening and intimal damage, stenosis and eventually thrombosis. Patients with venous TOS present with swelling of the entire arm, often with bluish discoloration, heaviness and aching pain. Arterial TOS is mostly associated with a cervical rib or anomalous first rib. It occurs in young patients typical atherosclerotic risk factors, without distinguishing it from peripheral artery disease. Hand ischemia with symptoms of pain, pallor, paresthesia, and coldness is the most common presentation. These symptoms are due to arterial thromboembolization arising from mural thrombus from the subclavian artery or a subclavian artery aneurysm. Presentations include upper extremity pain with activity due to subclavian artery stenosis or occlusion. Thrombus from the subclavian artery propagates to distal upper limb and causes ischemic forearm. However, because of the rich collateral circulation around the shoulder, ischemia is uncommon. On physical arm

examination, patients may have lower systolic blood pressure in the affected arm, and distal pulses at wrist may be diminished or absent. In patients with thromboembolism, fingertips ischemia or patchy ischemic skin may be present. A bruit or a thrill may be appreciated over the subclavian artery, and in patients who have developed post-stenotic aneurysmal changes, a pulsatile supraclavicular mass may be palpable. X-ray of chest, cervical region and Doppler ultrasonography aids in the initial evaluation of the vascular flow through the compromised territory.

Computed Tomography (CT) angiography is done to ascertain the extent of vascular compromise. The plan of management is surgical intervention to restore vascular insufficiency which involves the release or removal of the confounding structures such as cervical rib, scalene muscle, first rib and fibro muscular bands with adjuvant vascular intervention and/or reconstructive surgery. Rib resection can be performed through a transaxillary, supraclavicular and infraclavicular approach. Thoracoscopic (VATS) procedures are also described in the recent literature.

MATERIALS AND METHODS

This is a retrospective study including 22 patients, who underwent supraclavicular resection of cervical rib and first rib through supraclavicular approach in cardiothoracic and vascular surgery department of RNT medical college Udaipur, Rajasthan, India, over a period of 4 years from August 2020 to July, 2024. Data included patients' baseline data, surgical procedure and outcome.

Surgical Technique: After general endotracheal anesthesia and patients in supine position, the supraclavicular area is exposed by placing a large roll under the cervical and thoracic spine with the head turned to the opposite direction. An incision is made in supraclavicular fossa. By performing careful dissection of muscular, vascular and nervous structures, we identify the omohyoid muscle and lateral portion of sternocleidomastoid. Under them, the phrenic nerve is seen on the anterior surface of scalene muscle. Then we identify subclavian artery and brachial plexus. The brachial plexus retracted to reveal the cervical rib posteriorly. Finally cervical ribs along with some portion of first rib resected using a bone rongeur. Out of 22 cases, in 10 cases we performed embolectomy and in two cases (aneurysmal dilatation) vascular repair using reverse saphenous vein graft. There were no perioperative or late complications. Patient has reported improvement of symptoms. No recurrence has been observed.

RESULTS

Between August 2020 and July 2024, supraclavicular decompression procedures were performed on 22 patients (8 men) with Arterial TOS. The mean age was 30 years (range: 20-40). The most common

presenting symptom was ischemic pain and coolness in upper extremity. Diagnostic tests performed included x-ray chest and cervical region, duplex imaging study and CT angiography in every patient. patients underwent supraclavicular All decompression, which included anterior and middle scalenectomy, cervical ribs and partially first rib resection. Functional outcomes were excellent, good, fair, and poor in 60%, 30%, 10%, and 0% of cases respectively. In two patients' vascular reconstruction surgery performed using reverse saphenous vein graft. In 10 patients' embolectomy was performed. There was no death. Complications included neuropraxia (n = 1) which were treated with only analgesics. No patients experienced injury to the phrenic nerve. The mean duration of hospital stay was 4.5 days. The mean follow-up was 6 months.

DISCUSSION

Thoracic outlet syndrome (TOS) was first described by Sir Ashley Cooper in 1821.^[1] In 1903, Bramwell recognized the first rib to be the cause of TOS and resection of the first rib for TOS was first performed in 1910. Arterial TOS is caused by subclavian artery compression in the scalene triangle generally associated with an anatomic anomaly, such as a cervical rib, an elongated transverse process of C7 vertebra, accessory muscle-tendon bundles, and fibrotic bands. Continuous and pulsatile friction of the subclavian artery against bony structures causes fibrosis, stenosis, and aneurysmal dilatation.^[2] All the 22 cases presented here in this paper had a cervical rib joined to the first rib. In the 20 cases, compression caused the thickening of the artery wall, and in the 2 cases it caused an aneurysmal dilatation with mural thrombus in the artery. The presentation of arterial TOS varies greatly. Two Patients develop critical upper limb ischemia and presents in our emergency department. Another form of presentation is distal microembolization. This was the presentation seen in most cases, in which distal pulse was not palpable, and patients developed chronic ischemia of the upper limb in the form of intermittent claudication and ischemic changes on fingertips. Diagnosis was made on the basis of history, physical examination, and imaging studies.^[3] In our series of 22 cases presented with arterial symptoms of thoracic outlet syndrome managed by supraclavicular approach of cervical rib resection. This small sample size can be explained by our inclusion criteria of only arterial thoracic outlet syndrome caused by cervical ribs with exclusion of venous and neurogenic TOS. All cases presented with upper limb ischaemia, CT angiography was performed for diagnostic and therapeutic purposes. Operative success was achieved in all patients by a supraclavicular approach with scalenectomy, cervical rib and portion of first rib resection performed in every patient and additional vascular intervention. Supraclavicular incision provided good exposure of the cervical rib and anterior scalene

muscle for excision and good exposure of vessels for vascular reconstruction. Makhoul et al,^[4] reviewed the anatomical anomalies encountered in their extensive experience of 200 patients submitted to surgery for symptoms of thoracic outlet compression. It is noted that only 8.5% of their patients had a cervical rib or an anomaly of the first rib, while an anomaly of the scalene muscle was identified in 43% of patients, and 22.5% of patients having more than one anomaly. Contrary to this our study included all arterial thoracic outlet syndrome associated with cervical ribs. Desai and Robbs,^[5] reported a complete cervical rib in 60% of their patients surgically treated for TOS. In Lindgren et al,^[6] the result of surgery was considered successful in 59% at a two-year followup. In our series, cervical ribs accounted 100% of symptoms of arterial TOS. Numerous surgical case series have been reported and claimed good to excellent results in 50 to 90% of patients undergoing thoracic outlet decompression,^[7-9] which is concordant to our study. Lepantalo et al,^[10] reported the follow-up of 75 patients undergoing first rib resection for TOS. One month after surgery 52% of limbs were asymptomatic and 77% were improved, which is concordant to our study. In a recent report by Urschel and Kourlis,^[11] on their fifty-year experience at Baylor University Medical Center in 5102 patients treated for TOS, results were good in 85%, fair in 12% and poor in 3 while in our study result were excellent 60%, good 30%, fair in10% and poor in 0% cases.

CONCLUSION

Arterial TOS is a rare condition with the potential for limb-threatening thromboembolic complications.

This single-institution series demonstrates the diverse clinical presentation of arterial TOS coincident with bony and arterial pathology. This study indicates that supraclavicular resection of cervical ribs and portion of first rib can achieve excellent outcomes in a subset of patients. In addition to this, vascular intervention can be performed in the same sitting.

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