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Research paper

Gait speed and risk assessment for falls among men aged 80 years and older: A prospective cohort study in Taiwan

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ABSTRACT

Purpose: To evaluate the effectiveness of adding gait speed to the history of falls in predicting falls among men aged 80 years and older in Taiwan.
Methods: This prospective cohort study recruited 230 ambulatory men aged 80 years and older in 2012 and followed for 12 months. In addition to demographic characteristics and history of falls, a comprehensive geriatric assessment was performed for all study subjects. Gait speed was obtained by the 6-m walk and three different cut-offs (< 0.5, ≤ 0.8 and < 1.0 m/s) were tested in improving the ability of predicting subsequent falls by using history of falls.
Results: Among all subjects (mean age: 85.5 ± 4.0 years), 26.1% (60/230) reported falls during follow-up period. Univariate analysis showed that polypharmacy, urinary incontinence, history of falls, pain, poorer baseline physical function, depressive mood, and gait speed < 0.5 m/s were associated with falls. Logistic regression showed that history of falls (OR: 4.255, 95% CI 2.089–8.667; $P < 0.001$), pain (OR: 2.674, 95% CI 1.332–5.369; $P = 0.006$), older age (OR: 1.128, 95% CI 1.031–1.234; $P = 0.008$), and slow gait speed (OR: 2.964, 95% CI 1.394–6.300; $P = 0.005$) were all independent risk factors for falls. Fast gait speed (defined as ≥ 1 m/s) was a protective factor for falls, even among subjects with history of falls, but slow gait speed (defined as < 0.5 m/s) was an independent risk factor even among subjects without history of falls.
Conclusions: Combined history of falls and gait speed is a simple and effective tool in risk assessment of falls among older old population.

1. Introduction

Taiwan has become an aging society in 1993 and is estimated to become an aged society by 2017, which makes Taiwan the fastest aging country in the world [1]. Population aging may cause various challenges to the health care systems, and falls have been associated with strong risks to the health of older people. Generally speaking, nearly a third of elderly people may experience falls every year, and more than 50% of these falls occurred during certain form of locomotion [2]. Falls are the most common cause of injury-related deaths among people aged 75 and older, which is the same as in non-fatal injuries among females aged 85 years and older [3]. Falls are also a serious public health issue that are highly associated with morbidity and mortality of older people [4], and a multifactorial approach is considered the most effective strategy to prevent falls [5].

In fall prevention programs, screening the risk of falls is the first and the most critical step to stop the vicious cycle. Screening the history of previous falls is a quick, simple, and effective tool for the first step of risk assessment, which was supported by both the American Geriatrics Society (AGS) and the British Geriatrics

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Society (BGS) [6]. History of fall is the strongest predictor for subsequent falls [7–9], as well as the risk for fractures among people aged 45 years and over [10]. In the AGS-BGS guideline, after screening the history of falls, evaluating the gait/balance disturbance was the second step in the risk assessment, and a number of tests were recommended, such as Get up and Go test, Timed Up and Go test, the Berg Balance Scale, and the Performance-Oriented Mobility Assessment [6]. However, currently, no sufficient evidence supported using a specific test for balance and gait disturbance to predict subsequent falls [6]. Among all these tests, gait speed has been recognized as a simple screening test for various adverse health outcomes of older people, such as mobility disability, institutionalization, death, and cognitive decline [11]. It has been reported that the gait speed ≤ 0.8 m/s was associated with a higher risk of adverse health outcomes, [11,12] and a gait speed slower than 1.0 m/s may increase the risk of mortality [13,14]. However, studies focused on the effect of gait speed in predicting falls among people aged over 80 years were scarce. Moreover, some previous studies suggested to re-define the cut-off of slower gait speed among oldest old population due to their survival effect [15,16]. Although the history of falls is an effective screening tool for falls, it does not completely reflect the current health status, physical function and risk for falls of older people. Therefore, the main aim of this study was to evaluate the role of gait speed in history of previous falls to predict subsequent falls among people aged 80 years and older in Taiwan.

2. Methods

2.1. Participants and study design

This prospective observational cohort study invited all residents living in the Veterans Home, a retirement community, in southern Taiwan in January of 2012. For those who participated in the study, demographic data were collected and the comprehensive geriatric assessments were preformed to them twice a year after the enrollment. Subjects with the following conditions were excluded for study:

- unable to walk with a walking aid;
- unable to communicate with research staff;
- unable to obtain informed consent from participants;
- subjects with their expected life expectancy shorter than 12 months.

A total of 278 people aged 80 years and older were screened, and 7 of them were excluded (5 people were unable to walk, 2 person with incomplete fall history) for study. Among eligible study subjects ($n = 271$), 41 people did not complete the 6-m walk test, so, only a total of 230 residents were enrolled in this study. The whole study was approved by the Institutional Review Board of Kaohsiung Veterans General Hospital.

2.2. Data collection

2.2.1. Demographic characteristics

Three well-trained research nurses interviewed all participants to collect the demographic data, including age, smoking habit, habitual alcohol use status, presence of pain, sleep problems, urinary incontinence, medical history, co-morbidities by using Charlson Comorbidity Index [17], and body mass index (BMI) were obtained for each study subject.

2.2.2. Comprehensive Geriatric Assessment (CGA)

The research nurses performed CGA for all participants, which included visual and hearing impairment, polypharmacy (defined as currently using > 4 prescription drugs for over 2 weeks), depressive symptoms using the 15-item Chinese Geriatric Depression Scale (GDS-15, a score of 5 and more was defined as depressive) [18], nutritional status using the Mini Nutritional Assessment-short form (MNA-SF, malnutrition was defined as the MNA-SF scores of 11 and less) [19], cognitive function determined by the Chinese version of the Mini-Mental State Examination (MMSE, the scores less than 24 was defined as cognitive impairment) [20], the instrumental activities of daily living (using the Lawton-Brody Instrumental ADL scale, IADL) [21], and quality of life (using European quality of life–five domains, EQ5D) [22].

2.2.3. Gait speed measurement

A timed 6-m walk was performed for all participants at their usual walking speed with a static start throughout a 6-m distance without deceleration [23,24], and the time consumed was taken by a fixed study nurse with a stop watch (HS-70 W, Casio computer co. LTC, Tokyo, Japan). The test allowed the subjects to start with a cane or a walker as needed. Three different cut-offs for slower gait speed (< 0.5 m/s [25], ≤ 0.8 m/s [11,12], and < 1 m/s [13,14]) were tested to evaluate the effect in improving fall prevention among the study subjects.

2.2.4. Definitions of falls

In this study, a fall was defined as an unintentional change in position resulting in coming to rest on the ground or other lower levels [26]. For all study subjects, the occurrence of falls was carefully recorded during the 12-month follow-up period.

2.3. Statistical analysis

In this study, continuous variables in the text and tables were expressed as means with standard deviation, and categorical data were expressed as percentages. Comparisons between dichotomous and ordinal variables were done by using the Chi^2 test or Fisher's exact test when appropriate, and comparisons between continuous variables were done using the independent Student's *t*-test or Mann-Whiney *U* test when appropriate. Multivariate logistic regression analysis was used to determine the independent predictive factors for subsequent falls in the following year and the candidate predictors with a P value < 0.2 in univariate analysis were selected to enter the regression model. For the interaction of history of falls and gait speed, we combined the history of falls and slower gait speeds using different definitions, i.e. < 0.5 m/s, ≤ 0.8 m/s or < 1 m/s. The predictive effect was also analyzing by multivariate stepwise logistic regression analysis after adjusting confounders.

3. Results

3.1. Demographic characteristics and functional status

Overall, 230 subjects (mean age: 85.5 ± 4.0 years, range: 80–101 years, all males) participated in this study and 27.4% of them (63/230) reported falls in the previous year. Among them, 26.1% (60/230) reported fall events during the follow-up period. Table 1 summarized the demographic characteristics and functional status of the study participants. Approximately 40% of the study subjects had sleeping problems, urinary incontinence, cognitive impairment, or depressive symptoms. Those who developed falls in the follow-up period had significantly slower gait speed than those who developed no fall event (0.67 ± 0.33 m/s vs 0.78 ± 0.32 m/s, $P = 0.021$), lower scores in EQ5D (61.1 ± 22.9 vs 68.1 ± 15.7, $P = 0.039$), and higher prevalence of urinary incontinence (46.7% vs 27.6%, $P = 0.007$), presence of pain (61.7% vs 41.2%, $P = 0.001$), and depressive symptoms (43.3% vs 24.7%, $P = 0.007$).