Arch Orthop Trauma Surg (2015) 135:59–67
DOI 10.1007/s00402-014-2113-6

TRAUMA SURGERY

Urinary incontinence and poor functional status in fragility fracture patients: an underrecognized and underappreciated association

M. Gosch · H. Talasz · J. A. Nicholas · C. Kammerlander · M. Lechleitner

Received: 18 August 2014 / Published online: 16 November 2014
© Springer-Verlag Berlin Heidelberg 2014

Abstract

Purpose/introduction Urinary incontinence (UI) affects some 20 % of community-dwelling older people and 30–60 % of people in institutional care. UI is known as an independent predictor of falls, and likely impacts fracture rates. The aim of the study was to measure the prevalence of UI in a typical fragility fracture population, to evaluate the relationship of UI with functional disability in the post-acute setting.

Methods Our study is a retrospective cross-sectional study of patients admitted to rehabilitation setting after inpatient hospital management for a fragility fracture. We included all consecutively admitted fragility fracture patients aged over 65. All patients underwent standard clinical examination and Geriatric Assessment. We assessed UI using a two-stage process with a six-item UI screening questionnaire followed by an interview.

Results 1,857 (80.7 % female) patients were available for analysis, mean age was 81.7 years. UI was identified in 59.2 % of all fragility fracture patients, and was more prevalent in females. Patients suffering from UI differed significantly in almost all measured functional and cognitive tests, with increased dependency/lower ADL scores, increased rates of immobility, and higher rates of cognitive dysfunction and depression.

Conclusion This study confirms the high prevalence of UI in older fragility fracture patients, and the association between UI and functional impairments. The diagnostic work-up and treatment of patients should be focused on the special needs of these older patients. More efforts are needed to increase awareness about prevalence and consequences of UI among older fragility fracture patients.

Keywords Fragility fracture · Urinary incontinence · Disability · Older · Geriatric assessment

M. Gosch (✉)
Department of Internal Medicine 2, Geriatric Medicine, Klinikum Nürnberg, Paracelsus Private Medical University, Prof. Ernst-Nathan Strasse 1, 90419 Nuremberg, Germany
e-mail: markus.gosch@klinikum-nuernberg.de

H. Talasz · M. Lechleitner
Department of Geriatrics and Internal Medicine, Hospital Hochzirl, Zirl, Austria

J. A. Nicholas
Rochester Division of Geriatrics, University of Rochester Medical Center, Rochester, USA

C. Kammerlander
Department of Traumatology, Medical University of Innsbruck, Innsbruck, Austria

Introduction

Fragility fractures are a major health care problem worldwide. Due to increasing life expectancy and other associated demographic changes, the incidence of fractures and post fracture disability appear certain to increase [1]. Most clinical outcome studies on fragility fractures are focused on older hip fracture patients, and describe poor outcomes including up to 30 % 1-year mortality after fracture [2]. Furthermore, older hip fracture patients undergo dramatic changes in their overall functional status and independence in many daily activities including incontinence [3]. Urinary incontinence (UI) affects some 20 % of community-dwelling older people and 30–60 % of people in institutional care [4–6]. UI remains an underreported problem, despite its enormous impact on quality of life and associated morbidity [7, 8], and the majority of the patients with urinary incontinence either do not present for care, cope in silence or do not receive effective treatment [9, 10].

Fragility fractures are predominantly caused by falls, and falls are highly prevalent, with 30 % of adults aged over 65 years suffering fall every year and 8–9 % of older adults admitted to a hospital each year due to a fall [11–13]. UI is well known as an independent risk factor for falls. A meta-analysis of nine studies investigating falls and UI in community-dwelling older people showed a significant increase in the risk of falls in the presence of UI [14]. This correlation between UI and falls is not only known in community-dwelling older people, it is even stronger in older people living in institutional care units [15]. Despite the impact of UI upon the risk and consequences of falls, continence care is often overlooked in the management of specific diseases where it could be particularly relevant.

UI assessment is essential part of post fracture management aimed and secondary fall and fracture prevention. The use of a multidimensional clinically based UI assessment offers an adequate diagnostic tool for identification of conditions that might contribute to and aggravate incontinence, and can facilitate proper UI diagnosis and management in older adults [16–20]. Clinical practice guidelines and experts in UI recommend using history, targeted physical examination, urinalysis, determination of postvoid residual bladder volume and bladder diaries of up to 3 days in the initial assessment of UI symptoms [16–20].

We performed a cross-sectional study of recently hospitalized older fragility fracture patients, using routinely collected data from a standardized multidimensional geriatric assessment. The aim of our study was to evaluate the prevalence of UI symptoms in this cohort, to assess the correlation of UI with measures of functional and cognitive status, and to discuss the potential impact of UI on diagnostic and therapeutic management.

Patients and methods

Study design

The present study is a retrospective cross-sectional study with data collected between 2005 and 2011 at the Department for Geriatrics and Internal Medicine at the hospital of Hochzirl, Austria. This is a post-acute care Geriatric Evaluation and Management Unit (GEMU) aimed at providing rehabilitative and restorative services as "a ward that admits frail older inpatients for a process of multidisciplinary assessment, review and therapy" [21]. We included all patients with fragility fractures who were consecutively admitted to our department from trauma wards in our district. Due to the high age of our study population and our special setting for older patients with functional disabilities, we considered all fractures as fragility fractures. Based on the literature, osteoporosis is the most common condition contributing to 95 % of fractures in patients aged over 75 years and 80–90 % of fractures in patients aged between 60 and 74 years who are hospitalized for treatment of a fracture [22]. A fragility fracture is defined as a fracture caused by injury that would be insufficient to fracture a normal bone: the result of reduced compressive and/or torsional strength of bone as we can expect in older patients with osteoporotic bones and functional disabilities.

All patients underwent standard clinical examination and a Geriatric Assessment including a specialized assessment for urinary incontinence on the second day after admission to our hospital. Patients who were not able to perform the tests of the Geriatric Assessment (e.g., patients with life-threatening conditions or severe cognitive impairment) were not included in the evaluation. Each specific assessment tests was performed by a nurse specialized in geriatric assessment and urinary incontinence.

No institutional review and approval was necessary in light of the clinical origin of the data, its retrospective analysis, and use of de-identified patient data.

Study population

We included all in-hospital, post-acute fragility fracture patients aged over 65 from December 2005 to December 2011. A total of 1,857 patients were available for analysis, with a mean age of 81.7 ± 6.7 years; 80.7 % of the cohort was female. Based on the International Classification of Disease (ICD-10), we split the study group into 8 subgroups regarding the anatomical location of the fractures: 1 (hip); 2 (humerus); 3 (pelvis); 4 (vertebral); 5 (trunk); 6 (wrist); 7 (lower limb); 8 (unspecified fracture). All patient characteristics are presented in Table 2.

Data collection

Urinary incontinence

We assessed urinary incontinence using a two-stage process. As a first step, a non-validated questionnaire for screening UI symptoms with six items was used (Fig. 1) [23]. UI symptom assessments, such as questionnaires have been validated for use in clinical and research settings [24]. However, the evidence level of all kind of questionnaires is low (Evidence rating C) [25]. The questionnaire, that we used, is already recommended by the Austrian Society of Gerontology and Geriatrics and the Austrian Society of Continence [26]. For purposes of the present study, patients suffered from UI symptoms if they responded "Yes" (1 point) to more than one question or if they had an

Fig. 1 Questionnaire for screening UI symptoms

1. Do you need to urinate more often than previously (more than 7 times during the day and more than 1 times during the night)?

 □ No (0) □ Yes (1)

2. Do you occasionally experience a sudden, strong need to urinate?

 □ No (0) □ Yes (1)

3. Do you spontaneously leak urine when you don't want to?

 □ No (0) □ Yes (1)

4. Do you leak urine when you cough, sneeze or laugh?

 □ No (0) □ Yes (1)

5. How much do you suffer from /are you bothered by/ your incontinence problem?

 □ No (0) □ Yes (1)

6. Indwelling catheter?

 □ No (0) □ Yes (6)

indwelling urinary catheter (6 points) at the time of investigation. A maximum score of 6 points was possible. For all patients with a UI questionnaire score $\geq$1, a specialized nurse performed an individual interview to classify the patients as incontinent or not. Urinary incontinence was defined as the complaint of any involuntary loss of urine [27].

Patients using indwelling, intermittent or condom catheters were classified as incontinent [28].

Activities of daily living

Overall functional status was assessed using the Barthel Index (BI) [29]. BI is used to measure performance in basic activities of daily living by documenting the presence or absence of fecal or urinary incontinence, help needed with grooming, toilet use, feeding, transfers (e.g., from bed to chair), walking, dressing, climbing stairs and bathing. The maximum score of 100 points indicates a fully independent patient. Data were provided by nursing staff, after observing the patient for 24 h. This score has been validated for post fracture assessment of hip fracture patients [30] with a score >80 indicating that a patient with adequate function for independence in the community [31].

Cognition and depression

Cognitive function was assessed using the Mini-Mental State Examination (MMSE). MMSE is a validated and common screening instrument for cognitive impairment [32]. Patients with a MMSE score <27 were defined as cognitive impaired. We applied the geriatric depression scale (GDS) to screen for depressive disorders (short version) [33]. The short version contains 15 items, >5 positive answers are indicative of depression [33].

Mobility and risk of falls

Mobility was assessed using the Timed Up&Go (TUG) test. The TUG is a validated tool to determine impairments of mobility, gait and gait speed [34] based the time it takes the participant to stand up from a chair, walk 3 m, turn, walk back to the chair and sit down. The TUG test of $\geq$20 s is a simple indicator of an older adult's impaired functional mobility [30]. Patients who were not able to perform the TUG were classified as immobile. Furthermore, muscle strength was assessed by measuring the grip strength using a vigorimeter. Hand grip strength is strongly correlated with lower extremity muscle power, knee extension torque and calf cross-sectional muscle area [35]. The cut off as a marker for sarcopenia is <30 kg in men and <20 kg in women [36].

Nutrition

Nutritional status was assessed by the body mass index (BMI) and the mini nutritional assessment (MNA) [37]. MNA score allows for the identification of older adults with inadequate nutritional status, including those at risk of malnutrition and those who are malnourished. Patients with a MNA score <17.5 points were classified as malnourished.

Pain and sensory impairments

Pain was assessed using a visual analog scale (VAS), scored from 0 (no pain) to 10. A score of $\geq$3 was considered significant. Vision was assessed using an eye chart. A visual acuity of ≤20 % was evaluated as clinical relevant. Hearing impairment is assessed informally during the interview, and identified if patients endorse any problems understanding a face-to-face conversation held in an adequate loudness.

Statistical analysis

Statistical analysis was conducted using SPSS version 20.0 (2011). Metric scaled data are reported as arithmetic mean ± standard deviation and categorical data as absolute frequency and percentage distribution. Non-parametric statistics (Mann–Whitney U test) were used since normality assumptions were not met for most of the outcome variables. Group effect and main condition effects were tested for significance by the Mann–Whitney U test. The Chi-square test for independence was used to determine a possible relationship between two categorical variables. The significance level was defined by $p < 0.05$.

Multivariate logistic regression analysis was performed to identify the association of fracture location with the presence of UI. Bivariate analyses were based on logistic regression to generate odds ratios (OR) and 95 % confidence intervals (CI). The dependent variable for these analyses was UI. Independent variables were gender, age, ADL, MMSE, GDS, TUG, grip strength, MNA and sensory impairments.

Results

We analyzed the data of 1,857 patients with a mean age of 81.7 ± 7 years, 80.7 % were female. All patient‘s characteristics are presented in Table 1. More than 50 % of the patients sustained a hip fracture. In comparison to the group of non-hip fracture patients, hip fracture patients were significant older ($p < 0.001$), had a significant lower ADL score ($p < 0.001$), more gait disabilities, longer TUG times ($p < 0.001$) and a higher prevalence of immobility ($p < 0.001$). Cognitive impairment ($p < 0.012$), malnutrition ($p < 0.028$) and sensory impairments ($p < 0.001$) were also significantly higher in hip fracture patients. No significant difference was observed regarding GDS, grip strength, pain and length of stay.

UI was present in 59.2 % of all fragility fracture patients (Table 2). 27.4 % ($n = 508$) had no positive items on the questionnaire, and were classified as continent. 16.7 % ($n = 310$) had an indwelling catheter and were classified as incontinent. 18.7 % ($n = 347$) of the patients were not able to answer the screening questionnaire; 46.7 % ($n = 162$) of were subsequently classified as urinary incontinent, following the individual interview by the specialized nurse. Among the group of patients with only one positive item in the questionnaire after the individual interview, 68.7 % ($n = 147$) were classified as suffering from UI. UI was more frequently identified in female patients (61.1 vs. 51.5 %), and the prevalence was strongly correlated with age. In the youngest age group (65–69 years) UI prevalence was 40.9 %, increasing to 68.9 % in the oldest group (90 years and older). After adjustment for sex, age, ADL, MMSE, GDS, TUG, grip strength, MNA and sensory impairments fracture location had no significant association with UI ($p = 0.230$).

UI in fragility fracture patients was significantly associated with additional functional impairments. Except for visual impairment, patients suffering from UI differed significantly in all other measured functional tests (Table 3). Only 12.3 % of the patients with UI remained independent with an ADL > 80, compared to 26.5 % in the group without UI ($p < 0.001$). Significant cognitive dysfunction was higher in UI patients (62.1 vs. 45.9 %, $p < 0.001$). Furthermore, GDS scores consistent with depression were present in 25.1 % of UI patients compared to 13.2 % without UI ($p < 0.001$). Mobility was also significantly reduced in patients with UI, with high rates of immobility seen in the UI group (19.4 vs. 6.4 %, $p < 0.001$), and a TUG of more than 20 s frequent in both groups (90.4 vs. 87.2 %, $p = 0.041$).

Discussion

Our trial investigated 1,857 older patients with fragility fractures, urinary incontinence and the association with further functional impairments in the setting of a GEMU. It is the first study that includes not only hip fractures but also all fragility fractures independent of fracture location. However, hip fracture patients remained the largest fracture location subgroup with more than 1,089 (58.6 %). The overall prevalence of UI was 59.2 % and did not differ significantly within the fracture location groups. In comparison to other relevant trials, we found a higher prevalence of UI in this cohort. Sorbye et al. described a prevalence of UI of 49 % in hip fracture patients, and Palmer MH et al. noted a prevalence of 21.6 % in female hip fracture patients [28, 38]. Interestingly, Sran described a similar or even higher prevalence of urinary incontinence in women with osteoporosis [39]. In his cohort, 76 % of female patients with osteoporosis reported some symptoms of urinary incontinence. UI is common and affects 15–30 % of older individuals in the community and half of clients in home care programs, but UI symptoms are generally underreported and the condition is surely underdiagnosed [39, 40]. The prevalence of UI increases in both men and women with age and

Table 1 Baseline characteristics of 1,857 patients at admission

Fracture location	All	Hip	Non-hip	Humerus	Pelvis	Vertebral	Trunk	Wrist	Lower limb	Uf
Patients, *n* (%)	1,857 (100 %)	1,089 (58.6 %)	768 (41.4 %)	165 (8.9 %)	207 (11.1 %)	100 (5.4 %)	64 (3.4 %)	42 (2.3 %)	182 (9.8 %)	8 (0.4 %)
Age (years)	81.7 ± 7	82.2 ± 6.8	81.1 ± 7.2	80.6 ± 7.6	82.2 ± 6.6	81.2 ± 6.2	84 ± 7.2	81.1 ± 4.5	78.8 ± 7.6	88.6 ± 8.3
Female patients	1,498 (80.7 %)	883 (81.1 %)	615 (80.1 %)	143 (86.7 %)	159 (76.8 %)	74 (74 %)	48 (75 %)	38 (90.5 %)	149 (81.9 %)	4 (50 %)
ADL	61.9 ± 20.3	60.1 ± 20.2	64.6 ± 20.1	65.5 ± 18.9	61.5 ± 20.1	67.5 ± 21.6	62.8 ± 17.6	65.2 ± 17.3	66.6 ± 21.3	58.6 ± 25.1
MMSE	26 ± 3.8	25.8 ± 3.8	26.3 ± 3.7	26.2 ± 3.4	26.4 ± 20.1	26 ± 21.6	25.2 ± 4.2	26.1 ± 2.9	27 ± 3.4	20.8 ± 6
GDS	3.9 ± 2.4	4 ± 2.4	3.9 ± 2.5	4.2 ± 2.7	4.1 ± 2.5	4 ± 2.5	4.2 ± 2.5	3.2 ± 1.6	3.5 ± 2.4	3 ± 0
TUG	50.8 ± 39.2	57.5 ± 41.1	42.1 ± 34.9	31.3 ± 28.6	53.8 ± 38.8	38.1 ± 39	36.9 ± 30.5	41.1 ± 36.5	44.1 ± 30.4	38.6 ± 27.9
Immobility	259 (14.1 %)	180 (16.7 %)	79 (10.3 %)	9 (5.5 %)	22 (10.7 %)	9 (9.1 %)	2 (3.1 %)	3 (7.1 %)	33 (18.2 %)	1 (12.5 %)
Grip strength[a]	19.5 ± 20.9	19.4 ± 20.6	19.6 ± 21.4	17.2 ± 20	22 ± 22.1	16.2 ± 20.2	19.8 ± 22.2	15 ± 17.3	22.4 ± 22.5	5.7 ± 15.1
MNA	19.1 ± 3.2	19 ± 3.3	19.3 ± 3	19 ± 2.7	19.5 ± 3	19 ± 3.3	18.9 ± 3	19.1 ± 2.5	19.7 ± 3.2	19.3 ± 6
BMI	24.3 ± 4.5	24 ± 4.2	24.8 ± 4.8	25.7 ± 5.3	23.6 ± 4	24.9 ± 4.1	24.2 ± 4.4	25.3 ± 4.6	25.5 ± 5.3	23.3 ± 5.3
VAS	3.8 ± 3.2	3.7 ± 2.5	3.9 ± 2.6	3.6 ± 2.6	4.6 ± 2.4	4 ± 2.5	4.4 ± 2.6	3.6 ± 2.8	3.3 ± 2.4	1.8 ± 2
Visual impairment	295 (20.1 %)	204 (23.1 %)	91 (15.5 %)	22 (16.8 %)	21 (13.4 %)	13 (18.3 %)	10 (20.8 %)	3 (9.7 %)	21 (14.8 %)	1 (12.5 %)
Hearing impairment	668 (37.3 %)	427 (40.7 %)	241 (32.5 %	51 (32.3 %)	71 (35.5 %)	31 (33 %)	23 (35.9 %)	20 (48.8 %)	43 (24.4 %)	2 (25 %)
LOS	20.9 ± 8.5	20.7 ± 8.1	21.3 ± 9	22.7 ± 10.3	21.2 ± 7.1	21.8 ± 9.6	18.9 ± 9.6	21.4 ± 9.5	20.7 ± 9.8	16.8 ± 5.7

Continous variables are presented as mean with standard deviation and categorical variables as numbers and percentage

ADL activities of daily living, BI, *MMSE* mini-mental state examination, *GDS* geriatric depression scale, *TUG* timed up and go in seconds, *MNA* mini nutritional assessment, *BMI* body mass index, *VAS* visual analog scale for pain measurement, *LOS* length of stay in days

[a] Grip strength in kP

Table 2 Prevalence of urinary incontinence

	Yes	No
All ($n = 1{,}857$)	59.2 % ($n = 1{,}100$)	40.8 % ($n = 757$)
Sex		
Female ($n = 1{,}498$)	61.1 % ($n = 915$)	38.9 % ($n = 583$)
Male ($n = 359$)	51.5 % ($n = 185$)	48.5 % ($n = 174$)
Age group (years)		
65–69 ($n = 110$)	40.9 % ($n = 45$)	59.1 % ($n = 65$)
70–74 ($n = 174$)	48.9 % ($n = 85$)	51.1 % ($n = 89$)
75–79 ($n = 382$)	54.2 % ($n = 207$)	45.8 % ($n = 175$)
80–84 ($n = 479$)	61.4 % ($n = 294$)	38.6 % ($n = 185$)
85–89 ($n = 487$)	64.5 % ($n = 314$)	35.5 % ($n = 173$)
≥90 ($n = 225$)	68.9 % ($n = 155$)	31.1 % ($n = 70$)
Fracture location		
Hip ($n = 1{,}089$)	60.6 % ($n = 660$)	39.4 % ($n = 429$)
Non-hip ($n = 768$)	57.3 % ($n = 440$)	42.7 % ($n = 328$)
Humerus ($n = 165$)	53.7 % ($n = 87$)	47.3 % ($n = 78$)
Pelvis ($n = 207$)	61.4 % ($n = 127$)	38.6 % ($n = 80$)
Vertebral ($n = 100$)	61 % ($n = 61$)	39 % ($n = 39$)
Trunk ($n = 64$)	62.5 % ($n = 40$)	37.5 % ($n = 24$)
Wrist ($n = 42$)	69 % ($n = 29$)	31 % ($n = 13$)
Lower limb ($n = 182$)	50 % ($n = 91$)	50 % ($n = 91$)
Uf ($n = 8$)	62.5 % ($n = 5$)	37.5 % ($n = 3$)

Table 3 Correlation of urinary incontinence and functional impairments

	Incontinence	Continence	p value
Age (years)	82.6 ± 6.7	80.4 ± 7.2	<0.001
Sex (female)	83.2 %	77 %	0.001
ADL	56.8 ± 20.7	70.6 ± 16.2	<0.001
ADL < 80	87.7 %	73.5 %	<0.001
MMSE	25.5 ± 4	26.9 ± 3.2	<0.001
MMSE ≤ 27	62.1 %	45.9 %	<0.001
GDS	4.4 ± 2.4	3.4 ± 2.3	<0.001
GDS > 5	25.1 %	13.2 %	<0.001
TUG	58.3 ± 43.4	41.5 ± 30.8	<0.001
TUG ≥ 20	90.4 %	87.2 %	0.041
Immobility (yes)	19.4 %	6.4 %	<0.001
Grip strength[a]	17.5 ± 19.2	22.3 ± 22.9	<0.001
Strength <20/30 kg	53.1 %	46.1 %	0.003
Using walking aid (yes)	91.3 %	82.8 %	0.039
MNA	18.8 ± 3.2	19.7 ± 3	<0.001
MNA ≤ 17.5	35.2 %	23.7 %	<0.001
BMI	24.5 ± 4.7	24 ± 4.2	0.025
VAS	3.9 ± 2.5	3.6 ± 2.5	0.001
VAS ≥ 3	74.7 %	67.9 %	0.001
Visual impairment (yes)	21 %	18.6 %	0.257
Hearing impairment (yes)	42 %	30.6 %	<0.001
LOS	21.6 ± 8.8	20 ± 7.9	<0.001

Continous variables are presented as mean with standard deviation and categorical variables as percentage. For group comparison, Mann–Whitney *U* test was applied for continuous variables and Chi-square test for categorical variables

ADL activities of daily living, BI, *MMSE* mini-mental state examination, *GDS* geriatric depression scale, *TUG* timed up and go in seconds, *MNA* mini nutritional assessment, *BMI* body mass index, *VAS* visual analog scale for pain measurement, *LOS* length of stay in days

[a] Grip strength in kg

reached a prevalence of nearly 70 % in the oldest group in our study population.

The higher prevalence of UI among our study population may be due to a number of factors. First, we likely had increased clinical detection resulting from the use of formal UI screening protocol (the standardized questionnaire followed by an individual interview). Second, UI may be more common after sustaining a fragility fracture, due to increased functional impairments, delirium and more pain. Our study also found a much higher prevalence of UI in men, around 51.5 %, in contrast to other cohorts. Kwong et al. reported a prevalence of 14.8 % in men aged ≥70 years up to 26.3 % in men aged 85–89 years [41]. As in our study, Kwong et al. found a highly significant association with lower functionality after adjusting for age, comorbidities, prostate cancer and enlarged prostate UI [41]. Fragility fracture patients are commonly highly comorbid and functionally impaired, and our high prevalence in men seems to be reasonable in light of this.

Fracture location itself does not play a major role in terms of predicting UI. Historically, trials on fragility fractures were mainly focused on hip and vertebral fractures. More recent studies show that non-hip and non-vertebral fragility fractures are associated with increased excess mortality, risk of subsequent fractures and poor functional outcome [42, 43]. The fragility fracture may well represent a symptom of overall frailty that has clinical importance beyond the specific fracture prognosis.

In addition to being associated with fractures, frailty is associated with UI [44]. The maintenance of continence depends not only on adequate lower urinary tract and pelvic floor function, but also on adequate cognitive interpretation of the urge to urinate, the cognitive ability to locate a toilet, adequate mobility and dexterity to allow safe and effective toilet use, and an appropriate environment in which allow this [44]. In our trial patients with UI showed significant higher level of functional impairments compared to patients without symptoms of UI. Nearly 90 % of patients with UI did not reach a independent living threshold of 80 points. UI also was associated with a higher prevalence of cognitive dysfunction, depression, immobility and impaired mobility, muscle weakness, malnutrition, pain, and hearing impairment.

Clinical considerations

These results lead to important clinical considerations. First, as UI is known to be an independent risk factor for falls, optimized UI assessment and management should be specifically targeted in patients with fragility fractures [14]. Since subsequent fractures have an enormous impact on the long-term outcomes and mortality of fragility fracture patients, the prevention, assessment, and treatment of UI should be integrated in orthogeriatric co-management models of secondary fracture prevention [42]. Min et al. [45] demonstrated that improved fall prevention and UI management leads to improvements in participant-reported outcomes in less than 1 year.

Second, our study reflects common clinical issues seen in a practice with a high number of older fragility fracture patients. In addition to age-related chronic diseases and acute illness, many patients present with multiple functional issues including reduced mobility, assistive device needs, visual loss, reduced muscle mass, inadequate pain control, reduced cognitive function, and forced to temporarily or permanently reside in a novel and challenging medical environment. In these patients standard disease-oriented guideline-based diagnostic work-up and treatments are not always appropriate. For example, the implementation of bladder diaries in the evaluation of UI is not feasible in many older fragility fracture patients, particularly in the acute or post-acute setting. In selected patients nurses and care-givers can help to perform bladder diaries, but this is typically limited by time constraints and fails to reflect patients' perception of UI. From our point of view, bladder diaries can only be recommended for a small proportion of older fragility fracture patients, and not in the acute or post-acute setting. UI is most appropriately assessed using clinician-based standardized interviews and clinical examination [46].

Third, in addition to differences in the diagnostic work-up, there should be significant differences in the clinical treatment of UI in the fragility fracture population. Despite the high incidence of the side effects, anticholinergic drugs are widely used in the standard treatment of UI. While these drugs are effective in treating an overactive bladder, concerns have emerged about their central nervous system safety and the associated risk of cognitive impairment [47]. In addition to increasing the risk of cognitive and functional decline, drugs with anticholinergic properties have been shown to negatively impact length of hospital stay, institutionalization rates and mortality in older people [48]. When considering treatment choices for patients with overactive bladder, particularly in old patients, the potential adverse effects of anticholinergic agent have to be carefully weighed against the anticipated clinical benefits of treatment. In light of the complicating issues of diagnosis and treatment of UI in order adults, there needs to be strong emphasis on the effective prevention of UI. Diuretic use and timing should be adjusted in light of individual patient's ability to toilet whenever possible. Timed toileting programs in the hospital may limit incontinence and delirium. Constipation prophylaxis can be important to limit urinary retention and overflow incontinence [49].

Hospital-acquired incontinence affects 21 % of female hip fracture patients [50]. Indwelling catheters are used frequently in older patients with urinary retention and UI, ostensibly for the patient's comfort but sometimes to ease the burden of health care workers. In clinical practice, indwelling catheterization is often overused. Catheters should be inserted only for specific, well-documented indications [51]. The best way to avoid catheter-associated infections and other complications like UI is to avoid long-term catheter use whenever possible.

Limitations

This study has several important limitations. The present single-center study has a retrospective, uncontrolled design. Our study population is a selected group of fragility fracture patients of a GEMU, and may not be easily generalizable to other health care settings or communities. While the total number of patients is high, some fracture types and fracture locations are underrepresented. Male patients were particularly underrepresented in this cohort. Long standing or recent onset (and possibly transient) UI were not distinguished. We used a standardized procedure to diagnose UI. However, we were not able to collect sufficient information to describe the kind of UI, and there may be subtypes of UI with different clinical impacts. The impact of specific comorbidities on our results were not assessed; this specific data was not available in our database, which is focused on the validated functional and cognitive scores of the standardized complete geriatric assessment.

The degree to which UI is a marker for overall clinical frailty and multimorbidity is difficult to assess and not addressed in detail by this study. It seems likely the UI is a contributing cause and a result of many important clinical outcomes, including falls, fractures, functional status and quality of life. Regardless of the specific ways in which UI is related to these outcomes, more attention to its presence, more clinical recognition of UI, and patient-specific (predominant non-pharmacologic) treatments may improve function and quality of life in these patients. Further prospective studies of specific assessment tools and treatment approaches will be needed to draw more definitive conclusions regarding the ability to impact outcomes in this area.

Conclusion

Our results demonstrate the high prevalence of UI in older fragility fracture patients, and the strong association with multiple functional impairments. UI is likely significantly underrecognized by physicians, and standard evaluation and treatment for UI are often not appropriate in highly frail or functionally impaired individuals. The screening, diagnostic work-up and treatment of UI should be adapted to the special needs of these older patients. Due to the strong relationship between UI and falls, orthogeriatric management has to include a multidisciplinary approach to care for UI to maximize secondary fracture prevention and other important outcomes. Increased clinical awareness of the prevalence, consequences and complications of UI among older fragility fracture patients is essential.

Conflict of interest The authors have no conflict of interest.

References

1. Leung F, Blauth M, Bavonratanavech S (2010) Surgery for fragility hip fracture—streamlining the process. Osteoporos Int 21(Suppl 4):519–521
2. Elliott J, Beringer T, Kee F, Marsh D, Willis C, Stevenson M (2003) Predicting survival after treatment for fracture of the proximal femur and the effect of delays to surgery. J Clin Epidemio 56(8):788–795
3. Marks R (2011) Physical activity and hip fracture disability: a review. J Aging Res 741918
4. Thomas TM, Plymat KR, Blannin J et al (1980) Prevalence of urinary incontinence. Br Med J 281:1243–1245
5. Perry S, Shaw C, Assassa P et al (2000) An epidemiological study to establish the prevalence of urinary symptoms and felt need in the community: the leicestershire MRC Incontinence Study. J Public Health Med 22:427–434
6. Peet SM, Castleden SM, McGrother CW (1995) Prevalence of urinary and facial incontinence in hospitals and residential and nursing homes for older people. Br Med J 311:1063–1064
7. Dugan E, Roberts CP, Cohen SJ et al (2001) Why older community-dwelling adults do not discuss urinary incontinence with their primary physicians. J Am Geriatr Soc 49:462–465
8. Wagg AS, Malone-Lee JG (1998) Urinary incontinence in the elderly. Br J Urol 82(Suppl. 1):11–17
9. Teunissen TA, de Jong A, van Weel C et al (2004) Treating urinary incontinence in the elderly—conservative therapies that work: a systematic review. J Fam Pract 53:25–32
10. Burgio K, Locher JL, Goode PS (2000) Combined behavioural and drug therapy for urge incontinence in older women. J Am Geriatr Soc 48:370–374
11. Rubenstein LZ (2006) Falls in older people: epidemiology, risk factors and strategies for prevention. Age Ageing 35(S2):ii37–ii41
12. Sattin RW, Lambert Huber DA, DeVito CA et al (1990) The incidence of fall injury events among the elderly in a defined population. Am J Epidemiol 131:1028–1037
13. Stalenhoef PA, Cremholder HFJM, Knottnerus JA, van der Horst FGEM (1997) Incidence, risk factors and consequences of falls among elderly subjects living in the community. Eur J Public Health 7:328334
14. Chiarelli PE, Mackenzie LA, Osmotherly PG (2009) Urinary incontinence is associated with an increase in falls: a systematic review. Aust J Physiother 55:89–95
15. Delbaere K, Close JCT, Menz HB et al (2008) Development and validation of fall risk screening tools fort he use in residential aged care facilities. MJA 189:193–196
16. Dubeau CE, Kuchel GA, Johnson T et al (2010) Incontinence in frail elderly: report from the 4th international consultation. Neurourol Urodyn 29:165–178
17. Ouslander JG, Johnson TM (1999) Inconetinence. In: Hazzard WR, Blass JP, Ettinger WH et al (eds). Principles of geriatric medicine and gerontology, 4th edn. McGraw-Hill, New York, pp 1595–1613
18. Goode PS, Burgio KL, Richter HE et al (2010) Incontinence in older women. JAMA 303:2172–2181
19. Fung C, Spencer B, Eslami M et al (2007) Quality indicators for the screening and care of urinary incontinence in vulnerable elders. J Am Geriatr Soc 55:443–449
20. Woodford H, George J (2007) NICE guidelines on urinary incontinence in women. Age Ageing 36:49–50
21. Ellis G, Langhorne P (2004) Comprehensive geriatric assessment for older hospital patients. Br Med Bull 71:45–59
22. Bogoch ER, Elliot-Gibson V, Beaton DE, Jamal SA, Josse RG, Murray TM (2006) Effective initiation of osteoporosis diagnosis and treatment for patients with a fragility fracture in an orthopaedic environment. J Bone Joint Surg Am 88(1):25–34
23. Talasz H, Jansen SC, Kofler M, Lechleitner M (2012) High prevalence of pelvic floor muscle dysfunction in hospitalized elderly women with urinary incontinence. Int Urogynecol J 23(9):1231–1237
24. Bright E, Cotterill N, Drake M, Abrams P (2014) Developing and validating the international consultation on incontinence questionnaire bladder diary. Eur Urol 66(2):294–300
25. Khandelwal C, Kistler C (2013) Diagnosis of Urinary Incontinence. Ann Fam Physician 87(8):543–550
26. Pils K, Umek W (2014). Harninkontinenz der älteren Frau, Leitfaden für Abklärung und Therapie,Urinary incontinence, Guideline for diagnosis and treatment, Facultas, ISBN 978-3-7089-1141-0, S 10
27. Abrams P, Andersson KE, Birder L, Brubaker L, Cardozo L, Chapple C, Cottenden A, Davila W, de Ridder D, Dmochowski R, Drake M, Dubeau C, Fry C, Hanno P, Smith JH, Herschorn S, Hosker G, Kelleher C, Koelbl H, Khoury S, Madoff R, Milsom I, Moore K, Newman D, Nitti V, Norton C, Nygaard I, Payne C, Smith A, Staskin D, Tekgul S, Thuroff J, Tubaro A, Vodusek D, Wein A, Wyndaele JJ, Members of Committees, Fourth International Consultation on Incontinence (2010) Fourth International Consultation on Incontinence Recommendations of the International Scientific Committee: evaluation and treatment of urinary incontinence, pelvic organ prolapse, and fecal incontinence. Neurourol Urodyn 29(1):213–240
28. Sorbye LW, Grue EV (2013) Hip fracture and urinary incontinence—use of indwelling catheter postsurgery. Scand J Caring Sci 27:632–642
29. Mahoney FI, Barthel DW (1965) Functional evaluation: the Barthel index. Md State Med J. 14:61–65
30. Bryant DM, Sanders DW, Coles CP, Petrisor BA, Jeray KJ, Laflamme GY (2009) Selection of outcome measures for patients with hip fracture. J Orthop Trauma 23(6):434–441
31. Kasner SE (2006) Clinical interpretation and use of stroke scales. Lancet Neurol 5(7):603–612
32. Folstein MF, Folstein SE, McHugh PR et al (1975) „Mini-mental state“: a practical method for grading the cognitive status of patients for the clinicians. J Psychiatr Res 12:189–198
33. Yesavage JA, Brink TL, Rose TL et al (1982) Development and validation of a geriatric depression screening scale: a preliminary report. J Psychiatr Res 17:37–49

34. Podsiadlo D, Richardson S (1991) The timed “up and go”: a test of basic functional mobility for frail elderly persons. J Am Geriatr Soc 39:142–148
35. Visser M, Kritchevsky SB, Goodpaster BH et al (2002) Leg muscle mass and composition in relation to lower extremity performance in men and women aged 70 to 79: the health, aging and boy composition study. J Am Geriatr Soc 50:897–904
36. Cruz-jentoft AJ, Baeyens JP, Bauer JM et al (2010) Report of the European working group on sarcopenia in older people. Sarcopenia: European consensus on definition and diagnosis. Age Ageing 39:412–423
37. Guigoz Y, Garry JP (1994) Mini nutritional assessment: A practical assessment tool for grading the nutritional state of elderly patients. Facts Res Gerontol. pp 15–59
38. Palmer MH, Baumgarten M, Langenberg P, Carson JL (2002) Risk factors for hospital-acquired incontinence in elderly female hip fracture patients. J Gerontol A Biol Sci Med Sci 57(10): M672–M677
39. Klausner AP, Vapnek JM (2003) Urinary incontinence in the geriatric population. Mt Sinai J Med 70(1):54–61 (review)
40. Landi F, Cesari M, Russo A, Onder G, Lattanzio F, Bernabei R, Silvernet-HC Study Group (2003) Potentially reversible risk factors and urinary incontinence in frail older people living in community. Age Ageing 32(2):194–199
41. Kwong PW, Cumming RG, Chan L, Seibel MJ, Naganathan V, Creasey H, Le Couteur D, Waite LM, Sambrook PN, Handelsman D (2010) Urinary incontinence and quality of life among older community-dwelling Australian men: the CHAMP study. Age Ageing 39(3):349–354
42. Bliuc D, Nguyen TV, Eisman JA, Center JR (2014) The impact of nonhip nonvertebral fractures in elderly women and men. J Clin Endocrinol Metab 99(2):415–423
43. Kammerlander C, Riedmüller P, Gosch M, Zegg M, Kammerlander-Knauer U, Schmid R, Roth T (2012) Functional outcome and mortality in geriatric distal femoral fractures. Injury 43(7):1096–1101
44. Gibson W, Wagg A (2014) New horizons: urinary incontinence in older people. Age Ageing 43(2):157–163
45. Min LC, Reuben DB, Adams J, Shekelle PG, Ganz DA, Roth CP, Wenger NS (2011) Does better quality of care for falls and urinary incontinence result in better participant-reported outcomes? J Am Geriatr Soc 59(8):1435–1443
46. Thüroff JW, Abrams P, Andersson KE et al (2011) EAU guidelines on urinary incontinence. Eur Urol 59:387–400
47. Scheife R, Takeda M (2005) Central nervous system safety of anticholinergic drugs for the treatment of overactive bladder in the elderly. Clin Ther 27(2):144–153
48. Salahudeen MS, Duffull SB, Nishtala PS (2014) Impact of anticholinergic discontinuation on cognitive outcomes in older people: a systematic review. Drugs Aging 31(3):185–192
49. Schnelle JF, Leung FW, Rao SS, Beuscher L, Keeler E, Clift JW, Simmons S (2010) A controlled trial of an intervention to improve urinary and fecal incontinence and constipation. J Am Geriatr Soc 58(8):1504–1511
50. Palmer MH, Baumgarten M, Langenberg P, Carson JL (2002) Risk factors for hospital-acquired incontinence in elderly female hip fracture patients. J Gerontol A Biol Sci Med Sci 57(10):M672–M677
51. Inelmen EM, Sergi G, Enzi G (2007) When are indwelling urinary catheters appropriate in elderly patients? Geriatrics 62(10):18–22