Proposal for a New Predictive Scale for Recurrent Risk of Fall in a Cohort of Community-Dwelling Patients with Stroke

Elen Beatriz Pinto, PhD,*†§ Carla Nascimento, MSc,*†§ Maiana Monteiro, MSc,*†§ Mayra Castro, MSc,*†§ Iara Maso, PT,*†§ Adriana Campos, PhD,*†§ Camila Marinho, MSc,*§ Nestor J. Barreto-Neto, MD,*§ Antônio A. Lopes, PhD,‡§ Pedro A.P. Jesus, PhD,*§ and Jamary Oliveira-Filho, PhD*§

Objectives: This study aimed to determine risk factors related to the occurrence of falls in stroke patients and to propose a new predictive scale for falls. *Methods:* Demographic and clinical data were collected and the following scales were applied: Barthel Index, Timed Up and Go Test (TUG), and National Institutes of Health Stroke Scale (NIHSS). Subjects were followed prospectively for 2 years for the occurrence of recurrent (≥2) falls. Kaplan–Meier curves were constructed and univariable associations were tested using log-rank test. Two separate multivariable models were then used: the first used Cox proportional hazards regression and the second used Poisson regression. In each model, significant associations were considered present with a P value less than .05. *Results:* We evaluated 150 individuals and the final analysis included 131 patients; the average age of the patients was 55.8 ± 13 years, 52% were women, and the median NIHSS score was 2 (interquartile range = 1-5). Falls occurred in 17% of patients, with a median of 23 months of follow-up (interquartile range = 16-26 months). In the multivariable Cox regression model, only TUG quartile, female gender, and posterior circulation territory involvement remained significant predictors of recurrent falls. We used the predictors from the Cox regression model to propose a new recurrent fall risk scale. The area under the receiver operating characteristic curve was 73%, 95% confidence interval = 62%-83%, P = .001, with 81.3% sensitivity and 41.8% specificity. *Conclusions:* The new predictive scale for recurrent risk (including TUG, posterior circulation territory involvement, and female gender) is presented as an instrument for monitoring the risk of recurrent falls. **Key Words:** Stroke—fall predictors—recurrent fall—TUG.

From the *Stroke Clinic of the Federal University of Bahia, Brazil; †Department of Physical Therapy, Bahia School of Medicine and Public Health, Brazil; ‡Department of Internal Medicine and Diagnosis, Federal University of Bahia, Brazil; and §Ambulatório de Doenças Cerebrovasculares, Hospital Universitário Prof. Edgard Santos—HUPES, Salvador, Brazil.

Received February 12, 2016; revision received April 19, 2016; accepted June 30, 2016.

Address correspondence to Elen Beatriz Pinto, PhD, Ambulatório de Doenças Cerebrovasculares, Hospital Universitário Prof. Edgard Santos—HUPES, Rua Augusto Viana S/N, Canela, Salvador, BA 40.110-060, Brazil. Email: elen.neuro@gmail.com.

1052-3057/$ - see front matter

http://dx.doi.org/10.1016/j.jstrokecerebrovasdis.2016.06.045

Introduction

Stroke is a major health problem worldwide and is considered as one of the most important causes of death and disability.[1] The occurrence of falls and its consequences are referred to as one of the most common complications after stroke, and thus the identification of individuals likely to fall becomes an important priority in health care for this population of patients with stroke.[2,3] Factors associated with falls in the acute phase of stroke are not the same as those observed in individuals living in the community, in which balance control is required in performing more complex tasks.[4]

Several studies have aimed at finding demographic and comorbidity risk factors for falls and in which circumstances these falls occur.[5-8] Other studies have conducted clinical tests evaluating gait and balance to prospectively identify individuals at higher risk of falling.[9,10] However, specific validated instruments predicting falls are not widely available for this community-dwelling population of patients with stroke.[11,12]

Longitudinal studies with stroke survivors in different clinical and demographic conditions may enable increased awareness of modifiable and/or treatable factors related to the risk or occurrence of falls, and may also be used to encourage the adoption of preventive measures essential to the maintenance of functional capacity in this population of patients with stroke.[2,13] The present study aimed to determine risk factors related to the occurrence of falls in stroke patients and to propose a new predictive scale for falls.

Methods

Study Design and Population

This is a cohort study wherein the primary outcome was the occurrence of recurrent falls. The cohort was composed of stroke patients who were recruited at the Stroke Clinic of the Federal University of Bahia, Brazil, had clinical and radiological diagnoses of ischemic or hemorrhagic stroke, regardless of the number of events, and presented with the ability to walk independently. The Stroke Clinic receives outpatients referred from stroke units or family health clinics from the public health system in Brazil, to complete investigation of stroke mechanism and to define long-term treatment strategies. Stroke was defined as a focal neurological deficit lasting more than 24 hours, and confirmed by neuroimaging (computed tomography or magnetic resonance imaging).[14]

The ability to walk independently was identified in the initial assessment of each patient, selecting the ones who could walk alone in the outpatient setting, making use or not of orthoses or mobility aids, but without the need of assistance for transfers or during gait.

We excluded patients with other diagnoses, such as those with vestibular disorders, Parkinson's disease, or other neurological or orthopedic diseases that could affect balance. We also excluded individuals unable to understand test instructions or perform the requested tasks due to cognitive deficits (comprehension aphasia or dementia) based on a formal evaluation by a board-certified neurologist.

Data Collection Procedure

Consecutive patients were enrolled by completing a questionnaire containing information on demographic and clinical data such as age, gender, affected brain hemisphere, time from last stroke until admission to study, medications, vascular territory, use of orthoses or assistive devices, and previous history of falls. To minimize recall bias, we considered as previous history of falls the ones that occurred during the last year.

The National Institutes of Health Stroke Scale (NIHSS) was used to assess the severity of stroke,[15] the modified Barthel Index to assess functional capacity/daily life activities,[15,16] the European Quality of Life-5 Dimensions (EQ-5D) to assess quality of life,[17] and the Timed Up and Go Test (TUG) to evaluate functional mobility.[12] These scales were all applied on the day of study recruitment.

The TUG quantifies the time in seconds it takes for the individual to rise from a standardized chair, walk 3 m, and sit back. The individual is instructed to walk at his or her usual pace, with or without the use of orthoses.[18] The TUG was divided into quartiles, based on previous data linking TUG as a predictor of falls.[10,12,19]

Upon enrollment into the cohort, the subjects were followed prospectively for 2 years for the occurrence of recurrent (≥2) falls over the study period, the primary outcome of the present study. We chose recurrent falling as the primary outcome based on previous data suggesting that a single fall may be accidental and may not be as clinically relevant as 2 or more falls.[20] Secondary outcomes during follow-up included death, stroke, and new bone fractures. During follow-up, data were collected quarterly in clinical reassessment at the Stroke Clinic or by telephone. In case of patient incapacity to respond to the call, the patients' caregivers were interviewed. The examiners responsible for follow-up remained blinded to the patient's initial assessment data. To avoid recall bias and information loss, all patients and caregivers received a diary for recording falls. This project was approved by the local ethics committee and all individuals or caregivers participating in the study signed a consent form.

Statistical Analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences version 17.0 (SPSS Inc., Chicago, IL). Descriptive statistics included means and standard deviations for normally distributed continuous variables; median and interquartile range for non-normally distributed continuous variables; and proportions for categorical variables. Kaplan–Meier curves were constructed relating each categorical predictor to the time-dependent variable of recurrent falls, defined as 2 or more falls during the study period, and univariable associations were tested using log-rank tests. For model building, we used independent variables with a possible association to recurrent falls ($P < .20$) as well as variables not necessarily demonstrating statistical significance, but referred to in the literature as being associated with the occurrence of falls. Two separate multivariable models were then used: the first used Cox proportional hazards regression to test the association between these predictors and recurrent falls as a binary outcome. The second