

# ASSOCIATION OF SIT-TO-STAND PATTERN WITH FUNCTIONAL MOBILITY IN STROKE PATIENTS AND ELDERLY POPULATION

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## ABSTRACT

**OBJECTIVE:** To compare sit-to-stand (STS) pattern and different functional mobility tests in stroke and elderly population.

**METHODS:** This cross-sectional study was carried at Physical therapy departments of Pakistan Railway Hospital Rawalpindi, Rafsan Neuro Rehabilitation Centre Peshawar and DOW Medical Hospital Karachi, Pakistan. Study duration was 6 months from June 2016 to November 2016 with a sample size of 100. Non-Probability purposive sampling technique was adopted for sample collection. After informed consent, data including demographics details and results of applied tests were recorded and analyzed through SPSS version-21. Independent sample T-test was used to measure difference among means, while Odds Ratio was calculated to measure the association.

**RESULTS:** The mean age of stroke patients was  $54.5 \pm 9.83$  years and mean age of elder population was  $65.3 \pm 9.44$  years. The association of STS pattern and different functional mobility between stroke patients and elderly population showed higher odds for each step of elderly population with an OR of 42.667, 2.667, 1.826, 1.556 and 1.690 for feet behind knees, pre-extension, extension, knee extension and hip extension respectively. The mean scores of five times sit-to-stand test in stroke population group was  $33.8 \pm 8.59$  sec and  $18.4 \pm 8.59$  sec in elder population ( $p < 0.05$ ). Mean scores of timed up and go test, Tinetti performance oriented mobility scale, Berg Balance Scale & Mini-Best test showed a significant difference among these tests ( $p < 0.05$ ).

**CONCLUSION:** Elderly population can perform STS pattern with much ease as compared to stroke patients while the different functional mobility tests have a significant difference among its values.

**KEY WORDS:** Stroke (MeSH); Elderly (MeSH); Sit-to-stand (Non-MeSH); Mobility Tests (Non-MeSH) Timed up and go test (Non-MeSH); Tinetti performance oriented mobility scale (Non-MeSH); Berg Balance scale (Non-MeSH); Mini-Best test (Non-MeSH).

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## INTRODUCTION

Stroke is a vascular impairment of the blood flow to the brain that causes neurological dysfunction due to abnormal cerebral circulation. Patient's disability or weakness depends upon the corresponding damaged area of the brain.<sup>1</sup> Globally, stroke burden is high, with increase incidence and mortality rate particularly in middle and low

income countries.<sup>2</sup> Stroke is known to be the second leading cause of death; i.e. 4.4 millions of total deaths each year worldwide today and in United States 129000 people die per year.<sup>3</sup> The frequency of large vessel intracranial atherosclerotic disease (ICAD) is high among Asians that cause 30% to 50% of stroke among south Asian population.<sup>4</sup> James McIntosh in January 2016,

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suggested in his study that stroke is the fourth leading cause of death in United States and the death of a single person in every 4 minutes.<sup>5</sup> Pakistan is the sixth most populous country in the world, the incidence rate of stroke in Pakistan is 250/100,000 or 350,000 new cases per year.<sup>6</sup> According to another study prevalence of stroke is 4.8% in single ethnic group in Pakistan.<sup>7</sup>

The most common symptom after stroke is weakness on the affected side, which is caused by an imbalance in muscle strength; as a result, patients with hemiplegia have asymmetric weight bearing on one side, which exacerbates their balance problems. Difficulties in controlling balance can lead to numerous problems in activities of daily living.<sup>8</sup>

Sit-to-stand (STS) is very simple task for normal healthy individual but it is an important precursor towards functional mobility. In stroke and elder population, many movements can be seen beyond normal biomechanics.<sup>9</sup> According to the literature, STS is the complex task in which postural control is required to change three-point-based sitting to two-point-based standing posture.<sup>10</sup> In STS, power flows greater at hip than knees, but compressive forces at knee are slightly greater in sitting down than standing up. The angular velocity at knee decreased in sitting down. A recent review of 39 STS studies concluded that chair height, armrest and foot positioning considerably influence STS activity.<sup>11</sup>

STS activity is very important that is used in the clinical assessments and is the major factor to determine the level of independence in elderly and disabled

**TABLE I: SIT-TO-STAND PATTERN IN STROKE PATIENTS AND ELDERLY POPULATION**

STS PATTERN	STROKE PATIENTS			ELDERLY POPULATION		
	YES	NO	OR	YES	NO	OR
Feet behind knees	18	32	0.23	48	2	42.667
Pre-extension	30	20	0.37	40	10	2.667
Extension	12	38	0.548	17	33	1.826
Knee extension	15	35	0.643	20	30	1.556
Hip extension	15	35	0.592	21	29	1.690

OR= Odds Ratio

**TABLE II: FUNCTIONAL MOBILITY TESTS IN STROKE PATIENTS AND ELDER POPULATION**

Functional Mobility Tests	Stroke Patients		Elderly Population		p-value (independent sample t-test)
	Mean (seconds)	SD	Mean (seconds)	SD	
Five times sit-to-stand test	33.8	8.59	18.4	8.59	<0.05
Timed up and go test	49.91	21.38	26.61	12.43	<0.05
Berg balance Test	32.14	10.01	47.98	5.59	<0.05
Tinneti performance oriented mobility scale	13.24	5.12	24.24	2.74	<0.05
Mini-Best test	9.7	3.73	17.62	5.84	<0.05

population. In a study it was suggested that elder individuals takes longer average time with anterior head displacement in those using armrest compared with those rising without armrest from the chair.<sup>11</sup> In patients and elderly people STS activity can used as health maker that improve balance and strength to be independent in activities of daily living (ADLs).<sup>10</sup>

Sit-to-stand transfer is an essential task towards functional mobility and this becomes affected by aging and other pathology that may cause disability. Repeated task of STS is the main component of exercise plan for the elderly adults. Those elderly adults who perform inadequate amount of STS activity per day might experience decreased strength impairment and work deficit.<sup>12</sup> In an attempt to determine the association of sit-to-stand with functional mobility we conducted a co-relational study to determine the association of sit-to-stand and functional mobility in stroke patients and elder population.

## METHODS

This co-relational cross sectional study was carried out with the approval of

Riphah College of Rehabilitation Sciences ethical review committee, Riphah International University Islamabad, Pakistan in collaboration with the physical therapy departments of Pakistan Railway Hospital Rawalpindi, Rafsan Neuro Rehabilitation Centre, Peshawar and DOW Medical Hospital, Karachi, Pakistan. Study duration was 6 months, from June 2016 to November 2016. A sample size of 100 was enrolled in which 50 were stroke patients and 50 elderly people (above 60 years). Non-probability purposive sampling technique was used for sample collection. Sample with ability to perform STS pattern were included while patients with infectious diseases, recent fracture, cognitive impairment, severe visual impairments and severe psychosocial behavioral issues were excluded. Data was collected after written informed consent which included patient's personal data, five time sit-to-stand test (FTSTS),<sup>13</sup> timed up and go test (TUG)<sup>14</sup>, Tinneti performance oriented mobility scale (POMA), Berg Balance scale (BBS)<sup>13</sup>, Mini-Best test.<sup>15</sup> Descriptive statistics were used for both variables. Independent sample T-test was applied in comparison of means for functional mobility tests in both groups while cross

tabulation Odds Ratio was calculated for STS pattern among Stroke patients and elderly population. Data was analyzed through SPSS 21.0.

## RESULTS

The total number of patients in this study was 100, out of which 50 were stroke patients and 50 were elderly adults. The mean age of stroke patients was  $54.5 \pm 9.83$  years while the mean age of elder population was  $65.3 \pm 9.44$  years. Out of 50 stroke patients 40 were males and 10 were females that shows the rate of stroke was higher in males than in females.

The association of STS pattern and different functional mobility between stroke patients and elderly population showed higher odd for each step of elderly population with an OR of 42.667, 2.667, 1.826, 1.556 and 1.690 for feet behind knees, pre-extension, extension, knee extension and hip extension respectively (Table I).

The mean scores of Five times sit-to-stand test in stroke population group was  $33.8 \pm 8.59$  sec and  $18.4 \pm 8.59$  sec in elder population (Table II). Mean scores of FTSTS, TUG, BBS, POMA and Mini-Best test showed a significant difference among these tests ( $p < 0.05$ ).

## DISCUSSION

In our study, STS pattern and different functional mobility between stroke patients and elderly population showed higher odd for each step of elderly population for feet behind knees, pre-extension, extension, knee extension and hip extension as compared to stroke patients.

The mean age of stroke population was  $54.5 \pm 9.83$  years in this study; nearly similar mean age has been shown in another study evaluating stroke patients.<sup>16</sup> In our study the extension phase was not present properly in 38% of stroke patients and 33% of elderly adults while in other study the risk of fall was greater and need more time for stabilization especially during extension phase of sit-to-stand activity.<sup>9</sup> In this study, full-knee-extension was not present in 35% of stroke patients and 30% of elderly adults comparing with

another research sample with chronic stroke knee extensor weakness which takes greater time to rise during sit-to-stand activity than normal individual (elderly).<sup>17</sup>

According to the results of this study, there were lateral deviations of trunk towards unaffected side in 44 stroke patients out of 50. Many studies support our study in literature i.e. most of the hemiparetic individuals who are able to perform sit-to-stand activity independently have lateral deviation of trunk towards unaffected side due to which asymmetrical weight bearing takes place.<sup>9</sup> According to another study patients with hemiparesis, were able to stand independently and show several changes beyond normal i.e. trunk lateral deviation towards unaffected side with asymmetrical weight bearing and knee moment forces. Asymmetrical weight bearing was seen before seat off and the involved side remains still in contact with chair.<sup>17</sup> Postural sway would increase due to balance impairment during sit-to-stand activity. On the other hand, in our study the extension phase was not present properly in 38% of stroke patients and 33% of older adults; in other study the risk of fall was greater and needed more time for stabilization especially during extension phase of sit-to-stand activity.<sup>17</sup>

In stroke population, the time to STS activity and other ADLs is greater than the normal elderly individuals due to hemiparesis and muscle weakness; in our study, we correlate STS activity within elderly adults and stroke population. The time of STS task in FTSTS and TUG test was greater than the normal; the scores of POMA, BBS and Mini Best test was lesser than that which showed greater risk of fall with decreased functional mobility. The mean and standard deviation of five-time sit-to-stand test in stroke population group is  $33.8 \pm 8.59$  sec and  $18.4 \pm 8.59$  sec in elder population group with p-value is 0.000 ( $<0.05$ ) which is significant. In 2014, many other studies show nearly same means of five times sit-to-stand test times i.e. 15.2 to 17.1 seconds for six different conditions in five times sit-to-stand test.<sup>18</sup>

In this study, there were significant difference in the mean scores FTSTS

test and TUG in both groups. Goldberg A, et al confirmed the validity of FTSTS as a measure of dynamic balance and functional mobility in older adult.<sup>19</sup> The mean TUG test in stroke population was  $49.91 \pm 21.38$  sec while in elder population group was  $26.61 \pm 12.43$  sec which shows the greater fall risk. BBS score had the mean value of  $32.14 \pm 10.01$  seconds in stroke and  $47.98 \pm 5.59$  seconds in elder population respectively. Azad A, et al.<sup>20</sup> in a study found mean of BBS was  $48.05 \pm 8.77$  seconds and mean of TUG is  $22.8 \pm 21.76$  seconds. TUG test was indicated to measure for stroke patients who are more prone to have fall risk.<sup>20</sup>

Downs S, et al.<sup>21</sup> did a search from 17 relevant studies and suggests that the mean BBS score of 1363 individuals ranged from  $37 \pm 1.0$  to  $55 \pm 9.2$  in normal elderly adults around 70 years of age, showing a significant decline in balance with age.<sup>21</sup> In our study BBS score showed the increased risk of fall in stroke patients than the normal elderly population.

A cross-sectional survey in 2010-2012 also suggests that there were poor performance of STS and TUG in elderly people of age 65 to 86 years. In our study, higher values of FTSTS and TUG test suggested an increased risk of fall and decline in functional mobility.<sup>22</sup>

This was a small-scale study and there is a need of large-scale study over a long period, including electromyography studies to measure muscle performance during STS activity. The study can be done to increase awareness in elderly adults and stroke patients in Pakistan for better results in the community.

## CONCLUSION

The study concludes that elderly population has much ease in performing STS pattern activities as compared to stroke population. The means of different functional mobility tests showed a significant difference among the values. Hence, it can be extracted that stroke affects the mobility of a person more than ageing and can increase various mobility related complications.

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### AUTHORS' CONTRIBUTIONS

Following authors have made substantial contributions to the manuscript as under:

**UR:** Conception, acquisition of data, drafting the manuscript, final approval of the version to be published

**SJ:** Data analysis & interpretation, drafting the manuscript, final approval of the version to be published

**ANM:** Concept & study design, analysis and interpretation of data, critical revision, final approval of the version to be published

*Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.*

### CONFLICT OF INTEREST

Authors declared no conflict of interest

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NIL



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