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ORIGINAL ARTICLE

Using the Timed Up & Go Test in a Clinical Setting to Predict Falling in Parkinson's Disease

Joe R. Nocera, PhD,[a,b] Elizabeth L. Stegemöller, PhD,[c] Irene A. Malaty, MD,[d] Michael S. Okun, MD,[d] Michael Marsiske, PhD,[e] Chris J. Hass, PhD,[c] and the National Parkinson Foundation Quality Improvement Initiative Investigators

From the [a]VA Rehabilitation R&D Center of Excellence, Atlanta VAMC, Atlanta, GA; [b]Department of Neurology, Emory University, Atlanta, GA; [c]Department of Applied Physiology and Kinesiology, University of Florida, Gainesville, FL; [d]Center for Movement Disorders and Neurorestoration, University of Florida, Gainesville, FL; and [e]Department of Clinical and Health Psychology, University of Florida, Gainesville, FL.

Abstract

Objective: To investigate the ability of the Timed Up & Go test to identify patients with Parkinson's disease at risk for a fall.

Design: Cross-sectional cohort study.

Setting: Sixteen participating National Parkinson's Foundation Centers of Excellence.

Participants: A query yielded a total of 2985 records (1828 men and 1157 women). From these, 884 were excluded because of a lack of crucial information (age, diagnosis, presence of deep brain stimulation, disease duration, inability of performing the Timed Up & Go test without assistance) at the time of testing, leaving 2097 patients included in the analysis.

Interventions: Not applicable.

Main Outcome Measures: The primary outcome measure for this study was falls. The chief independent variable was the Timed Up & Go test.

Results: The initial model examined the prediction of falls from the Timed Up & Go test, adjusting for all study covariates. The estimated models in the imputed data sets represented a significant improvement above chance (χ^2 range [$df=17$], 531.29−542.39, $P<.001$), suggesting that 74% of participants were accurately classified as a faller or nonfaller. The secondary model in which the question of whether the effect of Timed Up & Go test was invariant across disease severity demonstrated 75% of participants were accurately classified as a faller or nonfaller. Additional analysis revealed a proposed cut score of 11.5 seconds for discrimination of those who did or did not fall.

Conclusions: The findings suggest that the Timed Up & Go test may be an accurate assessment tool to identify those at risk for falls.

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It is estimated that 70% to 87% of individuals with Parkinson's disease (PD) fall at some point during the course of their disease.[1,2] Despite these high fall rates, clinicians do not currently have an efficacious and reliable means to fully characterize fall risk. To date, the best predictor of a fall in PD patients is the occurrence of a fall in the preceding year.[3] As such, clinicians rely on historical recall during clinic assessments in order to quantify fall risk (question 13 on the Unified Parkinson's Disease Rating Scale [UPDRS]). Unfortunately, there are shortcomings with self-reported fall histories used to predict future falls. Further, fall histories do not inform about potential increased risk of a first fall because of disease progression and/or medical comorbidities.

Of equal importance, the UPDRS includes only 1 physical assessment focused on postural stability (item 30: the retropulsion or pull test). The retropulsion test is not highly associated with postural stability, as measured by the more objective and valid measures of dynamic posturography/balance.[4] Unfortunately, the more reliable dynamic posturography is usually not feasible in a clinical setting. As such, an accurate and feasible measure to identify PD patients at risk for a fall is critically needed.

The Timed Up & Go (TUG) test is a physical performance measure in which the ability to rise up from a seated chair position, walk 3m, turn, walk back, and sit down is timed. This measure is useful in an outpatient setting, because it requires only

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a few minutes, is easy to administer, and requires little equipment. Importantly, the TUG test is highly correlated with functional mobility, gait speed, and falls in older adults.[5] Specific to PD, longer TUG test times are associated with decreased mobility and may more accurately predict falls than the pull test of the UPDRS.[6,7] The TUG test is also demonstrated to have a high test-retest reliability and interrater reliability in PD populations.[8] The objective of this study was to investigate the TUG test's predictive ability to identify those with PD at increased risk of a fall during the course of their disease.

Methods

Participants

A cross-sectional study design was used from the National Parkinson Foundation's Quality Improvement Initiative Registry (NPF-QII). The data were obtained from 16 participating National Parkinson Foundation Centers of Excellence from within the United States. All participants signed informed consent.

All evaluations were done in the on medication state. Included were all patients registered in the NPF-QII between 2009 and 2010. The database query yielded a total of 2985 records available (1828 men and 1157 women). From these 2985 cases, 884 were excluded because of a lack of crucial information (age, diagnosis, presence of deep brain stimulation, disease duration, inability of performing the TUG test without assistance) at the time of testing. Demographic information of those used in the analysis can be found in table 1.

Measurements

The primary outcome measure for this study, falls, was collected via a self-reported history (over the previous 3mo) from each participant. Scores were reported by frequency as follows: 0 (no falls), 1 (<1 a month), 2 (1−3 falls a month), 3 (1−6 falls a week), and 4 (≥1 a day). As subsequently detailed, in predictive analyses, falls were dichotomized into 0 (no falls) and 1 (any fall) (collapsing original categories 1−4).

For the chief independent variable, the TUG test, patients were instructed to stand up from a chair and walk forward at their normative speed for 3m, then turn around and walk back to the chair and sit down. The whole procedure was timed in seconds from the command to go until the participant made contact sitting in the chair. If the patient could not perform the task without using their hands to push off, they were allowed to do it a second time while using their hands to push off on the chair. Use of assistant devices was not allowed.

List of abbreviations:

AUC	**area under the curve**
BMI	**body mass index**
H&Y	**Hoehn and Yahr**
NPF-QII	**National Parkinson Foundation's Quality Improvement Initiative Registry**
PD	**Parkinson's disease**
PDQ-39	**Parkinson's Disease Questionnaire-39**
ROC	**receiver operating characteristic**
TUG	**Timed Up & Go**
UPDRS	**Unified Parkinson's Disease Rating Scale**

Collection of covariates

The following covariates from data routinely collected in the registry including age, body mass index (BMI), disease duration and severity, quality of life, executive function, and presence of arthritis were added to the analysis based on their impact on falls occurrence and/or their potential to limit mobility.[9-11] In all, including subdomains of the subsequent tests, there were 17 covariates used in the model.

Disease duration and severity

Participants underwent a neurologic examination by a site neurologist, and disease severity was rated using standard Hoehn and Yahr (H&Y) staging. In the analyses, H&Y was dichotomized into those with scores of <2.5 versus >2.5. Disease duration was determined from the date of a diagnosis of idiopathic PD until the date of the study physical exam.

Quality of life

Quality of life was evaluated for each patient during the office visit using the Parkinson's Disease Questionnaire-39 (PDQ-39). The PDQ-39 measures quality of life in 8 discrete domains (mobility, activities of daily living, emotional well-being, stigma, social support, cognition, communication, and pain). The PDQ-39 was administered to each patient during the office visit. Scores for each domain were expressed as a percentage (100 indicating greater disruption and dissatisfaction within a domain). The PDQ-39 summary index score was computed by summing the 8 domain scores and standardizing the score on a 0 to 100 scale.

Executive function abilities

Executive function abilities were evaluated using immediate and delayed word recall and verbal fluency. For immediate word recall, patients were instructed to remember the 5 following words that were provided to them slowly and distinctly 1 time: face, velvet, church, daisy, and red. The patient was then asked to repeat the 5 words, and the number of correct responses was recorded. After at least 1.5 minutes and after performing a distracting task (TUG test), the participants were asked again to produce the same 5 words (delayed recall). The participants were not prompted, and the number of correct responses was recorded. To evaluate verbal fluency, patients were asked to name as many animals as possible in 1 minute. All living creatures that were not plants were counted and recorded.

Presence and severity of arthritis

The presence and severity of arthritis was scored as 0 (absent), 1 (asymptomatic/minimal), 2 (moderate), 3 (severe), and 4 (very severe).

Analysis

Prior to analysis, to ensure that the full sample was employed, multiple imputation using SPSS[a] missing values procedure was conducted. A total of 50 imputations were employed, and analyses subsequently described were pooled across the 50 imputations.[12] Where a pooling approach has not yet been defined, the range of values provided across imputations is shown. The data were assumed to be missing at random following inclusion of covariates, although Schafer and Graham[13] suggest that imputation is