A Study of Correlation between the Backward Tandem Walk Test with Balance and Functional Mobility in Elderly Population

Dr Md. Anamul Haque (pt)[1], Dr Tabassum Saher (pt)[2], Dr Joginder Yadav (pt)[3]
[1] Physiotherapist, at Prince Sultan Military Medical City Riyadh, Kingdom of Saudia Arabia
[2] Assistant Professor, SGT University, Gurugram
[3] Dean, Faculty of Physiotherapy SGT University, Gurugram
Corresponding Author: Dr. Md. Anamul Haque (pt)

Abstract

Background: Balance is an integral component to most activities of daily living. Increased age is associated with a decline in the speed of information transmission and changes in the mode of information processing in the brain, which lead to balance and postural disorders. Ischemic, degenerative and traumatic lesions of the cerebral trunk, the white matter, the frontal lobes, the gray matter and the cerebellum could induce Backward Disequilibrium (BD) in elderly subjects. This study is set out to assess the backward disequilibrium as a tool of testing. There is no component assessing for BD in frequent assessing the balance test. So, purpose of the present study is to find out the association between Backward Tandem walk test (BTWT) and Time up and Go test (TUG).

Methodology: This was a Cross-sectional study which was conducted from February 2017 to February 2018 with a convenient sample size of 50 normal healthy community dwelling elderly (both males and female). The subjects were tested on Time up and Go Test (TUG) and Backward Tandem walk test (BTWT) in randomized order. The data was analyzed using SPSS version 21.00 software and statistical test used was *P*earson's correlation coefficient test (r) to find the correlation of BTWT with TUG and significance was set at $p<0.05$ during the study.

Results: The mean age of the respondents was 71.62 ± 5.39 years. All the descriptive data was found to be non significant at baseline. The findings of the statistical analysis revealed that there is a strong correlation between the BTWT and TUG test.

Conclusion: Backward falls are neglected area in elderly population. In the present study BTWT is being used to asses BD and has been found to be moderately correlating with mobility measures i.e. TUG, so it can be added as a testing tool which is further can be used in future to assess BD

Introduction:

Balance is an integral component to most activities of daily living. As a complex sensori-motor function balance control requires the integration of multiple systems such as vestibular, visual, and somato sensory

information into the central nervous system (pyramidal, extrapyramidal, and cerebellar systems) in order to maintain antigravity postures and to produce a suitable response to any balance perturbation.(1) In the elderly, impairments of balance have serious health implications.(2) Impaired balance and mobility greatly increase the probability for falls, fractures, falls related injuries and functional dependency among older adults. Hence, increased health related costs at individual and social level for elderly population. Increased age is associated with a decline in the speed of information transmission and changes in the mode of information processing in the brain, which lead to balance and postural disorders.(3-6)

Studies estimated that 30% of community indwelling elderly above 65 years, 40% of those above 80 years and 66% of institutionalized elder fall every year.(7,8) It has been estimated that between 10% and 25% of all falls are associated with poor balance and gait abnormalities. There are reports of a positive correlation between cortical and subcortical cerebral lesions, identified on magnetic resonance imaging, and backward disequilibrium (BD).(9) Ischemic, degenerative and traumatic lesions of the cerebral trunk, the white matter, the frontal lobes, the gray matter and the cerebellum could induce BD in elderly subjects.(10) BD is a postural disorder which is characterized by a posterior position of the centre of mass with respect to the base of support in the standing and sitting position predisposing subjects to backward falls.(11) BD is associated with axial and limb rigidity. Backward disequilibrium could also be due to an imbalance between the ankle extensor muscles and the ankle flexor muscles, because of hypertonia of extensor muscles, which could be caused by a peripheral neurological lesion.[1] The pathophysiological mechanisms leading to BD behavior, however, have not yet been clearly identified.(12,13) The geriatrician can recognize BD, which is not uncommon in daily clinical practice, there are no tools to evaluate the severity. Only a few authors have examined this postural disorder in elderly subjects. (11) There are no epidemiological data on BD. Elderly subjects suffering from BD have a high risk of falling backwards. (14) Moreover, the diagnosis of BD is often made after a fall. Falls can cause trauma and have psychological and social consequences. Concerning trauma, hip fracture is the more serious injury(15) and there is a risk of posttraumatic subdural hematoma. These traumatic consequences are associated with a high risk of mortality. (16) Among the psychological consequences of falls, there is the fear of standing, walking, and falling, (17) which can exacerbate BD behavior and result in a vicious circle. Among the tests to assess balance and gait in elderly subjects, only the Minimum Motor Test includes items for a qualitative analysis of BD. The other usual tests, such as the Tinetti test, the Timed Up and Go test (TUG) or the Berg Balance Scale, are not able to diagnose BD. These tests are only suitable to evaluate the consequences of BD on certain daily tasks such as sit-to-stand, back-to-sit, maintaining a standing position or walking.[1]

Mobility tests are commonly used to assess function and frailty in older populations. Many of these tests are also used with younger adults as measures of physical fitness and general health. Kerstin et al. (1994) in their study assessed dynamic balance with a timed, backward tandem walk test. (18) Arnold C.M. et al.

(2002) in their study they has been found Backward Tandem Walk Test (BTWT) to be a sensitive test for detecting balance changes following an exercise intervention in community-dwelling older adults. [19]

In present study BTWT is been used to assess the backward disequilibrium as a tool. There is no component assessing for BD in frequent assessing the balance test. So, purpose of the present study is to find out the association between BTWT and TUG (time up and go test).

Methodology:

This was a Cross-sectional study which was conducted from February 2017 to February 2018 with a convenient sample size of 50 normal healthy community dwelling elderly (both males and female). Subjects were recruited from the community centre, sector 15 Faridabad and sector 51 Gurgaon Haryana. Subjects with 65-80 years of age were included in the study. They were included according to the HMSE score which must be more than or equal to 24/30 to participate in the study. Patients with limited cardiac diseases within 1 year of history or with any respiratory condition like COPD, Asthma were excluded from the study. Before the testing procedures informed consent were taken from all the participants of the study. On the day of data collection subject were verbally reoriented instructed again and testing procedure were carried out without shoes. The subjects were tested on Time up and Go Test (TUG) and Backward Tandem walk test (BTWT) in randomized order with rest as per the subject required and three trial were taken. During TUG Test Subject was instructed to start walking on word “go” and complete the sequence of walking task (as mentioned in testing procedure) and return to sit back in the chair at an ordinary comfortable speed. After this the Subject was made to stand up, walk three meters (to a mark on the floor), turn around, walk back to the chair and sit down. During the Backward tandem walk test a leveled surface for backward tandem walk of 20 steps and stopwatch to keep the record of time was arranged and the subjects were made to stand at starting position (place one foot behind the other foot in tandem stance, with their backside facing the direction of progression) and maintain balance. The Therapist was standing and moving by the side of the subject throughout the test. The subject was instructed to place one foot behind the other, each time making sure that the toe of swing foot was placed directly behind the heel of stance foot. The subject was walk backward as fast and comfortable as possible without falling down or making any mistake. Subjects standing at starting position and 20 steps backward progression in which heel of the stance extremity should touch with toe of the swing extremity. The score were recorded as time taken by the subject to complete 20-foot course. Trial was not considered or scored if subject did not complete the sequence successfully or loses balance during the sequence.

Statistical analysis:

The data was analyzed using SPSS version 21.00 software and statistical test used was pearson's correlation coefficient test (r) to find the correlation of BTWT with TUG and significance was set at $p<0.05$ during the study.

Results:

Total 48 subjects were included in the study and data was collected for BTWT and TUG test. The number of males and females was 33 and 15 respectively.

Table: 1.1 Showing Baseline Characteristics of the Subjects

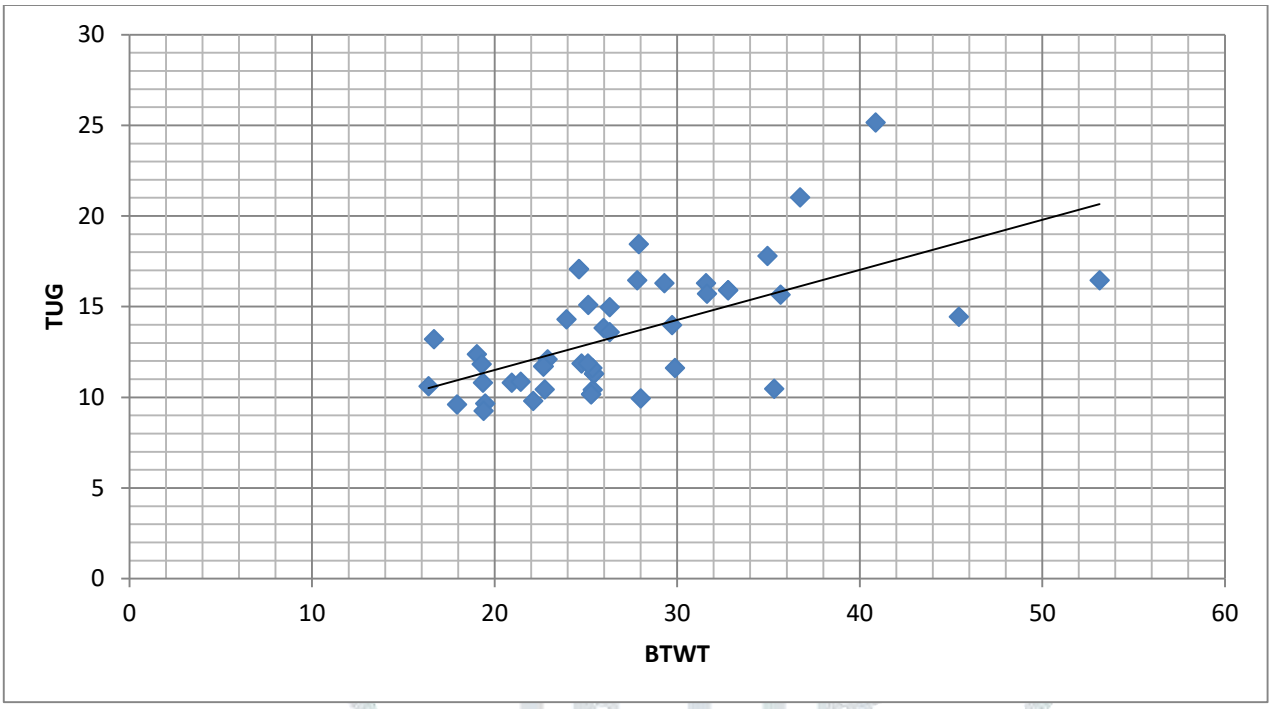
Variables	**Mean ± SD**	***p***
Age (years)	71.62 ± 5.39	0.7
Height (cm)	161.75± 8.12	0.31
Weight(kgs)	65.12± 12.56	0.6
BMI	24.91± 4.59	0.7
Hand dominance	Right (n=46) Left (n=2)	0.1
Leg dominance	Right (n= 39) Left (n= 9)	0.4

Data was analyzed by using Pearson's correlation coefficient and the correlation in the present study were positively significant.

Table: 1.2 showing correlation between the results of BTWT

Pearson correlation	TUG	BTWTT
r	0.61	0.57
p	0.01**	0.01**

The pearson's correlation coefficient (r=.61), and P value (0.01).



Graph 1.1 shows the correlation between TUG and BTWT

Discussion:

The Objective of present study was to find correlation of timed Backward tandem walk test and functional mobility by using Time Up and go test in elder population. BTWT involves subject's ability to maintain balance while moving backward in tandem fashion. It specifically assesses dynamic balance function while a subject is attempting to walk backward without getting direct visual feedback of the direction of progression. It further challenges the subjects ability by narrowing the base of support when Center Of Mass is shifting posterior which is not the natural way of his progression in activity of daily living. Since, BTWT is a novel task which imposes unique challenges to dynamic balance and mobility assessment. The researchers give the evidence of using BTWT for balance assessment and it also takes less time and is easily accessible to do without costing anything in clinical settings as it does not need any equipments. BTWT has been used as a evaluating tool as well as a tool for training. There is different version of BTWT in various studies. There are various studies which used BTWT for assessing and as outcome measure in balance interventional studies. In present study BTWT was performance based on time taken by the subject to walk in backward direction for 20 consecutive steps. Total 80 screening were done and out of which 49 people met the inclusion criteria which were included in this study. One subject was unable to complete timed backward tandem walk test so data of 48 subjects was analyzed. C.M. Arnold et al (2002), found the test-retest reliability of BTWT in their pilot study of 20 older men and women (ICC = 0.92). They used this test for detecting balance changes following an exercise intervention in community dwelling older adults.[20]

Miriam E. Nelson et al (1994), used BTWT as a assessment tool to check dynamic balance in this study subjects walk backward 20 foot with the toe of swing foot touches with the heel of stance foot. [21] Kerstin M. Palombaro et al (2009), did a study in which they assess physical performance measures included assessment of dynamic balance, quadriceps femoris muscle strength and gait in postmenopause with low bone mineral density. Roberta A. Newton et al (2001), used multidirectional reach test to assess anterio-posterior and medio-lateral static balance test and correlate it with TUG and Berg Balance Scale. The BD was assessed by BR. The interclass correlation for BR = 0.942. In present study, moderate positive correlation of BTWT with TUG is found.TUG has been used as a basic gold standard of performance- based mobility measure in clinical settings with high reliability and validity in assessing transfers, walking balance, two turns. [22-28] Like BTWT, TUG also takes lesser time, equipments and minimal cost for administering in clinical settings. The other tests, such as the Tinetti test, the Timed Up and Go test or the Berg Balance Scale, are not able to diagnose BD.[1] The present study result BTWT can be used as one of the good clinical test for assessing the balance like TUG. TUG test assess only walking ability and turns and transfers but BTWT assess backward disequilibrium which is one of the major cause of fall in elderly and there is no as such test to assess it dynamically. The present study did not include faller which could have given more predictive value for BTWT and BD. The BTWT is an inexpensive testing tool and no equipment and clinical set-up is required to carry out the procedure. So BTWT can be used in future as an additional tool to assess BD.

Conclusion:

Backward falls are neglected area in elderly population. In the present study BTWT is being used to asses BD and has been found to be moderately correlating with mobility measures i.e. TUG, so it can be added as a testing tool which is further can be used in future to assess BD.

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