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ORIGINAL ARTICLE

Association of Hand Stiffness with Balance Impairment in Chronic Stroke Patients

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ABSTRACT

Objective: To determine the association of hand stiffness with balance impairment in chronic stroke patients.
Methodology: A cross sectional study was conducted on eighteen chronic stroke patients with age range between 40 to 70 years. Patients were taken from Riphah Rehab Center and Govt. Kot Khawaja Saeed Teaching Hospital KEMU Lahore. The balance of patients was assessed by using Berg Balance Scale (BBS) and Timed Up and Go Test (TUG) while motor function of the hand was assessed by using Fugl Meyer Assessment-Upper Extremity (FMA-UE).
Results: The analysis of data done by using SPSS version25. The mean value of age of the patients was 54.9 $\pm$ 9.09 years. FMA-UE tool was used to assess motor activity of hand. Postural balance was measured by using BBS and TUG. The results showed a positive correlation of FMA-UE with BBS (r_s = 0.704, p =<0 .001) and a negative correlation with TUG (r_s = -.705, p = .001).
Conclusion: This study concluded that there is association of hand stiffness with balance impairment in chronic stroke patients
Key Words: Hand stiffness, Balance impairment, Chronic stroke, Postural instability, Proprioception.

INTRODUCTION

Nearly twenty five million people are diagnosed with stroke and 6.5 million people die from stroke every year. A mixture of muscle strength, balance, sensation, emotion and cognition loss that leads to reduction in abilities to achieve the “activities of daily living" (ADL) is experienced by most of chronic stroke patients (1). Stroke is defined as set of symptoms that expeditiously developing focal loss of cerebral function. The intensity of the stroke ranges from recovery in a single day to extreme disability to death. After coronary heart disease and cancer stroke is the 3rd commonest cause of death (2). Postural stability is the ability of the body to preserve the center of gravity (COG) inside the limits of base of support (BOS) or limits of stability; these are not stationary limits and these limits can be improved conferring to the movements, biomechanics of individual, tasks, and environmental features. Sensory feedback, intention, attention experience and environmental context can influence the motor reactions and stimulation of synergies within muscles (3).

There is a positive correlation of balance impairment and ankle proprioception in the stroke patients. Abnormal postural reactions can be seen with abnormal interactions between visual, vestibular and somatosensory systems. When there is a conflict in all these sensory systems the patient having stroke rely on a specific system (4). When stroke patient use single system for maintenance of balance this can cause unsuitable variations of the body and disturbances in balance. Reweighting and sensory integration can be diminished in stroke patients, that emphasizes visual input even when it delivers imprecise information (5,6). To perform activities of daily living ADLs, simultaneous use of arm and hand are mandatory (7). Beneficial reformation of cortex involved in motor function of the arm follows in reaction to active workout and to motor and attention involvement of the affected upper limb in task oriented activities. As severe paresis of upper limb obstructs hand training actively, conventionally, strategies of rehabilitation in such patients have almost completely aimed to reimburse for the deficit by training of the opposite limb in daily tasks (8).

A study in 2019 conducted by Lena Rafsten showed compromised motor function in upper extremity evaluated with Fugl-Meyer Assessment-upper Extremity is related to the occurrence of compromised balance of posture of the stroke patients. Total 56% participants had highest motor function in their lower extremity, and thirty percent participants had highest motor function of upper extremity. One fifth of the participants having impaired motor function of affected arm and intact motor function of lower limb and showed impairment in postural balance (9).

HC Persson in his study conducted in 2015 used Action Research Arm Test 3 days after stroke can expect the level of motor function evaluated with FMA-UE mandatory for a drinking task throughout 12 months after stroke. The tasks basically used to be clinically practical were pour water from one glass to another and place the hand over the top of head. Adequate motor function is necessary for daily activities in upper limb (10).

METHODOLOGY

Total eighteen chronic stroke patients with impaired hand function were recruited in this cross sectional study. Patients were taken from neurological department of Riphah Rehab Clinic and Govt. Kot Khawaja Saeed Teaching Hospital KEMU Lahore. Patients both male and female aged between 40 to 70 years were included with either right or left sided hemiplegia. Patients with normal cognition level > 25 score on MMSE and normal sense of vision were included. Language comprehension difficulty, diabetic retinopathy, motor deficits and wheel chair users were excluded. All participants were asked to give and sign consent form prior to participate in the study. Assessment of all the participants was done by using tools including Berg Balance Scale, Timed Up and Go Test and Fugl-Meyer Assessment-Upper Extremity. Data analysis was done on SPSS version 25.

RESULTS

Total 13(72.2%) men and 5(27.8%) women participated in study with mean value of age was 54.9 years and Standard deviation value 9.09 as shown in Table-I. Total 55.6% of chronic stroke patients have right side affected and 44.4% have left affected side (Table 1). A Spearman’s correlation was used to find the association among Fugl-Meyer Assessment-Upper Extremity and Timed Up and Go Test. Results showed negative correlation (r_s = -.705, p = .001) as depicted in Table-II. While strong positive correlation results seen between Fugl-Meyer Assessment-Upper Extremity and Berg Balance Scale (r_s = .704, p = .001) as shown in Table-III. The results of current study demonstrate that impaired motor function in upper limb especially in hand affects the balance in chronic stroke patients after assessment of all participants through BBS, TUG and FMA-UE.

Table-I: Summary of demographics of participants

		Number (N)	%	Mean	S.D	Max. Value	Min. Value
Population Gender	Men	13	72.2				
	Women	5	27.8				
Age (years)				54.94	9.09	70	41
Affected side	Right	10	55.6				
	Left	8	44.8				

Table-II: Correlation between FMA-Upper Extremity and TUG

	Correlation between FMA-UE and TUG	TUG
FMA-UE	Correlation value	-.705
	Value of P	<.001
	Number	18

A Strong negative correlation seen between FMA-UE and TUG (r_s = -.705, p = .001).

Table-III: Correlation between FMA-Upper Extremity and Berg Balance Scale

	Correlation between FMA-UE and BBS	BBS
FMA-UE	Correlation value	.704
	Value of P	<.001
	Number	18

A Strong positive correlation seen between FMA-UE and Berg balance (r_s = .704, p = .001).

DISCUSSION

The results of this study are same as results of the study of Rafsten L conducted in 2019, which was the first study conducted for these associations. In that study data of 121chronic stroke patients were taken and majority was men. The association of the motor function in affected upper extremity was low on measurement with Berg Balance Scale and Timed Up and Go Test showed the improved motor function in arm measured with FMA-UE correlated with improved postural balance (11). The results of current study also showed that FMA-UE have a positive correlation with berg balance scale and have a negative correlation with TUG.

The results of the study of Kim T-l conducted to check the validity and reliability of Fugl-Meyer Assessment showed that there was no statistically significant correlation of Berg Balance Scale. In the study correlation of FMA was checked with Motor Assessment Scale and Berg Balance Scale. In the study they took data from 31 chronic stroke patients, all other tools except BBS had correlation with FMA (12). While the results of current study are opposite showing that BBS has a strong positive correlation with FMA-UE. A study conducted in 2009 by Alzyer L found that chronic stroke patients should have cut off value for Berg Balance Scale value >46.5 to ambulate in the society and the cut off value for Timed Up and Go Test should be <14.8 (13).

Another study in 2019 by Kongwattanakul K conducted in chronic stroke patients with a population of 236, participants assessed for structural impairments by using FMA and MAS while activity limitation was assessed by using TUG, BBS and participation restriction. Results of this study showed BBS had the higher correlation to the model. The TUG was positively related to activity limitations while the ST, BBS and BI had negative relation (14). While the results of current study are opposite showing that BBS has a strong positive correlation with FMA-UE and TUG has a strong negative correlation with FMA-UE.

A study in 2010 by Pijnapples at el. concluded that most important function is played by the arm movements towards the recovery of postural balance, when the center of gravity is displaced back towards equilibrium by the change in angle or arm causes the patient to fall. Normally arms swing in opposition to the legs during walking that keeps the center of mass within base of support. Chronic stroke patients having hemiparesis and impaired upper limb function, the movements may be absent or minimal so they are unable to swing their arm because of placing the arm in anterior of the ribcage or besides the hip throughout walking (15). A possible reason for correlating the Berg Balance Scale with Timed Up and Go Test is that BBS have more dynamic values than TUG.

CONCLUSION

This study concluded that there is association of hand stiffness with impaired balance in chronic stroke patients.

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