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Research paper

# Factors associated with the night-time index fall in an older hip fracture population



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## ABSTRACT

**Purpose:** We examined factors associated with the night-time index fall in a population-based sample of hip fracture patients with a specific focus on the effect of nocturia and visits to the bathroom with falling at night.

**Material and methods:** The study population comprised 849 (69%) hip fracture patients aged 65 years and over. Data were collected by means of interviews. Age- and gender-adjusted and multivariate logistic regression analyses were used.

**Results:** Of these patients, 122 (14%) had fallen between midnight and 06:00. Of the night-time fallers, compared to the daytime fallers, 38% vs 9% had fallen on the way to the bathroom. Of these, 95% reported nocturia at least once. After adjusting for age and gender, age at least 90 years, taking 4–10 or more than 10 medications, reporting any nocturia or nocturia more than three times, fall on the way to the bathroom, non-independent mobility level and use of any walking aid were significantly associated with falling at night. In the multivariate analysis, having fallen on the way to the bathroom (OR 4.45; 95% CI 2.65–7.46), reporting nocturia more than three times (OR 2.44; 95% CI 1.15–5.16) and having non-independent mobility level (OR 1.84; 95% CI 1.08–3.11) remained significantly associated with falling in the night-time.

**Conclusions:** Falling on the way to the bathroom, severe nocturia and mobility impairment were independently associated with night-time falls in older hip fracture patients. The findings offer insights into understanding night-time falls and into preventing of falls and fractures in the oldest and frailest older population.

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## 1. Introduction

Most hip fractures are known to occur indoors and in daytime and only a minority at night [1–4]. Depending on the definition of night-time, the prevalence of night-time index falls in older hip fracture patients has varied between reports from 10% to 27% [1–4]. Little is known about the factors associated with falling at night in older hip fracture patients.

Nocturia is a multifactorial and extremely common symptom in older people [5,6]. Nocturia is defined according to the International Continence Society (ICS) as waking up at least once at night to void [5]. It has been reported in population-based studies to be a risk factor for falls and fractures [7,8]. As far as we know, there are two studies in which nocturia has been claimed to increase the risk

of hip fracture [9,10]. To the best of our knowledge, the association of nocturia with the time of the index fall in hip fracture has not so far been studied.

Of the other lower urinary tract symptoms, urinary incontinence, especially the urge type, has also been reported to increase the risk of a fall in both older men and women [11–13]. Other risk factors for falls in older populations include polypharmacy as well as specific groups of medications, comorbid conditions, cognitive problems, visual impairment and environmental hazards [14–16]. In addition, living in an institution [17] and mobility impairment are known to be among the most significant risk factors for falls and fractures in older populations [18,19].

The aim of the present study was to examine factors associated with the night-time index fall in a population-based sample of older hip fracture patients with a specific focus on the association of nocturia and visits to the bathroom with the night-time index fall.

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## 2. Material and methods

The study material consisted of 1224 consecutive patients aged 65 years and over who had suffered a hip fracture between January 2008 and December 2013 in the Hospital District of Southern Ostrobothnia, Finland, with a population of some 200,000. Only the first hip fracture in the same patient during the observation period was included. Pathological and periprosthetic fractures were excluded. All patients were treated at Seinäjoki Central Hospital, which is the only hospital in the area providing trauma surgery, so the material represents a population-based sample of hip fracture patients.

Data on Body Mass Index (BMI), American Society of Anesthesiologists (ASA) risk scores, pre-fracture diagnosis of memory disorder, number of medications taken regularly, use of hypnotics, circumstances of the fall (time of falling and falling or not falling on the way to the bathroom), living arrangements and living or not living alone before the fracture, pre-fracture mobility level and use of any walking aid pre-fracture were collected by a geriatric nurse during the perioperative hospital stay by interviewing the patient, close relatives or ward nurses and using available patient records. Mobility impairment was defined as needing any assistance in ambulation either outdoors or indoors while having no mobility impairment was defined as being able to move independently without any assistance.

As part of the postoperative follow-up, the geriatric nurse contacted the patients or their proxies (e.g. a family member or a nurse) by telephone one month after the fracture. In order to define pre-fracture nocturia, the patient was asked if before the fracture she or he had had to wake up at night to urinate. Nocturia was defined in two different ways: as waking up to urinate at least once during the night or as reporting nocturia 0–1, 2–3 or more than 3 times per night. To define pre-fracture urinary incontinence, the patients were asked if they had had any urinary leakage before the fracture. Urinary incontinence was defined as a positive answer to this question. The categorization of the variables is shown in Table 1.

The data were analyzed using the IBM SPSS Statistics version 20.0. *P*-values under 0.05 were considered as statistically significant. Cross-tabulations were used to describe the distribution of patient characteristics according to the time of falling. A night-time fall was defined as falling between midnight and 06:00. The results were presented as numbers of cases with percentages. Statistical comparisons between the groups were performed using Pearson's Chi-Square test or Fisher's exact test for categorical variables.

In the analyses, night-time fall was the dependent variable while age, gender, BMI, ASA scores, diagnosis of a memory disorder, number of medications, use of hypnotics, urinary incontinence, any nocturia, frequency of nocturia, falling on the way to the bathroom, living arrangements, living alone, pre-fracture mobility level and use of a walking aid were the independent variables.

First, age- and gender-adjusted binary logistic regression analyses were conducted to examine the association of each of the variable separately with the night-time fall. Second, a multivariate analysis was conducted adjusting simultaneously for all the independent variables.

## 3. Results

Data were available for 849 patients (69%). Of these patients, 121 (14%) had fallen between midnight and 06:00. The patients who had fallen at night were significantly older, more likely to report taking more than 4 medications, to report urinary incontinence and any nocturia, or nocturia more than three times,

to have fallen on the way to the bathroom, less likely to be living alone, more likely to have a non-independent mobility level and to use any walking aid before the fracture than patients who had fallen in the daytime. The patients who had fallen at night tended to have a higher ASA risk score, but the difference between the groups was not statistically significant (Table 1).

Of the night-time fallers, compared to the daytime fallers, 38% vs 9% had fallen on the way to the bathroom. Of these, 95% reported nocturia.

In the age- and gender-adjusted logistic regression analyses, at least 90 years of age (OR 2.10; 95% CI 1.18–3.72), taking 4–10 (OR 1.98; 95% CI 1.07–3.67) or more than 10 (OR 2.23; CI 1.09–4.55) medications, reporting any nocturia (OR 3.21; 95% CI 1.15–8.96), reporting nocturia more than three times (OR 2.47; 95% CI 1.23–4.95), having fallen on the way to the bathroom (OR 4.92; 95% CI 3.05–7.94), living alone (OR 0.27; 95% CI 0.37–0.90) having a non-independent mobility level (OR 2.35; 95% CI 1.55–3.58) and using any walking aid (OR 1.76; 95% CI 1.11–2.78) were significantly associated with falling at night.

In the final multivariate analysis, having fallen on the way to the bathroom (OR 4.45; 95% CI 2.65–7.46), reporting nocturia more than three times (OR 2.44; 95% CI 1.16–5.16) and having a non-independent mobility level (OR 1.84; 95% CI 1.08–3.11) remained significantly associated with falling in the night-time.

## 4. Discussion

Our study confirmed the common experience and assumption of an association between a night-time fall in a hip fracture patient and a night-time visit to the bathroom. Furthermore, reporting nocturia more than three times per night was also independently associated with a night-time fall. Recent studies have concentrated on examining the effect of severity of nocturia on different outcomes. A study by Tikkinen and co-workers [20], based on the quality of life impact, even proposed revising the definition of nocturia introduced by the ICS [5] from at least one episode to at least two episodes per night. In fact, nocturia more than two or three times per night has been reported to be associated with a risk of a fall [7,8] and nocturia two or three times or more with hip fractures in unselected older populations [9,10]. In our study, almost all the patients who had fallen on the way to the bathroom at night reported nocturia at least once. It has to be emphasized, however, that given the high prevalence of the symptom in this population, many of the patients reporting nocturia had fallen in the daytime.

In addition to visits to the bathroom and severe nocturia, mobility impairment remained significantly associated with night-time falls in the final multivariate analysis. A typical condition in older patients causing both mobility impairment and nocturia could be, for example, Parkinson's disease [21,22]. Furthermore, both urinary symptoms and mobility impairment are known to be common in other neurological conditions such as cerebrovascular disorders. Unfortunately, no diagnoses of specific disease conditions were recorded, which is one of the limitations of our study. Only comorbidity as defined by the ASA scores and a pre-fracture diagnosis of a memory disorder were registered in our database and could be used mainly as covariates. Nevertheless, ASA risk score has previously been used successfully as an indicator of comorbidity in hip fracture patients [23].

Use of any walking aid was associated with night-time falls in the age- and gender-adjusted analyses. There is however, no information on whether or not the patient had actually been using the walking aid at the time of the night-time fall. We therefore believe that, using a walking aid in our study in fact indicates mobility impairment in these patients. Similarly, the protective association of living alone against suffering a night-time fall may

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