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EFFECTIVENESS OF PASSIVE SCAPULAR MOBILIZATION ON PAIN AND SHOULDER CONTROL IN NEGLECTED STROKE SURVIVORS.

KEY WORDS: scapular mobilization, neglected stroke survivors, shoulder pain

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ABSTRACT

Background: The purpose of this study was to assess the effectiveness of passive scapular mobilization on pain and shoulder control in neglected stroke survivors.

Method: 50 neglected stroke survivors having shoulder pain were included in this study. Following the collection of data the subjects were allocated conveniently into 2 groups; Experimental group (Group A- scapular mobilization with conventional treatment) and control group (Group B- conventional treatment only). Before and after the treatment protocol the subjects were assessed for intensity shoulder pain by NRS, shoulder range of motion through goniometer, spasticity by MAS and total shoulder disability by SPADI. These outcome measures were analysed.

Result: Pre and post treatment protocol was analysed using paired t test and unpaired t test for parametric data and for non parametric data wilcoxon and Mann-whitney test were used. Analysis of non parametric data showed extremely significant difference for NRS ($p= <0.0001$) and not significant for MAS for all shoulder musculature. Analysis of parametric data showed significance for SPADI score($p=0.0019$) and shoulder ROM except external and internal rotation.

Conclusion: The scapular mobilization with conventional physiotherapy treatment enhances shoulder ROM , reduces pain and shoulder disability score in neglected stroke survivors with shoulder pain.

Introduction

The most common impairment after stroke is pain and has been reported in more than one third of stroke surviors.[1,2] Shoulder pain is most common type of pain in stroke,[2,3] other types are headache, central pain, spasticity related pain and musculoskeletal pain.[2] The prevalence of shoulder pain varies from 5- 84% in previous studies.[4,5] If patient has painful shoulder he may prefer not to move, or may withdraw from active rehabilitation.[6] An immobile and painful shoulder may interfere with upper limb function and also with balance, walking, transfers and performance of self care activities.[7] Individuals suffering from severe stroke has a shoulder pain most frequently. Other risk factors for post stroke shoulder pain includes low age[8] , depression.[2]

Specific causes and contributing factors of shoulder pain are unclear. They can be suggested as glenohumeral malalignment or subluxation, mental depression, adhesive changes or decreased ROM of shoulder, rotator cuff tears, capsulitis, somatosensory disturbances, swollen hemiplegic hands and spasticity of shoulder musculature.[9] In normal individuals, pain sensitive soft tissue surrounding the glenohumeral joint (rotator cuff, joint capsule, subacromial bursa and biceps brachii tendon) is subject to many stresses. In addition to that, gravity provides traction stress and GHJ flexion and abduction movements create friction-compression stress between the humeral head and coracoacromial ligament.[1] In hemiplegic patients, condition may produce additional stresses of paralysis, sensory and perceptual deficits and abnormal tone. On other hand reduced motor function and muscle imbalance lead to changes in joint position that may further land up into subluxation. Subluxation results in overstretching of soft tissues around the GHJ.[10]

Spasticity in the muscle groups itself can cause pain as spastic muscles are painful when stretched. Prevalence of rotator cuff tendon tears was reported about 33- 40 % in hemiplegic patients.[2,3] Neglect of half side of the body may also contribute to the shoulder pain as they may not protect their paralysed upper limb effectively.[11] Above variety of causes occurs due to altered biomechanics of shoulder complex.

In normal individuals, the mobility of shoulder complex involves combined motions of sternoclavicular, acromioclavicular, scapulothoracic and glenohumeral joints; coordination is important to perform full are elevation. In total 180 degrees of normal shoulder abduction, GHJ motion contribute for 120 degrees of motion and outward rotation of scapula contribute for 60 degrees. In initial phase of abduction, the scapula is reported to abduct or adduct slightly, to oscillate, or to remain fixed which is called as " setting phase ", which occurs in the first 30 degrees of abduction and in first 60 degrees of forward flexion. A 2:1 relationship of GHJ to scapulo- thoracic movement develops on further elevation of shoulder joint. So that for every 15 degrees of motion, GHJ contributes for 10 degrees and 5 scapula on thorax contributes 5 degrees.[12] The normal glenohumeral rhythm is disrupted when scapular stability is poor and the humerus and scapula move as one unit as in hemiplegics. The muscles like teres major and latissimus dorsi which never elongate fully and may become shortened. Hence abduction, forward flexion and lateral rotation are limited with excessive scapular instability with passive elevation.[13] This abnormal scapular biomechanics that occurs in hemiplegics create abnormal position of scapula and that decreases the normal shoulder functions.[14,15]

Thus treatment protocol includes number of techniques to treat shoulder pain in hemiplegics. This includes electrical stimulation, acupuncture, strapping, sling, handling, positioning, massage and pharmacological therapy. However, none of these treatment protocols has been significantly superior to each others.[16,17] Several interventions have been developed for treatment of hemiplegic shoulder pain, but evidence for these interventions remains insufficient.[16] Main concern of these patients are joint ROM which is limited by capsular or ligamentous tightness or adherence. This may lead to joint hypomobility due to capsular dysfunction; hence passive mobilization can be used to lengthen the shortened structures or to rupture the adhesions and for increasing ROM.[18]

Materials and methodology

Population:

Neglected stroke survivors with shoulder pain and restriction from the society willing to participate in the study were taken. The criteria for inclusion were: shoulder pain post stroke 4 weeks, brunnstrom stage 2 and more, able to follow commands. Subjects were excluded if they had History of fracture, bone disease (Osteoporosis, TB and Rickets), history of cervical problems, medication or cortisone for shoulder, hemiplegia followed by traumatic brain injury.

50 subjects (32 male, 18 female; mean ages in group A = 60.84, group B= 58.4; right side affected=28, left side affected=22)participated in the study. Subjects were divided into 2 groups through convenient sampling with random allocation in experimental group (Group A) and control group (Group B). 25 subjects (Group A) received scapular mobilization plus conventional physiotherapy treatment and other 25 (Group B) received conventional physiotherapy treatment only. All the subjects were informed about the experimental protocol and risks of the study and gave written consent before their participation. The protocol and the consent form were previously approved by protocol and ethical committee.

Measurement Procedure:

Numerical Pain rating scale (NRS) :

It is a 11 point numerical rating scale and was highly correlated with the VAS, verbal rating scale, faces scale. Patients had to point out how much pain they have experienced on average. It is considered a valid and reliable pain assessment tool for assessing shoulder pain.[19] This scale was graded from 0 (no pain) to 10 (the most intense level of pain).

Modified Ashworth Scale (MAS) :

The MAS is a 6 point scale of which, the reliability is demonstrated by Kappa-values of 0.75 – 0.83.[20] The MAS is performed by moving shoulder in flexion, extension, abduction, adduction, medial and lateral rotation with speed.

ROM assessment of shoulder :

The ROM is recorded in active shoulder flexion, extension, abduction, medial & lateral rotation with standard goniometer. All movements of shoulder joint were recorded while participants lying in a supine position and shoulder extension was measured in the side-lying position.

Shoulder Pain and Disability Index (SPADI) :

It is a self-administered assessment tool, was used to measure pain and disability related to shoulder pathology. It consists of 5 pain and 8 disability assessing questions measured on a visual analogue scale. The highest score indicating the most severe pain and disability. A systemic review showed that the intraclass correlation coefficient (ICC) was greater than 0.89.[21]

Therapeutic protocol[22]

Both groups (A and B) received a conventional physiotherapy program, as the following

Hot moist packs: Patient was asked to turn on sound side as affected arm should be upward. Then place the hot moist pack on the painful area for 10 minutes prior to the exercises program. Repeatedly ask the patient about the temperature status.

Facilitation of peri-scapular and shoulder muscles: Tapping , quick stretches, weight bearing exercises for weak muscle groups.

Inhibition of spastic muscles: Application ice pack on spastic muscle groups for 5 minutes.

Passive stretching: It will maintain the flexibility of tight muscles as subscapularis, pronator, biceps brachii, wrist flexors to destruct adhesions in muscles and sheath. 30 seconds hold with 3 repetitions.

Graduated active exercises or active assisted exercises: It will maintain the integrity and available joint range of motion of upper limb. Patient was tought how to use normal extremity to move the involved extremity through ranges of motion with clasped hands i.e with closed kinematic chain. Perform 10 repetitions of each motion of shoulder joint like flexion, extension, abduction, adduction etc.

Bed mobility exercises: Rolling to both sides, supine to sit, sit to stand. Perform 5 repetitions.

Exercises for trunk control: Pelvic bridging, pelvis rotations, bridging by taking weight on affected lower limb. Perform 5 repetitions.

Balance training program: It includes dynamic balance training for 5 minutes.

Gait training: It includes gait training with biofeedback in parallel bar with mirrior.

Group A (Experimental group) received scapular mobilization :

Scapular mobilization was given to the patient from side lying position facing to physiotherapist, therapist's index finger hold medial border of scapula; thumb hold lateral border of scapula and web space hold inferior angle of scapula. Mobilization was performed in upward rotation and downward rotation, adduction and abduction of scapula. 10 repetitions with rest interval of 30 seconds between sets were applied.

Scapular distraction was performed by putting ulnar fingers under the medial scapular border.

These mobilization patterns were used because research showed that there is decrease in scapular upward rotation, posterior tilt, superior tilt and external rotation.

Statistical analysis

The data was entered into Microsoft office excel 2007. The data was analysed using instat software. Descriptive statistics were used to analyse baseline data for demographic data. Pre and post treatment protocol was analysed using paired and unpaired t test for parametric data and for non parametric data wilcoxon and Mann-whitney test were used. p value less than 0.05 was considered to be statistically significant.

Results:

50 subjects meeting the inclusion criteria were included in the study. During 12 weeks of protocol program 25 subjects (17 males, 8 females) were in group A where scapular mobilization with conventional physiotherapy treatment was given and other 25 (15 males,10 females) in group B where only conventional treatment was given. The descriptive analysis of the study is summarized in table 1. Intra group analysis is done in table 2 and inter group analysis in table 3.

Table 1: Descriptive characteristics of subjects in the study

		Group A	Group B
VARIABLES			
Age (mean ± SD)		60.84 ± 15.37	58.4 ± 11.87
No of subjects		25	25
No of Males		17	15
No of Females		8	10
Side affected	Right	16	12
	Left	9	13

Table 2: Intra group analysis comparing pre and post of each group

Group A (Experimental group) N = 25		Pre M±SD	Post M±SD	p value	r/t value
NRS		6.16 ± 0.98	2.96 ± 1.060	< 0.0001	0.7412
MAS for shoulder musculature Mode(min-max)	Flexors	1±(1± - 2)	2 (1- 2)	0.0313	0.8852
	Extensors	0 (0-1)	0 (0-1)	0.0156	0.5204
	Abductors	0 (0-1)	0 (0-1)	0.0156	0.5204
	Adductors	1±(1± -2)	2 (1- 2)	0.0313	0.8852
	External rotators	0 (0-1)	0 (0-1)	0.0156	0.5204
	Internal rotators	1± (1± -2)	2 (1- 2)	0.0313	0.8852

ROM of shoulder joint	Flexion	105.76 ± 13.60	127.52 ± 11.84	<0.0001	20.676
	Extension	29.36 ± 12.16	41.96 ± 10.71	<0.0001	19.598
	Abduction	65.08 ± 8.87	77.04 ± 9.11	<0.0001	30.385
	External rotation	26.08 ± 6.57	31.04 ± 6.06	<0.0001	19.621
	Internal rotation	46.32 ± 13.46	50.76 ± 13.50	<0.0001	21.904
SPADI		77.77 ± 7.57	65.25 ± 7.11	<0.0001	18.531

Group B (control group) N = 25		Pre M± SD	Post M± SD	p value	r/t value
NRS		6.16 ± 0.89	4.72 ± 1.02	< 0.0001	0.8661
MAS for shoulder musculature Mode(min-max)	Flexors	2 (1± - 2)	2 (1- 2)	0.0625	0.9049
	Extensors	0 (0-1)	0 (0-1)	0.0625	0.6491
	Abductors	0 (0-1)	0 (0-1)	0.0625	0.6491
	Adductors	2 (1± - 2)	2 (1- 2)	0.0625	0.9049
	External rotators	0 (0-1)	0 (0-1)	0.0625	0.6491
	Internal rotators	2 (1± - 2)	2 (1- 2)	0.0625	0.9049
ROM of shoulder joint	Flexion	105 ± 12.83	111.03 ±19.16	<0.0001	13.204
	Extension	29.23 ± 11.03	34 ±10.44	<0.0001	14.932
	Abduction	64.80 ± 9.70	69.4 ±10.01	<0.0001	13.588
	External rotation	25.91 ± 6.05	28.54 ± 6.24	<0.0001	20.699
	Internal rotation	52.45 ±12.06	55 ±12.11	<0.0001	25.265
SPADI		80.17 ± 5.41	72.05 ± 7.48	<0.0001	8.390

Intra group statistical analysis revealed extreme significance (p=<0.0001) between pre and post intervention for all the groups using paired t test for parametric data and wilcoxon matched-pairs test for non parametric data except MAS for group B which showed not significant difference . Result shows the improvement in range of motion of shoulder joint, shoulder pain, spasticity and shoulder disability score.

Table 3: Inter group analysis comparing pre-pre post-post of each group

N = 50 (25 in each group)			Group A M± SD	Group B M± SD	p value	U'/t value
NRS		Pre	6.16 ± 0.98	6.16 ± 0.89	0.9688	315.00
		Post	2.96 ± 1.060	4.72± 1.02	< 0.0001	550.50
MAS for shoulder musculature Mode(min-max)	Flexors	Pre	1± (1± - 2)	2 (1± - 2)	0.6282	337.50
		Post	2 (1- 2)	2 (1- 2)	0.6028	339.50
	Extensors	Pre	0 (0-1)	0 (0-1)	0.9921	312.50
		Post	0 (0-1)	0 (0-1)	0.6239	337.50
	Abductors	Pre	0 (0-1)	0 (0-1)	0.9921	312.50
		Post	0 (0-1)	0 (0-1)	0.6239	337.50
	Adductors	Pre	1± (1± - 2)	2(1± -2)	0.6282	337.50
		Post	2 (1- 2)	2 (1- 2)	0.6028	339.50
	External rotators	Pre	0 (0-1)	0 (0-1)	0.9921	312.50
		Post	0 (0-1)	0 (0-1)	0.6239	337.50
	Internal rotators	Pre	1± (1± - 2)	2 (1± - 2)	0.6282	337.50
		Post	2 (1- 2)	2 (1- 2)	0.6028	339.50
ROM of shoulder joint	Flexion	Pre	105.76± 13.60	105 ± 12.83	0.8399	0.2032
		Post	127.52 ± 11.84	111.03 ± 19.16	0.0003	3.940
	Extension	Pre	29.36 ± 12.16	29.23 ± 11.03	0.8458	0.1956
		Post	41.96 ± 10.71	34 ± 10.44	0.0067	2.821
	Abduction	Pre	65.08 ± 8.87	64.80 ± 9.70	0.8895	0.1397
		Post	77.04 ± 9.11	69.4 ± 10.01	0.0069	2.821
	External rotation	Pre	26.08 ± 6.57	25.91 ± 6.05	0.8463	0.1950
		Post	31.04 ± 6.06	28.54 ± 6.24	0.2827	1.086
	Internal rotation	Pre	46.32 ± 13.46	52.45 ± 12.06	0.1081	1.637
		Post	50.76 ± 13.50	55 ± 12.11	0.2725	1.110
SPADI		Pre	77.77 ± 7.57	80.17 ± 5.41	0.2038	1.288
		Post	65.25 ± 7.11	72.05 ± 7.48	0.0019	3.292

Inter group analysis of all variables was done by unpaired t test for parametric data and Mann-whitney test for non parametric data. Pre interventional analysis for all variables between the groups were not significant. Post interventional analysis showed extremely significant difference between the groups for NRS (p=< 0.0001) and shoulder flexion ROM (p=0.0003) and very significant for shoulder extension (p=0.0067), abduction (p=0.0069) and SPADI score (p=0.0019) but were not significant for shoulder external (p=0.2827) and internal (p=0.2725) ROM and MAS for all the muscle groups of shoulder (flexors p=0.6028, extensors p=0.6239, abductors p=0.6239, adductors p=0.6028, external rotators p=0.6239, internal rotators p=0.6028).

Disscusion

The present study demonstrated that the effect of scapular mobilization with conventional physiotherapy protocol which significantly improved shoulder range of motion, shoulder pain, SPADI score.

Shoulder pain after stroke is a most common type of pain.[2,3] It may have variety of causes like subluxation, mental depression, adhesive capsulitis, decreased ROM of shoulder, rotator cuff tears, somatosensory disturbances, spasticity etc.[14] Post stroke shoulder pain affects the rehabilitation procedure and may also interfere with balance, walking, transfers, performance of self-care activities and quality of life.[23]

Study showed that mean age of occurrence of stroke was significantly decreased to 69.2 years and the proportion of all strokes under age 55 were increased to 18.6% in 2005.[24] This study also involve subjects with mean age of 60.84 (24-82) in group A and 58.4 (32-80) in group B.

Total 50 subjects who were clinically diagnosed with hemplegic shoulder pain fulfilling inclusion and exclusion criteria were taken in this study. Among them 32 were males and 18 were females. Various studies showed that hemiplegic shoulder pain is independent of age and sex.[25,26] This study also shows the same as there is no significance related to age and gender.

Study also involves total 28 subjects having right side affected (Group A =16, Group B =12) and 22 subjects having left side affected (Group A = 9, Group B = 13). Some studies found that there is no significant relationship between shoulder pain and side affected.[26] Whereas other studies showed that patients with neglect, due to right hemisphere damage may not take care there paralysed upper limb effectively and therefore be at greater risk of trauma.[16] Poulin de Courval et al.[27] also showed that shoulder pain was more common in subjects with left sided hemiplegia. On the other hand, other studies showed the relationship between right hemiplegia and hemiplegic shoulder pain.[28] Present study also had no significant relationship between shoulder pain and side affected.

In this study NRS was taken to quantify shoulder pain. Study showed extremely significance in shoulder pain this effect is may be due to the neurophysiological effects of mobilization. Which are based upon the stimulation of peripheral mechanoreceptors and which in turn leads to inhibition of nociceptors.[29] Some studies showed that the endogenous pain inhibitory system was sufficiently activated by synovial joint mobilization.[30]

Modified ashworth scale was evaluated before the interventions and after 12 weeks. The final result was not significant for all the muscle groups of shoulder joint i.e flexors, extensors, abductors, adductors, external rotators and internal rotators. This may be due to the insufficient changes in alpha motoneuron reflex excitability during the application of joint mobilization techniques.

Shoulder ROM in flexion, extension, abduction, internal and external rotation was calculated which showed significance except for shoulder external and internal rotation. Shoulder flexion range improve by 21.76 degrees in group A whereas extension range improved by 12.6 degrees. Shoulder abduction improved by of 11. 96 degrees; external rotation by 4.96 degrees and internal rotation by 4.44 degrees. The mechanical changes due to mobilization may include breaking up adhesions, realigning collagen, or increasing fiber glide this in turn increases the ROM of shoulder. Mobilization lengthens joint capsule and stretches the associated ligaments and tissue traction activates gamma motor neurons causing activation of mechanoreceptors throughout ROM increases sensory output. The Ruffini ending mechanoreceptors are slow adapting as they remain active even after joint mobilization is discontinued. Thus, central nervous system receives more afferent information from increased activity of slow-adapting mechanoreceptors.

Shoulder pain and disability index was significantly effective. This may be due to the mechanical and neurophysiological effects of mobilization technique. It reduces pain and also enhances shoulder ROM by providing synovial fluid motion that brings nutrition to the avascular portion of articular cartilage which in turn prevent the painful effect of stasis.[22] That decreases shoulder disabilityscore.

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