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The Correlation between Modified Ashworth Scale and Action Research Arm Test in Stroke Patients with Upper Extremity Rehabilitation Using Neurodynamics

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Abstract

Background: Stroke is a common disorder, caused by vascular disease. Hemiparesis occurs in stroke which leads to disability. Spasticity develops in 90% of stroke patients on the contra lateral side.

Objective: To determine correlation of Modified Ashworth Scale (MAS) and Action Research Arm Test (ARAT) used to assess spasticity and the recovery of upper extremity function in stroke patients.

Methods: It was a randomized control trial. 41 stroke patients were recruited for the study. Data was collected from DHQ Hospital Jhelum. To control group conventional treatment and to experimental group conventional treatment with neurodynamics was applied, 10 rep/set, 1 set/day, 3 days/week for 6 weeks. 0, 3rd and 6th week assessment was done through Modified Ashworth Scale (MAS) and Action Research Arm Test (ARAT). Correlation analysis was done through SPSS version 21.

Results: Spearmen correlation analysis was done through SPSS version 21. At 0 week r was -0.234, at 3rd week r was -0.275 and at 6th week r was -0.456 and p value was >0.05 at 0 and 3rd week and it was <0.01 at 6th week.

Conclusion: This study concluded that there was low to moderate negative correlation between Modified Ashworth Scale (MAS) and Action Research Arm Test (ARAT). This study determined that modified ash worth scale can be used separately for the assessment of spasticity.

Keywords: Neurodynamics; Rehabilitation; Spasticity; Stroke; Modified Ashworth Scale (MAS)

Introduction

Stroke is a common disorder, caused by vascular disease [1]. Stroke is of two types; ischemic and hemorrhagic. Ischemic stroke is more common, it affects 80 percent of individuals with stroke. Ischemic stroke results from thrombus; embolism or any other condition which results in lack of blood supply to brain. Hemorrhagic stroke affects 20% of individuals with stroke. It results from trauma leading to leakage of blood in extra vascular area of the brain. Increased intracranial pressure occurs in hemorrhagic stroke leading to deprivation of brain tissues from blood [2]. Hemiparesis occurs in stroke which leads to disability.

Spasticity develops in 90% of stroke patients on the contra lateral side [3]. Spasticity is a motor disorder in which resistance increases with the speed of movement [4]. Spasticity is the consequence of damage to upper motor neurons which results from brain lesion e.g. stroke. Thrombophlebitis develop in stroke patients due to prolong period of immobilization. It is more common during the acute phase of stroke due to prolong bed rest, paresis of limb, reduced activity and decreased cognitive status [5]. Stroke has poor effect on functional outcome for example gait, balance and fall, upper extremity functional performance, fine task performance (grasp, grip and pinch) and gross movements.

Modified ashworth scale is used to assess spasticity in stroke. Its reliability is 0.84 [6]. Action research arm test is used to determine coordination, dexterity and performance. Action research arm test predicts functional recovery after stroke in upper extremity. Its reliability is 0.96-0.99 [7].

Traditional treatment of spasticity includes use of physical therapy (proprioceptive neuromuscular facilitation, stretching, strengthening and range of motion exercises), medications and tendon surgeries [8,9]. Dynamic neural mobilization is the application of mechanics and physiology of the nervous system integrated with musculoskeletal system [10].

Materials and Methods

It was a randomized control trial. 41 stroke patients were recruited for the study. Data was collected from DHQ hospital Jhelum and patients were randomized to two groups; experimental and control, through simple random sampling. Chronic stroke patients were recruited for this study with age 40 to 60 years. To control group conventional treatment (stretching and range of motion exercises 11) and to experimental group conventional treatment (stretching and range of motion

exercises) with neurodynamics (dynamic neural mobilization technique) was applied, 10 rep/set, 1 set/day12, 3 days/week for 6 weeks. 0, 3rd and 6th week assessment was done through Modified Ashworth Scale (MAS) and Action Research Arm test (ARAT). Correlation analysis was d one through S PSS version 21 (Table 1).

Table 1: Demographic data of the 41 chronic stroke patients.

Characteristics	Value
Age of patient (years)	51.98 ± 7.425
Gender (male/female)	18/23
Stroke type, (Ischemic /Hemorrhagic)	34/7
Paretic side (right/left)	25/16

Results

Spearmen correlation analysis was done through SPSS version 21. At 0 week r was -0.234, at 3rd week r was -0.275 and at 6th week r was -0.456 and p value was >0.05 at 0 and 3rd week and it was <0.01 at 6th week which indicates that there was low to moderate negative correlation between Modified Ashworth Scale (MAS) and Action Research Arm Test (ARAT) which was used to assess spasticity and the recovery of upper extremity function in stroke patients (Tables 2 and 3).

Table 2: Mean and standard deviation of the MAS and ARAT.

Scales	Mean ± standard deviation		
	0 week	3rd week	6th week
MAS	1.41 ± 0.670	1.41 ± 0.670	0.95 ± 0.973
ARAT	1.63 ± 0.488	1.66 ± 0.480	1.73 ± 0.449
Note: MAS: Modified Ashworth Scale, ARAT: Action Research Arm Test, Data is presented as Mean ± standard deviation.			

Table 3: Spearman's correlation coefficient (r) and p value between ARAT and MAS.

Scales		ARAT	
		r	p
MAS	0 week	-0.234	>0.05
	3rd week	-0.275	>0.05
	6th week	-0.456	<0.01
Note: MAS: Modified Ashworth Scale, ARAT: Action Research Arm Test Data is presented as spearman rho=r and p value. Significant correlation <0.01, Non-significant correlation >0.05.			

Discussion

The results of this study suggest that there was moderate negative correlation between Modified Ashworth Scale (MAS) and Action Research Arm Test (ARAT) which was used to assess spasticity and the recovery of upper extremity function in stroke patients [11]. This study shows resemblance with some aspects of literature review as Wei, Xi-Jun, et al. concluded that there was fair to moderate correlation between Modified Ashworth Scale (MAS) and Action Research Arm Test (ARAT) which was used for the assessment in 27 chronic stroke patients to which robotic training was applied as intervention [12]. The study also determined that modified ash worth scale doesn't highly correlate with upper extremity function but it can be used separately for the assessment of spasticity in stroke patients. The present research concludes that there was low to moderate negative correlation between Modified Ashworth Scale (MAS) and Action Research Arm Test (ARAT) as at 0 week r was -0.234,

at 3rd week r was -0.275 and at 6th week r was -0.456 and p value was >0.05 at 0 and 3rd week and it was <0.01 at 6th week [13].

Jessica Castilho determined that neural mobilization was effective to reduce spasticity in bicep brachii muscle in stroke patients (study was done on 6 stroke patients). Treatment mechanism was alternation of electrical signals in spastic muscles [14]. Jorge H. Villafane, et al. concluded that neural mobilization combined with botulinum toxin A was effective to reduce spasticity. Decrease in spasticity was due to botulinum toxin A [15].

Alan Carlos, et al. determined that neural mobilization was effective to reduce tone and improve upper extremity function [16]. WENG Chang-shui, et al. did the study on 30 chronic stroke patients and determined that action research arm test has high validity for upper extremity function assessment in stroke patients.

Present research investigated the correlation of Modified Ashworth Scale (MAS) and Action Research Arm Test (ARAT) and determined that there was low to moderate negative correlation between Modified Ashworth Scale (MAS) and Action Research Arm Test (ARAT) as r was (0.234-0.456).

Action research arm test

Psychometric properties overview: To find all pertinent studies on the Action Research Arm Test's (ARAT) psychometric features in stroke patients, we searched the scientific literature. Twelve studies were found. It appears that the ARAT is a floor effect.

Ceiling/floor effects: In 48 patients with acute stroke, Hsueh and Hsieh looked at the floor and ceiling effects for the ARAT and the upper extremity motor assessment scale. Both at admission and upon leaving an acute rehabilitation ward, participants were evaluated.

ARAT's overall score at check-in had a subpar floor impact, with 52.1% of participants rating zero. Despite the fact that all of the subscales were rated as having a weak floor effect, 72.9% of participants had trouble with the pinch subscale, 70.8% had trouble with the grab and grip subscales and 52.1% had trouble with the gross movement subscale.

Only 7% of participants had achieved the maximum value when the participants were discharged, indicating an adequate ceiling effect for the ARAT total score. When examining the individual components of ARAT, the gross movement subscale showed the worst ceiling effect, with 29.2% of participants achieving the highest possible score, followed by 27% on the grip subscale. The most accurate classification was on the grip and pinch subscale. The grip and pinch subscale had the best classification, with an adequate ceiling effect of 18.8% and 16.7%, respectively.

In comparison to the ARAT, the upper extremity motor assessment scale demonstrated a low floor effect at admission with 58% of subjects scoring the minimum score. The upper extremity motor assessment scale, however, showed a better ceiling effect than the ARAT at discharge, with just 4.3% of participants achieving the highest score.

ARAT and wolf motor function test psychometric qualities were examined by Nijland, et al. in 40 stroke patients with mild to moderate hemiparesis. With just 12.5% to 17% of patients receiving the lowest or highest scores, the ARAT demonstrated appropriate floor and ceiling effects.

Reliability

Internal consistency: In 40 stroke patients with mild to moderate hemiparesis, Nijland, et al. looked at the internal consistency of the ARAT. The ARAT's internal consistency, as determined by Cronbach's Alpha, was very high (=0.98).

Test-retest

Note: It appears from the descriptions of the research that some authors referred to the testing as test-retest reliability while others referred to the same analysis as intra-rater reliability.

Test-retest reliability was investigated by Lyle in 20 people who had had cortical damage from a stroke or traumatic brain injury. The age ranged from 26 to 72 years, with 53 years being the mean. The same rater evaluated the participants again after a 1 week break in the same circumstances. The test-retest reliability was outstanding (r=0.98), as determined by Pearson correlation.

In 61 people with subacute stroke with a mean age of 63, Hsueh, Lee and Hsieh investigated test-retest reliability performed on a conventional table as opposed to the specially built table for this test [17]. After a two day break, the same rater reassessed the participants. The test-retest reliability was excellent for the total score (ICC=0.99) as well as for the grasp, grip, pinch and gross movement subscales (ICC=0.99, 0.98, 0.96 and 0.95, respectively). This was determined using the Intraclass Correlation Coefficient (ICC).

Conclusion

This study concluded that there was low to moderate negative correlation between Modified Ashworth Scale (MAS) and Action Research Arm Test (ARAT). This study determined that modified ashworth scale can be used separately for the assessment of spasticity. In dynamic opener technique repeated active or passive movement is done on the contra lateral side. In dynamic closers mobilization is done in inner, middle and outer range. Present research investigated the correlation of Modified Ashworth Scale (MAS) and Action Research Arm Test (ARAT) used to assess spasticity and the recovery of upper extremity function in stroke patients.

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