ORIGINAL ARTICLE

How Many Trials Are Needed to Achieve Performance Stability of the Timed Up & Go Test in Patients With Hip Fracture?

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ABSTRACT. Kristensen MT, Ekdahl C, Kehlet H, Bandholm T. How many trials are needed to achieve performance stability of the Timed Up & Go test in patients with hip fracture? Arch Phys Med Rehabil 2010;91:885-9.

Objective: To examine the number of trials needed to achieve performance stability of the Timed Up & Go (TUG) test using a standardized walking aid in patients with hip fracture who are allowed full weight bearing (FWB).

Design: Prospective methodologic study.

Setting: An acute 14-bed orthopedic hip fracture unit.

Participants: Patients (N=122; 89 women, 33 men) with hip fracture with a median age (25%–75%, quartiles) of 80 (67–85) years performed the TUG on hospital discharge to their own home (n=115) or further inpatient rehabilitation (n=7).

Interventions: Not applicable.

Main Outcome Measures: After a demonstration by a physical therapist how to perform the TUG with a standardized walking aid (a 4-wheeled rollator), the patients performed 6 timed TUG trials with up to 1-minute seated rest intervals. The participants were given a few minutes to familiarize with the rollator before commencing the timed trials. Repeated-measures analysis of variance (ANOVA) with Bonferroni corrections were used to examine the number of trials needed to ensure statistically stable TUG scores.

Results: A total of 106 (87%) patients performed all 6 TUG trials, while 120 patients performed a minimum of 3 timed trials. Repeated-measures ANOVAs of both groups showed that TUG scores improved significantly ($P \leq .007$) up to and including the third TUG trial.

Conclusions: These results suggest that the original TUG manual, described as 1 practice trial followed by 1 timed trial, needs modification when used in patients with hip fracture who are allowed FWB. The best (fastest) of 3 timed TUG trials performed with a standardized walking aid is recommended.

Key Words: Hip fractures; Rehabilitation.

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QUANTIFICATION OF THE physical functional mobility level is essential when assessing functional status and progress or deterioration in different patient groups, including patients with hip fracture. The TUG[1] that measures functional mobility, as the time in seconds it takes a person to rise from a chair with arms, walk 3m and return to the chair, is probably one of the most commonly used tests by physical therapists. The original TUG manual describes 1 practice trial followed by 1 timed trial,[1] but different assessment procedures are commonly used in elderly people.[2] Thus, the procedures have varied from only 1 timed trial to the best of 3 timed trials after 1 practice trial.[2-11]

In patients with hip fracture, high relative intratester ($ICC_{2,1}=.98$) and intertester ($ICC_{2,1}=.93$) reliabilities of the TUG test have been reported.[12] In addition, the TUG has proven useful in predicting nonfallers within 6 months[13] and 1-year walking ability[14] and has correlated with 10-m fast speed walking[15,16] and the Berg Balance Scale.[17] Also, in patients with hip fracture, 2 studies have indicated that standardizing the walking aid for TUG testing is important if one wishes to measure progress or compare TUG results between subjects.[12,18] Thus, patients who used a walker on discharge required on average 15 seconds more to perform the TUG compared with those who used elbow crutches.[18] Likewise, patients who used a walker required, on average, 13.6 (95% CI, 11.2–16.1) seconds less when using a 4-wheeled rollator.[12]

Because a large number of studies have used the TUG as an outcome measure in patients with hip fracture,[17,19-26] between-study comparisons are made difficult by the different TUG procedures. Some authors referred to the original TUG study and manual,[15,17,19,21,22,24] some described using 1 practice trial followed by 1 timed trial,[13,16,18,26] and others used 1 timed trial,[20,23] a mean of 2 timed trials,[25] or 3 practice trials followed by 1 timed trial.[14] These procedure differences call for a systematic investigation of the number of trials needed to achieve performance stability of the TUG when applied in patients recovering from a hip fracture.

Therefore, the purpose of this study was to determine the number of trials needed to achieve performance stability of the TUG test using a standardized walking aid in patients with hip fracture who were allowed FWB when discharged from the hospital.

METHODS

Participants

From November 2007 to November 2008, a total of 122 patients with hip fracture, 89 women and 33 men with a median

List of Abbreviations

ASA	American Society of Anesthesiologists
CI	confidence interval
FWB	full weight bearing
ICC	intraclass correlation coefficient
TUG	Timed Up & Go

age (25%–75%, quartiles) of 80 (67–85) years admitted to a 14-bed orthopedic hip fracture unit at Hvidovre University Hospital were included into this descriptive prospective study. The inclusion criteria were patients with surgical repair of a femoral neck (cervical), intertrochanteric, or subtrochanteric fracture who followed a multimodal rehabilitation program,[27] who were allowed FWB (practiced as weight bearing as tolerated), and who performed the TUG at time of discharge. Patients not allowed FWB were excluded.

The study is part of the department's hip fracture project, which has been approved by the local ethics committee and the Danish data protection agency. All participants gave informed consent, and the study was conducted according to the Declaration of Helsinki. Performing the TUG is part of normal discharge routines.

Timed Up & Go Test

Detailed instructions (verbal and written) of how to instruct participants were given to the 4 physical therapists, who supervised TUG trials in the study. All trials were performed with a standardized walking aid (a 4-wheeled rollator with 2 hand-brakes) as recommended,[12] and the participants were given a few minutes to familiarize with the rollator before commencing the timed trials. The patient first had a demonstration by the physical therapist of how to perform the TUG and was then instructed to perform 6 timed trials (TUG1–TUG6, respectively), separated by up to 1-minute pauses. The physical therapists were instructed not to announce TUG results during testing or to focus on the sixth trial being the last.

The following instruction was given to all patients: "On the command "ready-go," please rise from the chair using the arms of the chair if needed (chair seat height, 45cm), then walk as fast and safely as possible to the line drawn on the floor 3m away, then turn around and return to the chair and sit down. I will measure the time in seconds from the command "go" until your buttocks touch the seat of the chair again. Please do not talk during testing. I will give you verbal instructions during testing if you forget what to do, eg, if you forget to sit down when returning to the chair. Otherwise, no support is given."

Other Variables

Age, sex, fracture type, postsurgery day of TUG testing, and the patient's discharge walking aid were recorded.

Mental status, assessed by a 9-point Danish version of the abbreviated mental status test (a score above 6 indicative of a high mental day status)[28] was taken on admission.

Health status was evaluated using the ASA rating (1–5).[29] Ratings are defined as ASA 1, a normal healthy patient; ASA 2, a patient with mild systemic disease; ASA 3, a patient with severe systemic disease; ASA 4, a patient with severe systemic disease that is a constant threat to life; and ASA 5, a moribund patient who is not expected to survive without the operation. No patients presented ASA scores of 5; accordingly, the patients' health status evaluated by an anesthesiologist was classified as poor (ASA 3–4) versus good (ASA 1–2).[30]

The prefracture functional level, expressed by the reliable[31] and validated New Mobility Score (0–9),[32,33] with 0 indicating no walking ability at all and 9 indicating independent indoor, outdoor, and during shopping walking ability (no use of walking aids or other support needed), was recorded by physical therapists at the ward. The prefracture functional level was classified as low, New Mobility Score 0 to 6, versus high, New Mobility Score 7 to 9.[33]

Data Analysis

Descriptive statistics were calculated to present baseline characteristics of the participants. Continuous data (except TUG scores) evaluated by the Kolmogorov-Smirnov test were nonnormally distributed. Accordingly, we used Mann-Whitney U tests to evaluate differences between patients performing all 6 timed trials and those not able to perform all 6 trials, while chi-square or Fisher exact tests were used for categoric data. A subtrochanteric fracture was present in only 4 patients, and no significant differences were found between these and patients with intertrochanteric fractures. Accordingly, these fracture types were pooled for the subsequent analyses. We used repeated-measures analysis of variance with Bonferroni adjustments to examine significant differences between scores of the 6 and the first 3 timed TUG trials. The chi-square test was used to examine whether the best (fastest) of the first 3 TUG trials was related to age, sex, prefracture functional level, mental or health status, fracture type, postsurgery day of testing, or the patients' discharge walking aid (crutches, walker, or rollator). Data are presented as mean with 95% CI, as median (25%–75% quartiles), or as number of patients with percentage. All data analyses were conducted using SPSS 16.0.[a] The level of significance was set at P less than .05.

RESULTS

Baseline characteristics of the 122 consecutive patients who were allowed FWB, and who performed the TUG at time of discharge from the acute orthopedic ward, at median day 9

Table 1: Baseline Characteristics of Participants (N=122)

Variable	All Patients (N=122)	Performing 6 TUG Trials (n=106)	Performing Fewer Than 6 TUG Trials (n=16)	P
Age (y)	80 (67–85)	79 (66–85)	84 (75–89)	.055*
Women	89 (73)	77 (73)	12 (75)	
Men	33 (27)	29 (27)	4 (25)	1.0‡
Prefracture functional level, NMS 0–9	9 (6–9)	9 (7–9)	6 (4–8)	<.001*
Mental status, 0–9	9 (8–9)	9 (8–9)	9 (7–9)	.097*
Femoral neck (cervical) fractures	78 (64)	70 (66)	8 (50)	.213†
Intertrochanteric fractures	44 (36)	34 (34)	8 (50)	
ASA rating, 0–4	2 (2–2)	2 (1–2)	2 (2–3)	.119*
Postsurgery day of TUG testing	9 (6–12)	8 (6–11)	11 (9–16)	.006*

NOTE. Values are presented as median (25%–75% quartiles) or as number of patients (percentage).
Abbreviations: ASA, American Society of Anesthesiologists rating (a score of 4 indicates poor health status); NMS, New Mobility Score (an NMS and mental score of 9 indicate a high level).
*Mann-Whitney U test.
†Chi-square test.
‡Fisher exact test. P values refer to analyses between patients performing 6 TUG trials vs fewer.