

Falls and Injuries Resulting From Falls Among Patients With Parkinson's Disease and Other Parkinsonian Syndromes

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Abstract: We sought to ascertain frequency, type, risk factors of falling, and resulting injuries among parkinsonian patients. A survey was mailed to all patients treated at our center between 1/1/2000 and 4/30/2002 (N = 1,417). Information was collected on falls within the past 2 years, related injuries, and use of health care services. A total of 1,131 responses (response rate, 79.8%) were received. After the exclusion of nonparkinsonian disorders, statistics for the remaining group (n = 1,092) and predictive statistics for those diagnosed before 1/1/2000 (n = 1,013) were calculated. Outcomes included falls, fractures, injuries, surgery, and related use of health care services. Explanatory variables included sex, age, age at diagnosis, disease duration, atypical parkinsonism, and dementia. Most patients (55.9%) were men; 12.2% had atypical parkinsonism; 12.5% had dementia; median age was 74.7 years; median

disease duration was 7 years; 55.9% had at least one fall in the past 2 years; 65.0% of them sustained an injury; 33.0% sustained a fracture; 75.5% of injuries required health care services; 40.6% of fractures required surgery. Older age, atypical parkinsonism, longer disease duration, and dementia were risk factors for falling; female sex and older age were predictors of fractures. Need for health care services after an injury was higher among older patients. Further prospective studies will be necessary to elucidate the specific prognostic outcomes of injuries due to falls among parkinsonian patients, and the impact of these injuries on disease progression and quality of life. © 2004 Movement Disorder Society

Key words: parkinsonism; Parkinson's disease; falls; fractures

Postural instability is one of the cardinal symptoms of Parkinson's disease (PD) and other parkinsonian clinical syndromes. Falls resulting from postural instability may lead to considerable morbidity and even mortality in patients with parkinsonism. However, there is little information in the existing literature regarding the extent of the problem and even less information regarding the adverse outcomes of such falls.

Koller and colleagues¹ reported a 38% risk of falling among 100 PD patients, with 13% falling more than once a week. Falls resulted in hospitalizations, and, in 3% of cases, in wheelchair confinement. A prospective, con-

trolled 6-month-long study² revealed a 50.8% risk of falling among 59 PD patients, compared to 14.5% among controls. A retrospective study³ of 63 community-dwelling PD patients revealed a 1-year 64% risk of falling, with risk factors being similar to those in the general population. Schrag and coworkers⁴ reported very similar risk of falling (64%) among 124 community-based PD patients. A recent prospective study⁵ of 109 PD patients revealed a fall incidence of 68.3%, with risk factors being previous falls, disease duration, dementia, and loss of arm swing.

Despite differences between these studies, and possible methodological problems,⁶ it appears that the risk of falling among PD patients is higher than in the general population and may approach 38 to 68%. However, little information is available on the specific adverse outcomes of these falls, such as fractures. Johnell and colleagues⁷ reported increased risk of fracture in general, and proximal femoral fractures in particular among PD patients,

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TABLE 1. Demographics and disease characteristics (logistic regression)

	All cases (N = 1,092)	Patients with falls (n = 597)	Patients with no falls (n = 495)
Gender (% male)	55.9	55.9	55.8
Age	74.7 (31.9–95.2)	74.7 (31.9–95.2)	73.3 (42.5–94.3)
Disease duration	7.0 (0.0–37.0)	8.0 (0.0–37.0)	5.0 (0–32)
Age at diagnosis	65.9 (19.9–91.4)	66.2 (19.9–91.4)	65.6 (33.4–89.3)
Atypical parkinsonism	12.2%	16.1%	7.5%
Dementia	12.5%	18.8%	5.1%

Values are expressed as median years (range), unless otherwise indicated.

with 27% of them having suffered a hip fracture within 10 years of the diagnosis. Female sex, older age, low bone mass index, and low bone mineral density are predictors of hip fractures among PD patients.⁸ The rehabilitation process after such fractures is slower and less successful among PD patients.⁹ Multifactorial interventions may help reduce the risk of falling and resultant morbidity in the general population.¹⁰ Similar interventions may prove helpful in PD patients who are at increased risk for falling. As a first step of such an effort, we undertook the present study.

SUBJECTS AND METHODS

Subjects

All patients examined for a parkinsonian disorder at the Struthers Parkinson's Center between 1 January 2000 and 30 April 2002 were included. Patients who were known to be deceased were excluded.

Procedures

A cover letter with a survey was mailed to all subjects (Appendix). A reminder postcard was mailed 3 weeks later to nonresponders. A follow-up letter with a survey was sent to persistent nonresponders 3 weeks later.

Data Collection

The following information was obtained through medical record review: sex, age, and disease duration as of 1 January 2000. The diagnosis of Parkinson's disease, atypical parkinsonism, and dementia was documented by the patient's movement disorders specialist. For the purpose of this study, under the diagnostic category of atypical parkinsonism, we included the diagnoses of multiple systems atrophy (MSA), progressive supranuclear palsy (PSP), corticobasal degeneration (CBD), dementia with Lewy bodies (LBD), and atypical parkinsonism not further classifiable at the time of diagnosis.

Data Analysis and Statistics

Occurrence of any fall during the past 2 years, fractures due to a fall, surgery required for a fracture

resulting from a fall, any injury due to a fall, and use of any health care services for injuries resulting from a fall during the past 2 years were the primary outcome measures. Descriptive statistics were also performed on the type and site of fractures. Sex, age, disease duration, diagnosis of atypical parkinsonism, and diagnosis of dementia were explored as possible prognostic factors. Although descriptive statistics were performed on the entire group, predictive statistics were only performed on the subgroup of patients that had been diagnosed with parkinsonism before 1 January 2000. Both univariable analyses (χ^2 for categorical, and two-tailed *t* test for continuous variables) and multivariable logistic regression analyses were applied.

RESULTS

A total number of 1,417 surveys were mailed. We received 1,131 responses (response rate, 79.8%). The surveys were completed by either the patient or a caregiver. Notification of patient death was received from the next of kin in 60 cases. The next of kin completed the survey in 22 cases, and these surveys were included in the analysis. For the remaining 38 deceased patients, the survey was not completed. Twenty-nine patients could not be reached due to insufficient address information. Two hundred nineteen patients did not respond. Thirty-six of the responders were excluded from the analysis because they did not have a parkinsonian disorder. An additional 3 responders were excluded from the analysis because they were never examined by one of the movement disorders specialists in our center. A total of 1,092 surveys were analyzed. Table 1 summarizes demographics and disease characteristics for the entire group, and separately for patients who fell versus patients who did not fall. The breakdown of the outcomes of these falls is summarized on Figure 1.

Of the entire group of 1,092 subjects, 1,013 already had been diagnosed before 1 January 2000 and were included in the predictive analysis: 557 (55%) were men, 116 (11.5%) had atypical parkinsonism, and 130 (12.8%)



FIG. 1. Fall outcomes.

had dementia. Median age, median age at disease diagnosis, and disease duration as of 1 January 2000, were 72.7 (range, 29.9–93.2), 65.5 years (range, 19.9–89.8), and 5.0 (range, 0–35) years, respectively. Univariable analyses showed correlation between risk of falling and diagnosis of atypical parkinsonism ($P < 0.001$; χ^2); presence of dementia ($P < 0.001$; χ^2); longer disease duration ($P < 0.001$; two-tailed t test); and older age ($P < 0.001$; two-tailed t test). Sex ($P = 0.485$; χ^2) and age at diagnosis ($P = 0.901$; two-tailed t test) were not related to the risk of falling. The same variables were significant independent predictors of the risk of falling when included in a multivariable analysis, using a logistic regression model (Table 2). No significant interaction or correlation was found between age and disease duration.

Among patients who fell, female sex (odds ratio [OR], 2.66; 95% confidence interval [CI], 1.75–4.03; $P < 0.001$) and older age (OR, 1.03 per year; 95% CI, 1.01–1.05; $P = 0.009$) were associated with a higher risk for fracture. Disease duration, age at diagnosis, presence of dementia, and diagnosis of atypical parkinsonism were included in the model but were not significant. Among the same variables, only female sex predicted an injury after a fall (OR, 1.88; 95% CI, 1.31–2.68; $P < 0.001$), whereas, when only injuries

TABLE 2. Factors predictive of falls

Predictor	Odds Ratio	95% CI	P
Atypical parkinsonism	2.33	1.47–3.69	<0.001
Dementia	3.24	1.99–5.27	<0.001
Disease duration	1.08 ^a	1.05–1.10	<0.001
Age	1.02 ^a	1.00–1.03	0.025

^aOdds ratio per year increase.
CI, confidence interval.

TABLE 3. Distribution of fracture location in Parkinson's disease vs. atypical parkinsonism

Fracture location	Parkinson's disease, n (%)	Atypical parkinsonism, n (%)
Foot and ankle	7 (5.6)	2 (8.7)
Leg	8 (6.3)	1 (4.3)
Hip and pelvis	35 (27.8)	5 (21.7)
Trunk	27 (21.4)	7 (30.4)
Shoulder girdle	11 (8.7)	4 (17.4)
Skull	6 (4.8)	0 (0.0)
Arm	12 (9.5)	1 (4.3)
Hand and wrist	20 (15.9)	3 (13.0)
Total Fractures	126 (100)	23 (100)

other than fractures were analyzed, none of these variables was of any predictive value. As to the likelihood of needing health care professional services for any injury resulting from a fall, only older age was significant (OR, 1.04 per year; 95% CI, 1.02–1.06; $P < 0.001$); sex, disease duration, age at diagnosis, presence of dementia, and diagnosis of atypical parkinsonism were not significant.

There were 129 patients who sustained fractures, 111 with PD (a total of 126 fractures) and 18 with atypical parkinsonism (a total of 23 fractures). The distribution of fractures by location is outlined in Table 3. Although there appears to be a trend toward more trunk and shoulder fractures in atypical parkinsonism patients versus PD patients, there did not appear to be any statistically significant difference in the distribution between the two groups (χ^2 , $P > 0.05$).

DISCUSSION

The findings of the present study confirm, in a larger patient population, findings of previous, smaller studies with regard to frequency of falling among parkinsonian patients. The retrospective design of this study subjects our results to recall bias.⁶ Recollection of falls may not always be reliable, particularly among our elderly and often cognitively impaired patient population. Nevertheless, approximately 55% of our patients fell, which is comparable to 38 to 68% described in the literature.^{1–5} Age, disease duration, diagnosis of atypical parkinsonism, and dementia were identified as significant risk factors in falls. Conversely, gender and age at diagnosis were not found to significantly affect risk of falling.^{2,3}

Older age is a well recognized risk factor for falling seen in the general population. Several studies performed in population-based samples of community dwelling elderly people have shown incidence of falling between 28 and 35%.^{11–14} This risk does increase with increasing age

and is higher among women.¹⁵⁻¹⁷ Our estimate of the frequency of falling among parkinsonian patients, as well as estimates reported in the literature seem to exceed the frequency of falls in similarly aged community dwelling elderly. Indeed, our analysis did reveal additional factors affecting the frequency of falls among our patients above and beyond old age. Of interest, it appears that women have a higher risk of falling than men in general population studies, a trend not seen among parkinsonian patients in this, or previously reported studies.^{1,3} Longer disease duration was an expected risk factor for falling as it functions in part as a proxy for the degree of progression of the disease. Hoehn and Yahr stages 1 and 2 are, by definition, not associated with balance problems; stage 3, and, in part, stage 4 PD patients are ambulatory with balance problems; and stage 5 patients are nonambulatory. Because our primary outcome measure, i.e., falling, was a surrogate of the major criterion for disease staging, we decided against the use of Hoehn and Yahr stage as a possible predictive factor for falling. Under the rubric of atypical parkinsonism we included, for the purpose of this study, patients diagnosed with MSA, PSP, CBD, and LBD. A substantial number (approximately one third) of patients in this category were diagnosed with atypical parkinsonism not otherwise classifiable at the time of diagnosis. We kept these diverse diagnoses as a group to distinguish them from PD but also to maintain sufficient sample size to permit comparisons to the PD patients. Postural instability is a cardinal symptom in PSP, whereas gait ataxia and orthostatic hypotension are frequent manifestations of MSA. Dementia is a frequent early symptom of LBD and was also found to be a significant independent risk factor for falling in this and other studies,⁵ although it was not significant in others.¹ It was, therefore, not unexpected that the diagnosis of atypical parkinsonism would be associated with a higher falling risk. Because this study was largely based on a patient survey, data on orthostatic hypotension were not predictably available; therefore, we did not use this variable in our explanatory analysis. Cognitive difficulties have been reported among nondemented PD patients.¹⁸ It is unclear whether they may play a role in falling, and there was insufficient information in the present study to analyze this factor in detail. However, the presence of dementia was clearly associated with increased falls in this and other studies.³ Dementia is an independent risk factor for falls in community dwelling older people regardless of the presence of parkinsonism.^{19,20}

Of particular note is the extent and severity of injuries sustained by our patients. A total of 12% of our entire patient population, or 21.6% of those who fell, sustained

a fracture, 40.6% of the latter requiring surgical intervention. Although this relatively high percentage may be in part due to recall bias it is, nevertheless, at least twice as high as the 2 to 6% fracture risk after a fall, which has been reported in community dwelling older people.²¹ This difference may result from the lower bone density, lower bone mass, and high prevalence of vitamin D deficiency, which has been reported among parkinsonian patients.^{22,23} In accordance to previous reports, among our study subjects, older patients and women were more likely to sustain fractures, these subgroups conceivably affected more by osteoporosis, lower bone mass index, and lower bone mineral density.^{8,22,23} Of interest, dementia, which has been reported to be a risk factor for fall related fractures among the elderly population,^{21,24} did not seem to play a similar role among parkinsonian patients.

The location of the fractures in PD versus atypical parkinsonism yielded an interesting comparison. The top three fracture sites for PD were the hip/pelvis area, trunk, and hand and wrist. Similarly, hip fractures are the commonest type of fracture to follow a fall in the general elderly population.²⁵ This finding is in contrast to the atypical parkinsonian patients, in whom the trunk is followed by hip/pelvis area and shoulder. Although such differences were not statistically significant, they may conceivably reflect differences in the mechanics of falling in these subgroups. Given the grouping of all atypical parkinsonism syndromes in this study, further analysis was not deemed appropriate.

Although fractures occurred in a relatively small number of patients, 65% of the patients who fell (or 35.5% of the entire study group) sustained an injury as a result of falling. However, it is possible that the high percentage of falls that result in injuries is artificially increased due to recall bias (i.e., falls that resulted in injuries were more likely to be reported in the survey). Even so, this percentage remains a relatively high proportion of patients with falls resulting in injuries. Among these patients, 75.5% (27% of the entire study group) required health care professional services for this injury, whereas 13.4% (4.8% of the study group) required surgery. Such outcomes would suggest substantial health care-related costs associated with falling in parkinsonism. The likelihood of a similarly high social cost of such falls is supported by the response rate to our survey (79.8%), which we judged as unexpectedly high, for an older and quite often fairly disabled group of people. Such a high response rate can only reflect, in the opinion of these authors, the great importance assigned by parkinsonian patients to the problem of falls.

In summary, this retrospective study of a large, specialty clinic-based parkinsonian population identified more than half of the patients falling, with risk factors being older age, atypical parkinsonism, longer disease duration, and dementia. Female sex and older age predisposed the patients who fell to fractures. Further prospective studies will be necessary to elucidate the specific prognostic outcomes of injuries due to falls among parkinsonian patients and the impact of these injuries on disease progression and quality of life and to determine approaches to treatment of such injuries leading to better recovery and long-term prognosis. Our present data may be helpful further in targeting parkinsonian patients at risk for falling for early referral to allied health and rehabilitation services for falls prevention intervention.

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APPENDIX:

COVER LETTER:

Dear (subject name),

We are currently conducting a survey at Struthers, regarding the frequency and severity of falls resulting in serious injury in Parkinson's disease. We plan to use such information to design a research study that will help identify specific therapeutic intervention (either therapies or medications), that will decrease the risk of such serious injuries in patients with Parkinson's. Your response to the attached questionnaire would be very much appreciated. This information will be part of your medical record, and, as such, will be kept strictly confidential. You can contact the Center and talk to Sue Petersen R.N. if you have any questions about this mailing.

Sincerely, (signed)

Catherine Wielinski

Director of Research
Struthers Parkinson's Center

MAIL-IN SURVEY:

Thank you for taking the time to complete this survey. Your responses will be kept strictly confidential. Please check the box with your response.

1. Have you fallen in the last 2 years because of Parkinson's?
Yes (Go to Question 2)
No (STOP)
If you answered "no" to this question, stop. You do not need to read further. Please return the survey to Struthers in the enclosed envelope.
2. If you did fall in the last two years, did you have any fractures or break any bones?
Yes (Go to Questions 3 and 4)
No (Go to Question 5)
If you answered "yes" to this question, go on to question 3. If you answered "no" to this question, jump forward to question number 5.
3. If yes, which bone(s)?

4. Did you have surgery because of this?
Yes (STOP)
No (STOP)
You have completed the survey. Please return the survey to Struthers in the enclosed envelope.
5. If you did fall but broke no bones, did you injure yourself in some other way?
Yes (Go to Question 6)
No (STOP)
6. Did this injury require treatment by a health care professional?
Yes
No

Thank you

Please return the survey to Struthers in the enclosed envelope.

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