ROLE OF THERAPEUTIC EXERCISES IN NEUROGENIC THORACIC OUTLET SYNDROME

Saquib Hanif, Noreen Tassadaq[*], M. Farooq Azam Rathore, Pervaiz Rashid[**], Nadeem Ahmed[***], Farooq Niazi[****]

Physical Medicine and Rehabilitation (PM&R), Armed Forces Institute of Rehabilitation Medicine (AFIRM) Abid Majeed Road, Rawalpindi, [*]Consultant PM&R, Fauji Foundation Hospital, Rawalpindi, [**]Consultant Rheumatologist and Commandant AFIRM, Rawalpindi, [***]Consultant PM&R, AFIRM, Rawalpindi, [****]Consultant Radiologist, PNS Shifa, Karachi.

Background: Neurogenic Thoracic Outlet Syndrome (TOS) is a set of signs and symptoms existing due to compression of brachial plexus in the cervical area. We performed the study to highlight the role of therapeutic exercises on patients with neurogenic thoracic Outlet Syndrome. **Methods:** This quasi-experimental study was carried out at Armed Forces Institute of Rehabilitation Medicine (AFIRM), Rawalpindi. Fifty consecutive patients of neurogenic TOS of both genders and all ages were selected. Patients were diagnosed clinically and the diagnosis was confirmed by electrodiagnosis. These patients were asked to follow a therapeutic exercises program for 6 months. Outcome measures included Visual Analogue Scale (VAS) and Ulnar Nerve Conduction Velocity across neck. Results were compared by applying relevant tests of significance on follow up visits at 3 and 6 months. **Results:** Mean age was 39.1±7.79 years. Thirty seven (74%) cases were females and thirteen (26%) were males. On each visit, statistical analysis showed significant improvement with therapeutic exercises. After 6 months of conservative treatment, 17 (34%) of patients showed full recovery, 14 (28%) had marked improvement, 16 (32%) had partial improvement while 3 (6%) patients reported with persistent severe symptoms. **Conclusion:** Current study shows that a trial of therapeutic exercises provides relief of symptoms of Neurogenic Thoracic Outlet Syndrome in majority of patients.

Key Words: Thoracic Outlet Syndrome, entrapment syndromes, Electrodiagnosis, Therapeutic Exercises, Rehabilitation

INTRODUCTION

Thoracic outlet syndrome refers to the constellation of symptoms occurring due to compression of the neurovascular bundle by bony, ligamentous or muscular obstacles between the cervical spine and the lower border of the axilla.[1] This neurovascular bundle consists of the brachial plexus, usually the C_8 and T_1 nerve roots, the subclavian artery and vein.

The clinical presentation can be varied. There may be pain and heaviness in the cervical region and arms, paraesthesias (medial side of arm) aggravated by overhead positioning of the arms, intrinsic muscle deficit/atrophy of hand, easy fatigability, paleness or coldness of hand.[2] Certain studies[1-4] show that thoracic outlet syndrome most commonly presents with neurological symptoms in the arm. It is said that thoracic outlet syndrome may be the most underrated, overlooked and misdiagnosed peripheral nerve compression in the upper extremity.[1]

The diagnosis is based upon clinical evaluation and absence of other relevant pathology.[2] The clinical examination may be entirely normal or show cervical muscle spasm, tenderness in the supraclavicular area, radial pulse attenuation, sensory or motor deficits,[2] atrophy of intrinsic hand muscles and aggravation of symptoms upon positional manoeuvres.

Electrophysiological studies are helpful in deciding the mode of treatment and gauge the improvement after conservative or surgical treatment.[2,3] In most cases the initial treatment is conservative with an emphasis on therapeutic exercises for neck and shoulder girdle whereas surgery is indicated for acute vascular insufficiency, progressive neurological dysfunction,[2] and refractory pain that fail with conservative treatment.

To the best of our knowledge, very little work has been done on this topic in Pakistan.[2] This study was preferred to see the effect of exercises in the conservative management of neurogenic thoracic outlet syndrome.

MATERIALS AND METHOD

This quasi-experimental study was carried out at Armed Forces Institute of Rehabilitation Medicine (AFIRM) Rawalpindi, which is a tertiary health care rehabilitation institute. Duration of study was two years from 1st Feb 2005 to 31st Jan 2007. The ethics committee of the institute approved the study at the beginning.

Fifty consecutive adult patients were selected from the electrodiagnostic department at Armed Forces Institute of Rehabilitation Medicine, Rawalpindi and were invited to participate in the study. These patients were referred by neurosurgeons, general surgeons and rehabilitation physicians to the

electrodiagnostic clinic for nerve conduction studies and electromyography (NCS/EMG) to rule out neurogenic thoracic outlet syndrome. The inclusion criteria were (1) Positive Roos Test, (2) Standard Electrophysiological Criteria for TOS, with moderately reduced motor conduction velocity across neck in Ulnar nerve [55–59 m/s] (Table-1), (3) patients willing for 6 months follow up at AFIRM, Rawalpindi. The Roos test is described as 90 degrees abduction with external rotation of the shoulder, which reproduces symptoms of numbness and paresthesias in ulnar aspect of forearm and hand. Roos has modified this by incorporation of a 3-minute stress test of rapidly closing and opening the hand. To determine ulnar nerve conduction velocity, points of stimulation included the supraclavicular fossa, middle upper arm, below elbow, and wrist. Normal value across the thoracic outlet was assumed to be more than 66 m/sec in our population. Values less than 66 m/sec were taken to be indicative of compression (Table-1).

Table-1: Grading of Ulnar nerve compression across neck assessed by Electro-diagnosis

Velocity	Grade
More than 66 m/sec	Normal
60–65 m/sec	Mild
55–59 m/sec	Moderate
less than 54 m/sec	Severe

Patients with (1) diabetes mellitus, (2) Previous trauma/surgery around neck, (3) Vasogenic thoracic outlet syndrome on the basis of positive Adson's test and the costoclavicular test along with vasogenic symptoms like Raynauds phenomenon and cyanosis of fingers, (4) Co-existing polyneuropathy and carpal tunnel syndrome diagnosed on Nerve conduction studies and (5) TOS with nerve conduction velocity of less than 54 m/s (severe TOS) were excluded from the study.

All the patients underwent a detailed exercise program. This included active strengthening exercises of paraspinal, scapular and trapezius muscles and stretching exercises of sternocleidomastoid, scalene anterior and pectoralis major muscles. Patients were instructed these exercises at the beginning of the study, and repeated at fortnightly visits for 6 months by the same physiotherapist in gymnasia at AFIRM. They were asked to perform these exercises once a day, four days a week for 6 consecutive months. These patients were only prescribed tablet paracetamol & NSAIDS (e.g., Ibuprofen) for pain relief during the study. Patients were followed up for 6 months and a detailed clinical examination and electrodiagnosis were repeated at three and six month intervals.

The main outcome measures included subjective improvement in visual Analog scale (VAS) and at least one grade improvement in Nerve conduction velocity as described in Table-1. The VAS was taken as 10 Cm scale with 0= No pain, 1–3= mild, 4–6= moderate, and 7–10= severe pain. Full recovery was defined as patients having no pain (VAS=0) and normal nerve conduction velocity in ulnar nerve across neck. Marked improvement was defined as patient having pain (VAS=1–3) and at least one grade improvement in base line NCV. Partial improvement was defined as a patient having pain (VAS=4–6) and at least one grade improvement in NCV across neck. No improvement was considered when patients had no benefit of exercise program with pain (VAN=7–10) and no change/improvement in nerve conduction velocities.

The results were recorded on pre-designed proforma and were analyzed by using SPSS ver 10.0. The paired sample T test was applied to compare the results of electrodiagnosis and visual analogue scale. The *p* value of <0.05 was considered statistically significant.

RESULTS

The sample consisted of thirty seven women (74%) and thirteen men (26%), with a mean age of 39.1±7.79 years.

At the beginning of the study, mean VAS was 5.8 ±1.47. NCS mean of 50 patients was 55±2.5 m/s.

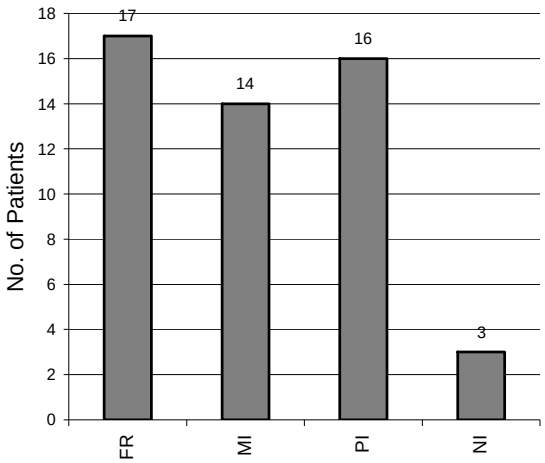
After following a continuous exercise program for initial 3 months, the mean VAS was found to be 3.3±1.9 and NCS showed a mean of 60±2.83 m/s. Seven (14%) patients showed full recovery, 16 (32%) revealed marked improvement, 17 (34%) had partial improvement, while 10 (20%) had severe complaints or showed no improvement.

On 2nd follow up visit after 06 months, mean VAS was 1.92±1.91 (Figure-1). 17 (34%) of patients showed full recovery, 14 (28%) had marked improvement, 16 (32%) revealed partial improvement while 3 (6%) patients had either no improvement or had persistent severe symptoms. When results were compared between the two visits it was seen that the difference was statistically significant (*p*<0.05, Table-2).

Table-2: Recovery after 06 months (Paired sample T test)

Variable	Before exercise	6 months after exercise	*p*Value
NCV-Ulnar Across Neck	55 (2.51)	60.1 (2.830)	<0.00001
VAS	5.8 (1.47)	1.9 (1.81)	<0.0001

NCV= Nerve Conduction Velocity mean (S.D),
VAS= Visual Analogue Scale mean (SD). (0–10 at 10 Cm scale)



FR=Full Recovery, MI=Marked Improvement,
PI=Partial Improvement, NI= No Improvement

Figure-1: Recovery of patients after 6 months.

DISCUSSION

Thoracic outlet syndrome refers to compression of the neurovascular structures at the superior aperture of thorax. It represents a group of symptoms. The causes, diagnosis and treatment are controversial. Neuralgic symptoms occur in 95% of patients. Female to male ratio was 3:1, which is comparative to international studies.[2,3]

Initially conservative treatment with exercises appears to be the most universally accepted approach except those with vascular symptoms. Surgeons also recommend a prolonged trial before any operative treatment in neurogenic TOS.[9] In addition, surgical treatments have been known to have devastating complications, which further debate with the opponents of recognition of this entity.[2]

Several studies compared surgical and conservative treatments for TOS with results in favour of conservative treatment.[2-14] While the main stay of treatment remains exercises and postural correction, randomized controlled trial have evaluated orthosis, massage & kinesiotherapy involving cervical spine and shoulder girdle, and acupuncture.[2]

Most authors agree that non surgical measures involving stretching scalene, pectoral, and trapezius muscle performed to avoid recreating symptoms, proper positioning and avoidance of aggravating factors should be tried first.[2-4]

Approximately 60% of patients improve significantly with conservative treatment alone.[2] As shown in our study 62% had significant improvement where 32% revealed partial improvement.

We also compared improvement in outcome measures with an international study published in literature. In a study by Landry *et al*[12] 78% of the patients treated conservatively returned to work with in a follow up of 2 years (Table-3). In our study, 62% of patients had returned to work, probably due to the fact that duration of follow up period is less as compared to that study.

Table-3: Return to work after conservative management of Thoracic outlet Syndrome

	Lindgren[20]	Landry GJ[12]	Present study
No of Patients	119	68	50
Time (duration)	24 month	>60 months	6 months
Female	91	-	37
Male	28	-	13
Return to work	73%	78%	62%

In our study, certain biases on the study group level exist. For instance, though the study was conducted on strict selection criteria, most of the patients belonged to a specific section of population, i.e., armed forces personnel and their families. Similarly, most of our patients were either illiterate or less educated. This may have resulted in improper understanding and ineffective execution of therapeutic exercises. This was minimized by fortnightly visits to the same physiotherapists and repetitive demonstrations of same exercises.

CONCLUSION

Neurogenic TOS is a common cause of neck and arm pain that leads to a significant disability. We recommend nerve conduction studies and electromyography to confirm the diagnosis of neurogenic thoracic outlet syndrome. Patients diagnosed as mild to moderate cases of neurogenic TOS should undergo a therapeutic exercise plan for at least six months to attain effective results. Compliance to these exercises can be enhanced by regular follow up and repetitive demonstration of exercises. However, more research is required to formulate the most effective mode of treatment in cases of Neurogenic TOS in our local population.

REFERENCES

1. Woods WW: Personal experiences with the surgical treatment of 250 cases of cervicobrachial neurovascular compression syndrome. J Int Coll Surg. 1965;44:273–83.
2. R. A. Cooke. Thoracic outlet syndrome-aspects of diagnosis in the differential diagnosis of hand-arm vibration syndrome, Occup Med (Lond). 2003;53(5):331–6.
3. Brantigan CO, Roos DB. Diagnosing thoracic outlet syndrome, Hand Clin, 2004;20:27–36.
4. England JD, Tiel RL: AAEM case report 33: costoclavicular mass syndrome. Amr. Ass. Of Electrodiagnostic Medicine. Muscle Nerve 1999;22:412–8.
5. Gruss D. Thoracic outlet syndrome. Acta Chir Aust 2000;32:15–19.
6. Tolson TD. EMG for thoracic outlet syndrome. Hand Clin 2004;20:37–42.
7. Balci AE, Balci TA, Cakiro, Eren S, Eren MN. Surgical treatment of thoracic outlet syndrome: effects and results of surgery. Ann Thoracic Surgery 2003;75:1091–6.

8. Niazi PHK, Ahmad K, Hussain A, Waheed A, Alam A. Electrodiagnosis of Thoracic Outlet Syndrome. J Med Armed Forces Pak. 2001;51(1):6–9.
9. Andrew KC, Bohan JS. Thoracic outlet syndrome [online] 2006 [cited 2006 October 06]; Available form: URL: http://www.emedicine.com/emerg/topic578.htm.
10. Nancy AK. Evaluation and treatment of thoracic outlet syndrome [online] 2003 [cited 2004 Apr 5]; Available form URL: http://www.therasite-thoracic outlet handouts.htm
11. Benjamin MS: Thoracic outlet syndrome [online] 2006 [cited 2006 December 13]; Available from URL: http://www.emedicine.com/PMR/topic136.htm.
12. Landry GJ, Moneta GL, Taylor LM Jr, Edwards JM, Porter JM. Long-term functional outcome of neurogenic thoracic outlet syndrome in surgically and conservatively treated patients. J Vasc Surg 2001;33:312–7, 317–9.
13. Nakatsuchi Y, Saitoh S, Hosaka M, Matsuda S. Conservative treatment of thoracic outlet syndrome using an orthosis. J Hand Surg [Br]. 1995;20:34–9.
14. Buonocore M, Manstretta C, Mazzucchi G, Casale R. The clinical evaluation of conservative treatment in patients with the thoracic outlet syndrome. G Ital Med Lav Ergon 1998;20:249–54.
15. Tariq M, Zahir J, Saleem SA. Role of acupuncture in thoracic outlet syndrome. BMJ Acupuncture in Med 2000;18:122–3.
16. Kenny RA, Traynor GB, Withington D, Keegan DJ. Thoracic outlet syndrome: a useful exercise treatment option. Am J Surg 1993;165:282–3.
17. Singh MK, Patel J. Thoracic outlet syndrome [online] 2006 [cited 2006 January 31]; Available from: URL: http://www.emedicine.com/neuro/topic369.htm.
18. Dubuisson AS. The thoracic outlet syndrome [online] 2002 [cited 2005 May 25]; Available from URL: http://www.medschool.lsuhsc.edu/neurosurgery/nervecenter/ TOS.html
19. Garcia ND, Eskandari M, Tehrani H, Morasch MD. Thoracic outlet obstruction [online] 2007 [cited 2007 May 23]; Available from URL: http://www.emedicine.com/med/topic2774.htm.
20. Lindgren KA. Conservative treatment of thoracic outlet syndrome: a 2-year follow-up. Arch Phys Med Rehabil. 1997;78(4):373–8.

Address for Correspondence:

Dr. Saquib Hanif, Graded Specialist, Rehabilitation Medicine, Armed Forces Institute of Rehabilitation Medicine, Abid Majeed Road, Rawalpindi. Tel: Office: +92-51-56131721, 561-34494, Cell: +92-345-5118440
Email: drsaqii1711@gmail.com