Physical performance and quality of life in single and recurrent fallers: Data from the Improving Medication Prescribing to Reduce Risk of Falls study

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ABSTACT

Aim: Although guidelines regarding falls prevention make a clear distinction between single and recurrent fallers, differences in functional status, physical performance, and quality of life in single and recurrent fallers have not been thoroughly investigated. Therefore, we investigated the differences in functional status, physical performance and health-related quality of life (HRQoL) between single and recurrent fallers.

Methods: From October 2008 to October 2011, 616 community-dwelling older adults who visited the emergency department as a result of a fall were enrolled. Physical performance was assessed with the Timed Up & Go (TUG) test, the Five Times Sit to Stand (FTSS) test, handgrip strength and the tandem stand test. Functional status was measured using the activities of daily living and instrumental activities of daily living scales. HRQoL was measured using the European Quality of Life five dimensions (EQ-5D), and the Short Form-12 version 2. A general linear model was used to compare the means of the scores.

Results: Recurrent falls in community-dwelling older adults were associated with poorer physical performance as measured by the TUG test ($P < 0.001$), FTSS test ($P = 0.011$), handgrip strength ($P < 0.001$) and tandem stand ($P < 0.001$), and lower HRQoL scores as measured by the EQ-5D ($P = 0.006$) and SF-12 ($P = 0.006$ and $P = 0.012$).

Conclusion: The present findings provide further evidence that recurrent fallers have poorer physical performance and quality of life than single fallers. Recurrent falls might be a symptom of underlying disease and frailty, and reason for further assessment.
Keywords: falls, older adults, physical performance, quality of life, recurrent.

Introduction

Falls affect a large proportion of the population aged 65 years and older, and are associated with conse- quences such as disability, loss of quality of life, institutionalization,[1–3] and high morbidity and mortality rates.[4,5] In order to reduce the incidence of falls, guide- lines on falls prevention recommend detailed assess- ments and a multifactorial intervention for persons with a history of recurrent falls.[6] Fallers are classified in dif- ferent ways. A single faller is generally defined as someone who has fallen at least once during a defined time period, usually 6 or 12 months. A recurrent faller is someone who has fallen twice or more during a defined time period.[7]

Several studies have reported specific differences between single and recurrent fallers, using varying outcome measures, such as sensory and motor function outcomes,[8] certain physical performance tests,[9–11] the Mini-Mental State Examination (MMSE),[12] posturography[13,14] and dual-tasking tests.[15,16] Most studies compared the prevalence of specific risk factors in single and recurrent fallers.[17–20] In addition to inves- tigating physical performance and functional status, we assessed the health-related quality of life (HRQoL). To the best of our knowledge, no previous study has inves- tigated quality of life measures in single and recurrent fallers.

Therefore, the aim of the present descriptive study was to determine physical functioning and HRQoL in community-dwelling older men and women who visited the emergency department (ED) after experiencing a fall,[21] and to evaluate if these differed in single and recurrent fallers. Validated and commonly used tools for measuring physical performance, functional status, and HRQoL were used.

Methods

Study population

For the present study, baseline data of the Improving Medication Prescribing to reduce Risk Of Falls (IMPROveFALL) study were used, a detailed descrip- tion of the methods can be found elsewhere.[21] In short, patients meeting the following inclusion criteria were eligible for enrolment: aged 65 years or older, visited the ED because of a fall, use of one or more fall-risk increasing drugs,[22] MMSE score of at least 21 out of 30 points,[23] ability to walk independently, community dwelling and provision of written informed consent by the patient. Enrolment was carried out in two academic and four regional hospitals, was started in October 2008 and was completed in October 2011. The local medical research ethics committees at all participating sites approved the study.

Fall history

A fall was defined as coming to rest unintentionally on the ground or a lower level with or without losing con- sciousness, but not induced by an acute medical con- dition; for example, stroke; or exogenous factors, such as a traffic accident.[24] The history of falls was ascer- tained during an interview with the clinical investigator. The number of falls in the 12 months before the out- patient research clinic visit was used to divide partici- pants into two groups – single and recurrent fallers. A single faller was defined as someone who had fallen once in the 12 months preceding inclusion, a recurrent faller was defined as someone who had fallen twice or more in the 12 months preceding inclusion.

Data collection

At the baseline assessment, a geriatric assessment was carried out. Medical history, prescription medication and sociodemographic factors were documented. The number of comorbidities was derived from the following chronic comorbidities: any malignancy, diabetes melli- tus, cardiac disease (i.e. hypertension, myocardial infarction, cardiomyopathy, congestive heart failure, arrhythmia and valve disease), chronic obstructive pul- monary disease, stroke, neurological disorders (i.e. Par- kinson's disease, epilepsy, neuropathy, myopathy, spinal disc herniation and multiple sclerosis), peripheral vascular disease, renal insufficiency and arthritis. Col- lected data were verified with records from the patient's general physician and local pharmacist. Height and weight were measured using standardized equipment and procedures. Body mass index (BMI) was calculated as bodyweight (in kilograms) divided by height (in meters). ^{2}

Physical performance

Physical performance was assessed with the Timed Up & Go (TUG) test, the Five Times Sit to Stand (FTSS) test, handgrip strength and the tandem stand test. In the TUG test, time was measured while the participant stood up from a sitting position, walked 3 m along a line, carried out a 180° turn, walked back to the chair and sat down, as fast as safely possible.[25,26] In the FTSS test, time was measured while the participant stood up and sat down five consecutive times, as fast as safely possible. The participant was not permitted to use their hands or the chair's arm supports during standing up or sitting down.[25,27] Handgrip strength was measured in kilograms using a digital strain-gauged dynamometer (Takei TKK 5401; Takei Scientific Instruments, Tokyo, Japan). The participant was asked to stand upright with arms hanging beside his or her body. Subsequently, grip strength was measured with the left and right hand.[28] In the tandem stand test, the participant had to stand fully independent for 10 s with one foot in front of the other. The test was scored as completed or failed.[25] All tests were carried out twice and the best score was recorded.

Functional status

Functional status was measured using the activities of daily living (ADL) score,[29] which evaluates indepen- dence while bathing, dressing, going to the toilet, con- tinence, getting around the house and feeding; and the instrumental activities of daily living (IADL) score,[30] which evaluates independence while using the tele- phone, handling finances, taking medications, prepar- ing light meals, housekeeping, shopping and using transportation outside of the home. ADL is scored 0–12 points, a higher score indicates greater disability; and IADL is scored 0–14 points, a higher score also indi- cates greater disability.

HRQoL

Based on the recommendations of *Prevention of Falls Network Europe* (ProFaNe), HRQoL was measured using the Dutch versions of the European Quality of Life five dimensions (EQ-5D) utility score, and the Short Form-12 (SF-12) version 2.[31] The EQ-5D questionnaire covers five health domains (i.e. mobility, self-care, usual activities, pain/discomfort and anxiety/depression). The EQ-5D is a validated and extensively used general health questionnaire to measure quality of life.[32] The SF-12 contains 12 questions, and is designed and vali- dated to assess the quality of life in large population studies; it consists

of eight items measuring physical and mental health outcomes. These items are physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional and mental health. Information from these items is used to construct the physical and mental component summary measures (PCS and MCS).[33]

Statistical analysis

Analyses were carried out using SPSS version 17.0 (SPSS, Chicago, IL, USA). Baseline characteristics between single fallers and recurrent fallers were compared using Student's *t*-test analyses for continuous variables and χ^2-test analyses for dichotomous variables. A general linear model was used to compare means of the TUG, FTSS, handgrip strength, ADL, IADL, EQ-5D utility score, SF-12 PCS and SF-12 MCS scores. Data were adjusted for age, sex, BMI, MMSE and number of comorbidities. The individual domains of the EQ-5D and the tandem stand test were assessed with χ^2-test analyses. Participants with incomplete or missing functional status, performance tests or HRQoL scores were excluded from related analyses, TUG test (n = 57), FTSS test (n = 99), handgrip strength (n = 7), tandem stand test (n = 4) and SF-12 (n = 4). The missing measures of the physical performance tests were mostly as a result of injuries following a fall (e.g. upper or lower extremity fractures). A *P*-value <0.05 was used as a threshold for statistical significance.

Results

From October 2008 to October 2011, 616 community-dwelling men and women who visited the ED because of a fall were enrolled in the IMPROveFALL study, of which 338 (55%) reported no prior falls, and 278 (45%) reported one or more prior falls in the 12 months preceding inclusion. The baseline characteristics are shown in Table 1. Age, sex, MMSE scores, BMI, smoking, alcohol intake, and number of comorbidities did not differ between single and recurrent fallers.

The physical performance, functional status and HRQoL outcomes are shown in Table 2. The scores of recurrent fallers were significantly poorer than the single fallers in all the physical performance tests. The mean ADL and IADL scores did not differ significantly between single and recurrent fallers. Finally, recurrent fallers scored significantly lower than single fallers in all of the HRQoL measures. Furthermore, the recurrent fallers reported significantly more problems than the single fallers in all five domains of the EQ-5D (Table 3).

Discussion

In the present study, we found that recurrent fallers had poorer physical performance, and lower EQ-5D and SF-12 scores than single fallers. The functional status scores did not differ significantly between single and recurrent fallers.

Participants with a history of recurrent falls per- formed significantly poorer than single fallers at all the physical performance tests, these tests measure mobility, muscle strength and balance. In previous literature, 12 s has been suggested as a practical cut-off value for the TUG test, and has been found useful in detecting mobility impairment in older adults.[34] In the current study population, recurrent fallers had below normal TUG test scores, and were significantly slower than the single fallers who had normal scores. Furthermore, poor muscle strength is a known risk factor for falls,[35] it predicts disability[36] and mortality,[37] and is one of the criteria used to define frailty.[38]

The recurrent fallers also reported lower HRQoL scores than the single fallers, including significantly lower EQ-5D utility scores and more problems in all the five EQ-5D domains. In addition, the recurrent fallers scored below the Dutch population norm for the SF-12 PCS and MCS, whereas the single fallers scored above the norm. The Dutch SF-12 PCS and MCS population norms for the ≥65 years age group are 45.2 and 52.9, respectively.[33] Previous studies have reported lower quality of life scores in older fallers than in older adults without a previous fall.[3,39] However, in these studies, no comparison was made between single and recurrent fallers. The scores from the current study show how dissimilar single and recurrent fallers are. It is striking to note that regardless of age, sex, MMSE, BMI and the number of comorbidities being similar in both groups, the measures of mobility, muscle strength, balance, and quality of life showed significant differences between single and recurrent fallers. This suggests that recurrent falls could be a symptom of underlying disease severity and frailty.[38] Although guidelines regarding falls preven- tion make a clear distinction between single and recur- rent fallers,[6] these groups have not been thoroughly investigated. Previous studies report differences between single and recurrent fallers, with varying study methods. In some studies, the population consisted of older adults admitted to hospital or aged-care facilities,[11–13,15,20] generally an older and frailer popula- tion than the community-dwelling older men and women who participated in the current study. Another study only assessed community-dwelling women.[8] Fur- thermore, varying outcome measures were used in the previous studies.[8–20] In addition to investigating the TUG and FTSS tests, which has been carried out pre- viously,[10] we used physical performance tests. As far as we are aware, this is the first time that HRQoL has been

assessed. Finally, the current study consisted of a large number of recurrent fallers, whereas other studies included relatively low numbers of recurrent fallers, the number of recurrent fallers included in the aforemen- tioned studies ranged between 18 and 237.

The functional status scores did not differ between single and recurrent fallers, despite recurrent fallers having poorer physical performance and lower HRQoL scores. A potential explanation for this finding is that the study population consisted of community-dwelling older adults. Being able to carry out the individual com- ponents of ADL and IADL is a prerequisite for living independently. Possibly the sensitivity of the ADL and IADL questionnaires was not sufficient to detect differ- ences in functional status.

The following limitations should be acknowledged when interpreting the results of the present study. First, the cross-sectional design limited the ability to infer a causal relationship between poor functional status, physical performance, HRQoL and recurrent falls. Second, recall bias with respect to the history of falls in the 12 months before inclusion cannot be ruled out. If any, this effect is likely to be small, as patients can usually accurately recall whether they have experienced one or more prior falls in the preceding 12 months, and the participants' medical records of the year preceding inclu- sion were made available to us. Third, the self-report nature of ADL and IADL scales can be influenced by the interviewer, and the mood and personality of the partici- pant. Nevertheless, these instruments are validated and are widely used by healthcare professionals to determine functional status. Finally, the study population only included older men and women who visited the ED after a fall. Thus, these results are not applicable to the general population. However, this is an important group of fallers, representing those with injurious falls. The strengths of the present study were the study population size, the validated tests used to assess physical perfor- mance and that we adhered to current recommendations regarding HRQoL outcome measures.[31]

In conclusion, in the present study, we found that compared with single falls, a history of recurrent falls was associated with poorer physical performance, and lower HRQoL scores in older community-dwelling men and women.

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Disclosure statement

The authors declare no conflict of interest.

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Table 1 Baseline characteristics according to history of falls

	Single fallers (n = 338)	Recurrent fallers (n = 278)	P-value
Age (years)	76.0 ± 6.7	77.0 ± 7.1	0.069
Sex (female)	199 (59)	182 (66)	0.094
Mini-Mental State Examination score	27.1 ± 2.3	26.8 ± 2.3	0.054
Body mass index (kg/m^2)	27.3 ± 4.5	28.0 ± 4.7	0.072
Smoking	42 (12)	29 (10)	0.440
Alcohol (units per day)			0.834
0	165 (49)	145 (52)	
<1	51 (15)	38 (14)	
1–3	83 (25)	67 (24)	
>3	39 (12)	28 (10)	
No. comorbidities	2.1 ± 1.1	2.1 ± 1.3	0.410

Continuous data are shown as mean ± standard deviation and were analyzed using the Student's t-test. Categorical data are given as number with percentages and were analyzed using the χ^2-test.

Table 2 Physical performance, functional status and health-related quality of life according to history of falls

	Single fallers (n = 338)	Recurrent fallers (n = 278)	P-value
Physical performance			
Timed Up & Go (s)	10.9 ± 0.5	14.2 ± 0.6	<0.001
Five Times Sit to Stand (s)	17.0 ± 0.6	19.3 ± 0.7	0.011
Handgrip strength (kg)	27.2 ± 0.3	25.3 ± 0.4	<0.001
Tandem stand (completed)	237 (70)	152 (55)	<0.001
Functional status			
ADL scale score	0.8 ± 0.2	0.8 ± 0.2	0.893
IADL scale score	1.4 ± 0.3	1.4 ± 0.3	0.979
Health-related quality of life			
EQ-5D utility score	0.78 ± 0.01	0.72 ± 0.01	0.006
SF-12 Physical Component Summary	46.5 ± 0.5	44.4 ± 0.6	0.006
SF-12 Mental Component Summary	53.9 ± 0.5	51.9 ± 0.6	0.012

Data were analyzed using general linear models, adjusted for age, sex, body mass index, Mini-Mental State Examination and the number of comorbidities, and given as mean ± standard error. ADL, activities of daily living (range 0–12, a higher number indicates higher impairment); EQ-5D, European Quality of Life five dimensions questionnaire; IADL, instrumental activities of daily living (range 0–14, a higher number indicates higher impairment); SF-12, Short-Form 12.

Table 3 Prevalence of problems on the five dimensions of the European Quality of Life five dimensions questionnaire according to history of falls

	Single fallers (n = 338)	Recurrent fallers (n = 278)	P-value
Mobility	137 (41)	178 (64)	<0.001
Self-care	41 (12)	65 (23)	<0.001
Usual activities	107 (32)	115 (41)	0.012
Pain/discomfort	174 (52)	173 (62)	0.007
Anxiety/depression	74 (22)	94 (34)	0.001

Data are shown as number (percentage) and were analyzed using the χ^2-test.