

The Influence of Type of Assistive Device on Interpretation of Timed Up and Go Test Scores

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ABSTRACT

Background: Assessment of fall risk is a common component of physical therapist management of patients with limitations in balance and mobility due to injury, disease, or post-surgery. One widely used standardized fall risk assessment is the Time Up and Go (TUG) test. Although the TUG has been established as a useful tool to assess functional mobility and fall risk in the older adult, studies have shown that the type of assistive device used during the test factors into the score. To date, there have been no studies examining the extent to which TUG scores may differ when individual patients are tested using a rolling walker versus a cane, or no assistive device. The purpose of this study is to examine the impact of type of assistive device used during the TUG on assessment of a patient's fall risk.

Methods: Ten older adults >65 y/o in inpatient care underwent a comprehensive assessment of balance and fall risk using the Berg Balance Scale (BBS), TUG, and linear gait speed as part of their usual reassessment in preparation for discharge. TUG and gait speed were assessed using a rolling walker, and either a straight cane or no assistive device, based on the assistive device used prior to hospitalization. Patient's fall risk as measured by the BBS was used as a benchmark fall risk assessment, and compared to TUG scores with both walking aide conditions.

Results: Linear gait speed was similar in both conditions, while TUG times were slower for all patients using a rolling walker versus a cane or no assistive device. In some cases this impacted fall risk interpretation as measured by the TUG.

Significance: Consideration for the effect of assistive device on TUG scores has important implications as it may influence interpretation of fall risk based on those scores.

INTRODUCTION

Fall-related injuries and their sequelae are the most prevalent cause of injury and death in persons over age 65 in the US [1]. Nearly 30% of older adults report having experienced a fall in the previous 12 months. Of those, greater than one-third resulted in restriction of activity or the need for medical treatment. Fall incidence increases with age, with subsequent increase in restriction of activity and declines in balance and mobility [1,2]. Early identification and management of balance in the geriatric client is essential to minimize fall risk and injuries related to falls. Physical therapists routinely assess balance, gait speed, and fall risk as part of a comprehensive examination procedure in the geriatric client receiving rehabilitation care due to exacerbation of disease, injury, or post-surgery in both in-patient and

outpatient settings. These measures are good indicators of morbidity [3], functional mobility [3,4], and recovery attributable to skilled care. Further, they guide the development of a physical therapy diagnosis and a targeted plan of care and can predict readiness for discharge. One such assessment tool is the Timed Up and Go (TUG) test. The TUG was developed by Posiadlo and Richardson [4] to determine level of functional mobility in the older adult, and was later validated to be predictive of fall risk in community-dwelling older adults [5]. It has also been shown to be a valuable assessment of functional mobility and predictive of fall risk across a wide variety of conditions [6-8]. Not only does the TUG have value as a simple screen for fall risk [9-12] it has also been shown to be predictive of future disability [13]. The TUG is a valid and reliable tool as demonstrated across multiple order community dwelling and patient populations (Steffen 2002; Podsiadlo & Richardson 1991; Wrisley & Kumar 2010). The protocol for the TUG requires the patient to rise from a standard height chair, walk 10 feet, turn, and walk 10 feet back to the chair and return to a seated position, using their usual assistive device, or no device as appropriate. The score is the time it takes for the patient to complete the test, measured in seconds. Older adults who take 13.5 seconds or longer to complete the TUG are classified as having a risk for falls, with a 90% prediction rate [5].

A TUG score of less than 20 seconds indicates that a person is independent with basic transfers, while scores greater than 30 indicate that a person is dependent with transfers including shower/tub and does not leave the home unattended [4]. Although the TUG has been established as a valuable tool in determining level of functional mobility and fall risk in the older adult, the TUG protocol instructions indicating the patient should use the "customary walking aid" does not take into consideration the potential effect of assistive device use on performance. Assistive devices are often used to increase stability and reduce joint pain, and although this can improve overall walking tolerance and confidence, the attentional and physical resources required to navigate the assistive device may have a negative impact on fostering improved ambulation. Walkers and rollators (four wheeled walker), both stable devices, can be cumbersome to navigate in narrow spaces and over various surfaces in the home setting. The

physiological energy cost index of using a walker has been found to be 61% greater than using a rollator (Cetin, 2010). Therefore, it bears consideration that the type of assistive device used during the TUG may affect the score, and ultimately the interpretation of that score of the patient's mobility and fall risk. Previous studies have examined the impact of assistive device use on the time it takes to complete the TUG. One study compared TUG scores within individuals using either a standard walker or forearm crutches with their TUG scores using a rollator [14]. They found that a rollator reduced the patient's time to complete the test as compared to using forearm crutches or a standard walker [14]. Another study compared TUG scores in a population of healthy older adults who did not typically use an assistive device for walking, when randomly assigned the use of a cane, rolling walker, or standard walker. Each group was found to have increased TUG times as compared to not using an assistive device, with the standard walker and rolling walker groups having the longest times to complete the TUG. When comparing differences in TUG performance between groups, the group using a rolling walker performed the TUG on average of 5.23 seconds slower than the group using a cane [15]. However, neither of these studies compared TUG scores with a change of assistive device from a rolling walker to a cane or no assistive device within the same patient. A comparison of such scores could impact interpretation of a patient's mobility skills and fall risk. Transitioning patients from a more restrictive assistive device, such as a rolling walker, to a less restrictive assistive device, such as a cane (or no assistive device) is common practice in preparing the patient for discharge from skilled Physical Therapy (PT) care. Comprehensive assessment of fall risk is an essential component of determining readiness for this transition. While using a more restrictive device, such as a rolling walker, may be more conducive to safe mobility, the greater time to complete the TUG assessment with a rolling walker versus a cane (or no assistive device) may hinder accurate interpretation of the patient's mobility status and fall risk. The purpose of this study is to explore whether type of assistive device used during the TUG can impact PT diagnosis of mobility and fall risk. This knowledge will have important implications in guiding clinical decisions for recommendations on

appropriate assistive device and interventions for patients undergoing PT care.

METHODS

Approval for the study was obtained from the University's IRB committee. Subjects were a purposive sample of patients undergoing inpatient rehabilitation at a skilled nursing facility. The facility had a 55 bed rehabilitation unit staffed with 4 full-time PT's, 2 full-time physical therapist assistants, 3 full-time occupational therapists, and 2 full-time occupational therapist assistants. Patients were included in the study if they were >65 years of age, currently using a walker, had an admitting diagnosis of lower extremity fracture, lower extremity total joint replacement, recent fall, debility or deconditioning due to recent hospitalization for other medical conditions including urinary tract infection, flu, and pneumonia, were able to walk 10 feet without physical assistance, able to stand without support, were walking with either a cane or no assistive device prior to admission, and were able to follow 2 step instructions and able to recall reason for admission and personal history on initial examination. Patients with an admitting diagnosis of neuromotor disease (e.g. stroke, Parkinson's disease, Multiple Sclerosis), history of multiple falls, had medical or surgical restrictions precluding them from transitioning from a rolling walker during their course of short term rehabilitation care, or had a diagnosis of altered mental status or cognitive deficits were not considered for participation in the study. Evidence of cognitive deficits was assessed by the primary physical therapist on initial evaluation and screening, or by medical diagnosis as stated in the patient's hospital records. Patient characteristics and demographic information is summarized in (Table1).

Demographics and Health Characteristics	Total (n=13)
Age (65-94)	\bar{x} 77.1
Gender, female, %	46
Prior AD (cane/none)	4/9
Reason for Admission	
Fall	1
Debility	9

Assessment of balance, gait speed, and fall risk was performed within 1-2 weeks of the patient's planned discharge date to determine the patient's readiness to transition to their previous walking aid condition (cane or none), based on their reported prior level of function. The Berg Balance Scale (BBS) was used to assess balance and fall risk. The BBS is a 14-item tool scored on a 0-4 interval scale assessing balance in sitting and standing without an assistive device for support [16]. It has been validated for use in community-dwelling older adults, with a cutoff score of $\leq 45/56$ with 92% specificity predictive of fall risk [17]. The BBS served as the criterion measure for fall risk in this study for comparison to fall risk prediction based on TUG scores.

Linear gait speed and TUG were each assessed with the patient using a rolling walker and either a cane or no assistive device, according to the patient's report of prior walking aid use, and appropriate for progression according to their medical condition and precautions. Linear gait speed was measured using the protocol for a 3.3 meter (10 foot) distance according to Fritz and Lusardi [3]. Collection of gait speed data was necessary to determine whether there was a corresponding relationship between type of assistive device used and linear walking speed for greater interpretation of TUG performance scores across assistive device conditions. Data was collected by the principle investigator (JH) with scores for BBS, TUG, and linear gait speed verified by 2 student physical therapists simultaneously to eliminate scoring bias. Testing was performed in a quiet hallway, using the same standard height arm chair for each patient for the TUG test. The order of assessment procedures was the same for each patient, with the BBS performed first, followed by the TUG, and then linear gait speed assessment. Each patient was instructed to "walk at your comfortable walking speed" for both the TUG and gait speed tests. The physical therapist guarded the patient during each walking activity, walking behind the patient so as to not influence their pace. The order of assistive device use was rotated for every other patient. All patients were given a brief rest period between each assessment procedure.

RESULTS

Study results are outlined in (Table 2). Thirteen patients were selected for inclusion in the study over an 8 month period of time, identified by number based on their order of participation. All patients completed all testing, without any adverse effects. BBS scores ranged from 41-52, with 3 patient's having a BBS score just below the fall risk cutoff of 45. Linear usual gait speed was fairly consistent across assistive device conditions for each patient. Gait speed with a rolling walker ranged from 0.57 to 1.32 m/s and from 0.62 to 1.38 m/s for the lower restrictive assistive device condition, with an average difference of 0.12 ± 0.08 m/s. Gait speed measures categorized 3 patients as limited community ambulators, with considerations for fall risk intervention and

discharge to home (0.4-0.79 m/s) and 10 patients as community ambulators (>0.8 m/s). TUG times for all patients were longer with the use of a rolling walker as compared with their prior walking aid condition of a cane or no assistive device. Difference in TUG scores ranged from 2.4 to 9.0 seconds, with an average of 4.25 ± 1.43 seconds longer to complete the TUG with a rolling walker across the group. While TUG scores categorized all patients at risk for falls with a rolling walker, TUG times with a lower restrictive assistive device were faster than or near the fall risk cutoff time of 13.5 seconds for 8 of the 13 patients. Of these, 7 patients had a BBS score at or above the fall risk cutoff of 45/56, and a gait speed >0.8 m/s.

Table 2: Individual patient TUG, Gait Speed, and BBS Scores

Patient #	Assistive Device	TUG (sec)	TUG Difference	Gait Speed (m/s)	Gait speed Difference	BBS score
1	RW	18.5	3.2	1.00	0.12 [^]	43
	Hurricane®	15.3		0.88		
2	RW	16.7	3.9	1.32	0.10 [^]	45
	St cane	12.8		1.22		
3	RW	20.0	7.0	0.73	0.12	52
	None	13.0		0.85		
4	RW	19.1	2.4	0.63	0.03	48
	None	16.7		0.66		
5	RW	17.1	3.4	0.57	0.05	41
	None	13.7		0.62		
6	RW	15.4	2.4	0.92	0.08	51
	St Cane	13.0		1.00		
7	RW	22.4	5.7	0.70	0.06	49
	None	16.7		0.76		
8	RW	17.0	3.0	0.92	0.08	48
	None	14.0		1.00		
9	RW	16.3	4.1	1.1	0.10	50
	None	12.2		1.2		
10	RW	17.3	3.6	0.93	0	51
	St Cane	13.7		0.93		
11	RW	24.0	9.0	1.00	0.10	42
	None	15.0		1.10		
12	RW	14.0	2.5	1.24	0.14	47
	None	11.5		1.38		
13	RW	21.0	5.5	0.77	0.06	45
	None	15.5		0.83		
Average			4.25±1.43		0.12±0.08	

Denotes slower gait speed with least restrictive AD as compared to RW

DISCUSSION

This study aimed to determine whether the type of assistive used impacted a patient's performance on the TUG test. As TUG scores are often used to inform the physical therapist about the patient's fall risk, these findings have important implications in guiding decisions for care and appropriate recommendations for assistive device use upon discharge to

home. Time to complete the TUG was associated with the level of assistive device used, with TUG times of 4 seconds longer on average noted with a more restrictive assistive device (rolling walker) as compared with a lower restricted walking aid condition of either a cane or no assistive device, selected according to what the patient used for ambulation prior to their

hospital admission. In most cases, that difference in TUG completion time translated to a different interpretation of the patient's fall risk. These findings are consistent with those of Kristensen et al. [14], who compared TUG times in patients with hip fracture using a rollator, standard walker, and forearm crutches, and Medley and Thompson [15] who compared TUG times in healthy older adults with and without an assistive device randomized to rolling walker, crutches and standard walker groups. In both studies, the use of the more stable, and consequently more cumbersome assistive device (i.e.: standard walker) resulted in longer TUG times as compared to a lower restrictive assistive device or no device. Hence, the effectiveness of rehabilitation may be underestimated at re-evaluation prior to discharge. This underscores the importance of comparing performance on the TUG with the patient's prior assistive device condition when making decisions about progressing their level of ambulation from a rolling walker in preparation for returning home. One patient with a TUG time that approached the cutoff for fall risk had a BBS score and gait speed findings that were indicative of fall risk. A recent systematic review demonstrated that the TUG had limited ability in ruling in fall risk [18], supporting our use of additional fall risk measures. Two patients with BBS scores $>45/56$ had among the longest TUG times under both conditions and gait speed values that were indicative of limited community ambulation and fall risk. While Hatch et al. [19] found a high correlation between TUG scores and BBS scores ($r=.810$), the BBS assesses balance ability during functionally-based activities in sitting and standing, whereas the TUG assesses ability to maintain balance during ambulation and transfers. Taken together, these findings highlight the importance of triangulating data across different domains of balance and mobility to create a comprehensive clinical picture and guide safe and effective clinical decisions. This study was the first to compare TUG scores with different assistive devices within individuals, and to cross-compare fall risk as measured by TUG, linear gait speed and BBS scores to determine appropriate assistive device recommendation at discharge. Admitting diagnoses for this study population included LE joint replacement, falls, and general debility, allowing for some generalizability to the older adult population undergoing rehabilitation in the post-acute care setting. In order to be able to underscore the decision-making

process of transitioning from a rolling walker prescribed in the acute setting to a previous level of assistive device, only patients who were not medically complicated and had used a cane or no assistive device prior to admission were included in this study. As this resulted in a small sample size, interpretation and application of results must be done with care. Studies in larger more diverse population should be undertaken to determine if these findings remain constant for patients with a greater variety of conditions, including neurologic and complex medical disorders. As the cross-sectional design limits the predictive value of these findings, prospective studies are recommended to examine outcomes within the critical 30-day period post discharge related to transitioning to a lower restrictive assistive device. Although lower restrictive assistive devices can facilitate mobility, for persons with limitations in balance and lower extremity strength deficits the reduced support during mobility can result in attenuated functional decline in ADL capacity and mobility [20]. Thus, it is essential that rehabilitation professionals use these tests in context with a comprehensive history and examination to identify declines in muscle performance and physical function related to hospitalization and the reason for hospitalization. Finally, this study did not compare baseline and discharge TUG scores to determine the extent of improvement in the patient's mobility and fall risk. The ability to interpret meaningful change in TUG scores for patients who exhibit faster TUG times but are still categorized as having a fall risk is limited, as currently there is no MDC value for TUG scores in community dwelling elders. Studies in patients with Alzheimer disease [21], Parkinson's disease [22], and chronic stroke [23] have found MDC values of 4.09, 4.85, and 2.9 seconds, respectively. Further study in this area in the community-dwelling older adult population is warranted.

CONCLUSIONS

The TUG test is a widely used measure to predict fall risk and provide categorical data with regard to level of functional mobility to guide clinical decisions for care. With evidence that the assistive device used during the TUG test impacts the time to complete the TUG, more evidence is needed to guide the clinician in effective interpretation and appropriate recommendations for care and assistive device use based on the patient's performance. This study provides preliminary

information that although the TUG can be a valuable tool in determining fall risk, decisions for determining which assistive device is most appropriate upon discharge to home is strengthened when comparing the TUG scores across both assistive device conditions and in combination with other measures of mobility and fall risk.

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