



Influence of urinary urgency and other urinary disturbances on falls in Parkinson's disease



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ABSTRACT

Introduction: Falling is one of the most common and serious public health problems. It can cause injuries such as sprains and fractures, and hospitalization may be required for serious injuries. Patients with Parkinson's disease have a higher risk of falls, and urinary incontinence is a known risk factor for falls in the elderly. However, whether other urinary disturbances contribute to the risk of falling remains unclear. The purpose of this study was to identify the association between falls and urinary disturbances in Parkinson's disease.

Methods: A prospective cohort study was conducted at a single institution with a 6-month observation period. Subjects were ambulatory patients with Parkinson's disease. Assessments included patient demographics, disease severity measured by the Hoehn and Yahr scale, and urinary disturbances measured using the overactive bladder symptom score (OABSS). Falls were reported using a self-documented fall record.

Results: A total of 97 patients were included. Forty-four subjects experienced one or more falls during the observation period. The frequency of urination was not related to falling; however, mild urinary urgency, but not severe urinary urgency, increased the risk of falls by an odds ratio of 5.14 (95% confidence interval: 1.51–17.48). Mild urinary urgency was also associated with the time to the first fall and the frequency of falls. One third of falls occurred in the living room, and 13.8% of falls occurred on the way to/from the toilet.

Conclusion: Falls in patients with Parkinson's disease might be associated with urinary urgency, but not with the frequency of urination.

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1. Introduction

Falling is a common and serious public health problem that can cause injuries such as sprains, fractures, and even intracranial hemorrhages. Occasionally, serious injuries may require hospitalization. After a fall, patients may experience a reduction in activities of daily life (ADL) or be bedridden, because of which they may require social support, which can increase healthcare costs [1]. Elderly people have a high risk of falling, and one-third of the falls per year involve elderly individuals because of general physical decline and illness-related drug use [2]. Therefore, physical therapy and environmental support such as handrails are important for preventing falls [3].

Parkinson's disease is one of the most common neurodegenerative diseases involving motor deficits, and affects 1% of the elderly population over the age of 60 [4]. Patients with Parkinson's disease have a

higher risk of falls, which can be more than twice that of healthy elderly people [5,6]. In addition to motor symptoms, Parkinson's disease presents with non-motor symptoms including orthostatic hypotension and neurogenic bladder, which can also increase the risk of falling [7, 8]. Urinary incontinence, a symptom of neurogenic bladder, is a known risk factor for falls in elderly people [9]. In patients with Parkinson's disease, urinary incontinence raises the risk of falls as an independent factor [10]. However, urinary disturbances caused by neurogenic bladder also include urinary frequency, nighttime urination, urinary urgency, and urinary incontinence. Recently, the concept of overactive bladder symptoms that stems from neurogenic bladder has become popular and a scoring system called the "overactive bladder symptom score (OABSS)" has been established [11]. The OABSS has four domains including daytime frequency, nighttime frequency, urinary urgency, and urinary incontinence. The total OABSS is associated with falls in community-dwelling adults [12], however, a prospective survey in patients with Parkinson's disease has not yet been conducted and the association between each aspect of the OABSS and falls is still unclear.

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Therefore, the purpose of this study was to evaluate the interaction between urinary disturbances and falling in patients with Parkinson's disease.

2. Methods

2.1. Settings and participants

This study used a prospective cohort design in an outpatient clinic of an academic hospital. Patient data was collected between April 2009 and August 2012, and each patient was observed for 6 months. All subjects had a confirmed diagnosis of Parkinson's disease based on the United Kingdom Parkinson's Disease Society Brain Bank Criteria [13] at study inclusion. The Institutional Review Board of Hokkaido University Hospital approved this study. All subjects in this study submitted a written consent form.

2.2. Data collection and variables

We used the World Health Organization's definition of a fall, which describes a fall as an event that results in a person coming to rest inadvertently on the ground or floor or other lower level. A "faller" was defined as a person who had one or more falls during the 6-month observation period. Each fall was recorded in a self-documented fall record by the patients themselves with or without caregiver help. The fall records included the date of each fall, location of the fall, associated symptoms (fainting or syncope), whether they were on the way to/from the toilet or not, and any injuries. The fall records were checked by either in-person or telephone interviews monthly or bimonthly. Baseline assessments including patient demographics, past medical history, medications, previous falls, and the OABSS were determined by the same investigator (KS) in all subjects. The OABSS consists of four domains: Daytime frequency, divided into three categories of ≤ 7 , 8–14, and ≥ 15 ; nighttime frequency, divided into four categories of 0, 1, 2, and ≥ 3 ; and both urgency and incontinence divided into six categories of not at all, less than once a week, once a week or more, about once a day, 2–4 times a day, and 5 times a day or more. The severity of the patients' Parkinson's disease was assessed using the Hoehn and Yahr rating scale [14] and Unified Parkinson's Disease Rating Scale [15]. Depression symptoms were assessed using the Center for Epidemiologic Study Depression Scale [16]. ADL were assessed using the Barthel Index [17]. Gait function was assessed using the functional independence measure (FIM) locomotion score [18]. Outdoor ADL were assessed by counting the number of times they left the house. Cognitive function was assessed using the mini-mental state examination [19]. Orthostatic hypotension was defined as a drop in blood pressure of over 20 mm Hg systolic or 10 mm Hg diastolic on standing [20]. Patients with visual problems were defined as those who could not understand the facial expressions of another person at a distance of 4 m.

2.3. Statistical analyses

Descriptive summaries of subject demographics are reported as the mean and standard deviation (SD) for continuous variables, and as frequencies and percentages for categorical variables. Based on the OABSS items regarding urinary urgency and urinary incontinence, patients were categorized into two groups with the mild group having these symptoms less than once a day and the severe group having these symptoms once a day or more based on the distribution (tertile) and whether the patients were clinically luculent when assessed by the physicians. In the bivariate analysis, the association between fallers and each item on the OABSS was determined with a chi-squared test. The survival time to the first fall was described using a Kaplan–Meier curve and examined by a log-rank test. Multivariate analyses adjusted for age, sex, and severity of parkinsonism were conducted for evaluating the association between the OABSS and falls, in terms of their time and

frequency. The association between fallers and the OABSS as determined by the bivariate analysis was analyzed using a logistic regression model. In addition to a logistic regression model, a Cox proportional hazards model and Poisson regression model were used to analyze the relationship between the OABSS and falls [21,22]. A Cox proportional hazards model was used to evaluate the time from the study enrollment to the first fall. A Poisson regression model was used to evaluate the association between frequency of falls and urinary disturbances to take into account of the small number of falls observed in the 6-month observation period. The demographics of each fall were also described to reveal the circumstances and outcomes of the falls.

3. Results

3.1. Association between OABSS and falls

The demographics of the 97 subjects who completed the 6-month study period are shown in Table 1. Forty-four subjects experienced one or more falls during the observation period and were categorized as the faller group. The numbers of falls in the faller group were 1–5 times in 23 subjects, 6–10 times in 11 subjects, and 11 times or more in 10 subjects including 2 subjects with more than 99 falls (Supplementary Fig. 1). The mean age (SD) was 70.6 (7.0) years in the faller group and 72.2 (7.6) years in the non-faller group. The proportion of women was 63.6% in the faller group and 54.7% in the non-faller group. The duration of Parkinson's disease was longer in the faller group (113.3 months) than in the non-faller group (73.6 months). Based on the Hoehn and Yahr stage, the disease severity was more advanced in the faller group (3.0 [0.9]) compared to in the non-faller group (2.3 [1.0]). The associations between falls and the OABSS are shown in Fig. 1. The frequency of urination both during the day and at night was not related to falling. However, both urinary urgency and urinary incontinence were related to falling with a bell-shaped phenomenon, where the mild phenomenon was more associated with falling compared to the severe phenomenon. Kaplan–Meier curves of the first falls related to urinary urgency and urinary incontinence are shown in Fig. 2. Mild urinary urgency had the most obvious association with falls, and this association was statistically significant ($p < 0.05$). The results of the multivariate analyses adjusted for disease severity, age, and sex are shown in Table 2. Logistic regression analysis showed that mild urinary urgency increased the risk of falls by an odds ratio of 5.14 (95% confidence interval [CI]: 1.51–17.48). A Cox proportional hazard analysis showed that mild urinary urgency shortened the time to the first fall by a hazard ratio of 2.67 (95% CI: 1.24–5.73). A Poisson regression analysis showed that mild urinary urgency increased the frequency of falls by 3.97 (95% CI: 3.07–5.14) times.

3.2. Fall demographics

The fall demographics revealed that one third of the falls occurred in a living room (Supplementary Table 1). There was an increased frequency of falls during the time periods of 10:00–11:00 and 15:00–18:00, while the times when meals are common were associated with fewer falls (Supplementary Fig. 2). The frequency of falls that occurred on the way to the toilet was 13.8%. Fall outcomes included 4 fractures, 1 laceration, and 37 minor injuries.

4. Discussion

This study revealed three aspects regarding the association between urinary disturbances and falls in patients with Parkinson's disease. First, among the urinary disturbances, mild urinary urgency had the strongest association with the risk of falls. Second, mild urinary urgency was associated with not only the risk of falls, but was also consistently associated with the frequency of falls and the time to the first fall. Third, the most

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