ROLE OF THERAPEUTIC EXERCISES IN NEUROGENIC THORACIC OUTLET SYNDROME

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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. This neurovascular bundle consists of the brachial plexus, usually the C3 and T1 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, paraesthiasias (medial side of arm) aggravated by overhead positioning of the arms, intrinsic muscle deficit/atrophy of hand, easy fatigability, paleness or coldness of hand. Certain studies 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. The diagnosis is based upon clinical evaluation and absence of other relevant pathology. The clinical examination may be entirely normal or show cervical muscle spasm, tenderness in the supraclavicular area, radial pulse attenuation, sensory or motor deficits, 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. 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, 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. 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**

<table>
<thead>
<tr>
<th>Velocity</th>
<th>Grade</th>
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<tbody>
<tr>
<td>More than 66 m/sec</td>
<td>Normal</td>
</tr>
<tr>
<td>60–65 m/sec</td>
<td>Mild</td>
</tr>
<tr>
<td>55–59 m/sec</td>
<td>Moderate</td>
</tr>
<tr>
<td>less than 54 m/sec</td>
<td>Severe</td>
</tr>
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</table>

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 gymnasias 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 & NSAIIDS (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)**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Before exercise</th>
<th>6 months after exercise</th>
<th>pValue</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCV/ Ulnar Across Neck (m/s)</td>
<td>55.2(3.1)</td>
<td>60.1(2.830)</td>
<td>&lt;0.00001</td>
</tr>
<tr>
<td>VAS</td>
<td>5.8 (1.47)</td>
<td>1.9 (1.81)</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>Lindgren&lt;sup&gt;18&lt;/sup&gt;</th>
<th>Landry GJ&lt;sup&gt;19&lt;/sup&gt;</th>
<th>Present study</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of Patients</td>
<td>119</td>
<td>68</td>
<td>50</td>
</tr>
<tr>
<td>Time (duration)</td>
<td>24 month</td>
<td>&gt;60 months</td>
<td>6 months</td>
</tr>
<tr>
<td>Female</td>
<td>91</td>
<td>-</td>
<td>37</td>
</tr>
<tr>
<td>Male</td>
<td>28</td>
<td>-</td>
<td>10</td>
</tr>
<tr>
<td>Return to work</td>
<td>73%</td>
<td>78%</td>
<td>62%</td>
</tr>
</tbody>
</table>

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.

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