Age and Ageing 2005; **34:** 21–24
doi:10.1093/ageing/afh203

Fracture rates in Parkinson's disease compared with age- and gender-matched controls: a retrospective cohort study

RICHARD W. GENEVER[1], THOMAS W. DOWNES[1], PIPPA MEDCALF[2]

[1]Sheffield Teaching Hospitals NHS Foundation Trust, Northern General Hospital, Herries Road, Sheffield S5 7AU, UK
[2]Chesterfield and North Derbyshire Royal Hospital NHS Trust, Calow, Chesterfield S44 5BL, UK

Address correspondence to: R. W. Genever. Fax: (+44) 114 271 3689. Email: richard.genever@sth.nhs.uk

Abstract

Introduction: patients with Parkinson's disease (PD) are not routinely prescribed bone-protecting medication despite the fact that they are known to be at risk of falling. We investigated whether subjects with PD were more at risk of fractures than other patient groups in order to establish whether preventative measures should be targeted on those who have been diagnosed with PD.
Methods: we performed a retrospective cohort study, reviewing the records of PD patients compared with age- and gender matched patients attending medical clinics. Power analysis indicated the need for 194 in each group for a 95% confidence level. Our study comprised 200 PD patients and 200 controls. All limb and vertebral fractures before the date of diagnosis, or control, were recorded.
Results: 52% of patients in each group were female. The mean age of the PD patients was 75.6 years (43.7–96.0) and that of controls 75.2 years (43.9–95.9). The mean interval from diagnosis was 5.46 years, providing 1092 person-years of follow-up in both groups. Fractures were significantly more common in the PD group than the control group (PD 15%, controls 7.5%; $p=0.007$). The commonest site of fracture was femur in PD patients (11 of 38 fractures) and forearm in the control group (5 of 16 fractures).
Conclusion: the risk of fracture is significantly increased in PD relative to patients with other medical conditions. Hip fractures are commonly fatal in older people and partly preventable. Prospective studies of intervention to prevent fractures in PD are required.

Keywords: *falls, fracture, osteoporosis, Parkinson's disease*

Introduction

Bone fractures result in significant mortality and morbidity. The risks are increased in older people [1]. Studies in patients with Parkinson's disease (PD) have shown that this group has complication rates, which are, at least, comparable with the general population but may even be greater [2–5].

In 1992 Johnell *et al.* [6] found an increased incidence of hip fractures in patients with PD compared with controls. Despite this, patients with PD are not routinely prescribed bone-protecting medication. The aim of this study was to establish whether patients with PD still show an increased risk of fractures when comparison is made with age- and gender-matched subjects. Confirmation of a higher incidence of fractures would indicate the need for a prospective, randomised controlled trial to look at prevention.

Methods

We designed a retrospective cohort study. This involved reviewing the records of 200 patients with known idiopathic PD, chosen at random from the PD register of the Movement Disorder Clinic at Chesterfield and North Derbyshire Royal Hospital. Power calculation indicated the need for 194 subjects in each arm. The subjects were diagnosed by a consultant Care of the Elderly physician, specialised in movement disorders, using the United Kingdom Parkinson's Disease Society Brain Bank criteria. Two hundred controls were identified from general medical outpatient lists by the Hospital Audit and Research Department. They were matched for age and gender with each PD case. They were selected from all medical specialities in order that biases were reduced. The controls were selected on the criterion that they had been seen in clinic within 1 month of the date that their matches were diagnosed with PD. We refer to this as the index date. We recorded all radiologically confirmed limb, vertebral and rib fractures occurring after the index date, following cases until April 2002 or death. Fracture data were taken from computerised records at the hospital. We noted any previous fractures for further analysis. We also recorded mortality data for both groups.

Student's paired *t*-test was used for comparison of groups in fracture and mortality rates. A 2×2 contingency table was drawn up of fractures before and after the index date. Chi-squared with Yates' correction was applied to this table to establish the significance of any changes to the fracture incidence following the diagnosis with PD. We received approval from the North Derbyshire Local Research Ethics Committee before commencing the study.

Results

The patient demographics are summarised in Table 1. The mean age in the PD group was 75.6 (range 43.7–96.0) and 74.36 (43.0–96.9) in the controls; 52% of each group were female. The differences between groups are not significant. The mean follow-up period was 5.94 years for each group. The average age at diagnosis with PD was 70.12 (range 39.41–91.95). There were fewer deaths in the PD group (29) compared with the controls (48) ($p=0.01$).

The PD group had a higher total number of fractures after the index date than did the control group. In total there were 38 compared with 16 amongst the controls ($p=0.007$). The study was not specifically powered to look at individual sites; however, the PD group had a higher incidence of limb fractures (PD=27, control=13; $p=0.038$) and showed a trend to a larger number of femoral fractures (PD=11, control=4; $p=0.07$). Figure 1 shows the site and number of fractures in each group.

Table 1. Patient demographics

	PD group	Control group
Number	200	200
Mean age (range)	75.6 (43.7–96.0)	74.36 (43.0–96.9)
Number of females (%)	104 (52)	104 (52)
Number of males (%)	96 (48)	96 (48)

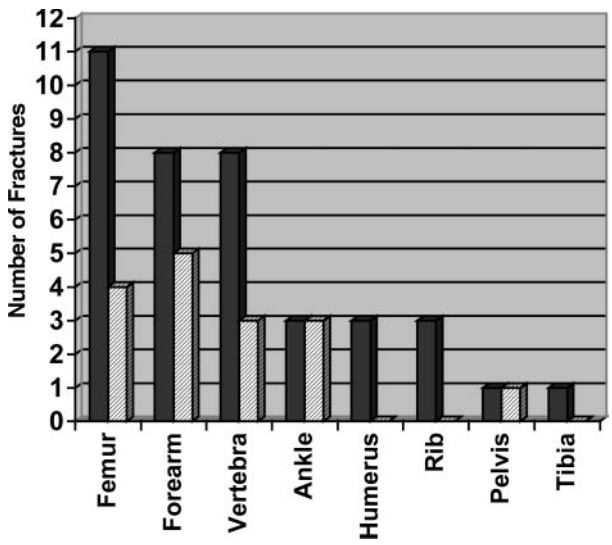

Figure 1. Sites of fractures in PD subjects and controls. Dark stippled columns, PD; grey stippled columns, controls.

Table 2. 2×2 Contingency table of fractures

	Pre-index date	After index date	Total
Parkinson's disease	12	38	50
Controls	25	16	41
Total	37	54	91

The first analysis took no account of the risk of fracture in the PD group before the onset of the disease. Thus, the second part of the analysis specifically tested the hypothesis that the risk of fractures increases following the onset of idiopathic PD. Table 2 shows the number of fractures in both groups before and after the index date. The number of fractures in the PD group was found to increase after diagnosis, compared with the change in fracture rate in the control group before and after the index date. [chi-squared=12.8 without Yates' correction, chi-squared=11.3 with Yates' correction ($p<0.001$ for either method).]

Discussion

Interpretation of results

In this cohort study we illustrated an increased risk of bony injury in idiopathic PD. The results demonstrate that the increased risk comes about after the onset of the disease and does not represent a phenomenon occurring throughout life. The technique for data retrieval was a retrospective review of X-ray records. This necessitated that the controls were taken from patients under hospital follow-up. It is possible that a different answer would have been reached if a healthy age- and gender-matched control group had been used. The higher number of pre-index fractures in the control group may indicate that these patients had more serious illnesses, which could have affected their fracture risk. This might also explain the higher number of deaths amongst controls. The increased death rate observed in the control group is recognised as a potential source of error as those that died may have experienced fractures had they lived longer. We attempted to reduce possible confounding factors in the selection of control subjects by recruiting from a range of medical specialities.

Some fractures may have been missed by this data collection method as only those diagnosed radiologically at Chesterfield and North Derbyshire Royal Hospital could be counted. This assumes that neither group was more likely to leave the area or attend other hospitals with bony injuries. Impaired mobility due to PD or a higher degree of co-morbidity, which was postulated in the controls, could have caused either population to be more static.

Factors influencing fracture risk in PD

It may seem obvious that people with parkinsonism would have a higher incidence of fractures. They are more likely to fall for a number of reasons and 90% of fractures in older people result from a fall [7–13]. In particular, certain subgroups of patients are even more at risk, such as those who are unable to wash or dress themselves independently [14], those with more severe PD and those who report the greatest

increase in function after taking levodopa [7, 10]. However, there may be other factors that influence the number of fractures. For instance, there were a higher number of vertebral fractures in the Parkinson's group (Figure 1). Such fractures are associated with osteoporosis but only one in four results from a fall [15].

Although it is important to be careful when attempting to interpret a study in ways for which it was not designed, this does raise the question of whether PD is associated with lower bone mineral density (BMD). Sato *et al.* found that 71 PD patients had lower metacarpal BMD than controls. They also had elevated calcium levels and lower vitamin D intake [16]. Another study showed significantly lower BMD at the hip but not the lumbar spine in PD [17].

There may be some body composition factors, which are also important. There are conflicting data in the published studies relating to body weight, body mass index (BMI) and energy expenditure in PD [18–20]. However, there may be an association between the condition and reduced total and percentage body fat as well as reduced triceps skin-fold thickness [19, 21]. Reduced body size is a risk factor for fractures of the hip, pelvis and ribs [22]. Lower fat mass correlates with reduced BMD of the hip, spine and distal radius [23]. Low BMI has been linked with reduced trochanteric soft tissue thickness which, in turn, may lead to greater force being transmitted to the hip after a fall [24]. If total or percentage body fat have the same influence it would contribute to explaining why only the increased incidence of hip fractures reached significance in the Johnell study.

Intervention

If factors other than frequency of falls contribute to the incidence of fractures in PD, the reduction of fractures may require strategies other than falls prevention alone. One study has already looked at the effects of 1α(OH)D3 in subjects with PD, showing a reduced incidence of fractures but no improvement in BMD [25]. There may be a place for researching other agents which have shown bone-protecting properties in other populations, such as calcium and vitamin D or bisphosphonates [26–28].

The future

This study supports a direct association between PD and fractures. Further research is required, comparing fracture incidence in subjects with PD and healthy controls. We have not established a mandate to routinely prescribe bone-protecting medication or request bone densitometry on all patients with a diagnosis of PD. Therefore, it would be valuable to assess the incidence of fractures and BMD according to the grade of Parkinson's severity. A prospective approach would allow long-term follow-up with serial bone densitometry to establish the effects of disease progression on an individual's fracture risk. Previous work on the prevention of fractures in PD and non-PD populations suggests that a randomised controlled trial of combination therapy with 1α(OH)D3 and a bisphosphonate is indicated. Until such trials are completed we should continue to assess our patients' risk of falling and fracture on an individual basis and intervene according to the findings.

Key points

- The onset of PD is associated with a significantly increased risk of fractures.
- The higher number of fractures is unlikely to be due to increased incidence of falls alone.
- Currently, patients with PD are not routinely prescribed bone-protecting medication nor referred for densitometry. Research into both of these issues is necessary.

Ethics

Ethical approval to undertake the study was obtained from the North Derbyshire Local Research Ethics Committee.

Acknowledgements

We are grateful to the Chesterfield and North Derbyshire Royal Hospital Audit and Research Department for their assistance in identifying age- and gender-matched controls.

Funding

There was no external funding for the study.

Conflict of interest

There were no conflicts of interest.

References

1. Keene GS, Parker MJ, Pryor GA. Mortality after hip fractures. BMJ 1993; 307: 1248–50.
2. Coughlin L, Templeton J. Hip fractures in patients with Parkinson's Disease. Clin Orthop Rel Res 1980; 148: 192–5.
3. Turcotte R, Godin C, Duchesne R, Jodoin A. Hip fractures and Parkinson's Disease. Clin Orthop Rel Res 1990; 256: 132–6.
4. Eventov I, Moreno M, Geller E, Tardiman R, Salama R. Hip fractures in patients with Parkinson's Syndrome. J Trauma 1983; 23: 98–101.
5. Londos E, Nilsson LT, Strömqvist B. Internal fixation of femoral head fractures in Parkinson's Disease. Acta Orthop Scand 1989; 60: 682–5.
6. Johnell O, Melton LJ, Atkinson EJ, O'Fallon M, Kurland LT. Fracture risk in patients with Parkinsonism: a population-based study in Olmsted County, Minnesota. Age Ageing 1992; 21: 32–8.
7. Ashburn A, Stack E, Pickering RM, Ward C. A community-dwelling sample of people with Parkinson's disease: characteristics of fallers and non-fallers. Age Ageing 2001; 30: 47–52.
8. Senard JM, Rai S, Lapeyre-Mestre M *et al.* Prevalence of orthostatic hypotension in Parkinson's disease. J Neurol Neurosurg Psychiatry 1997; 63: 584–9.
9. Aita JF. Why patients with Parkinson's Disease fall. JAMA 1982; 247: 515–6.
10. Playfer JR. Falls and Parkinson's Disease. Age Ageing 2001; 30: 3–4.
11. Wood B, Walker R. Parkinson's disease: characteristics of fallers and non-fallers. Age Ageing 2001; 30: 423.
12. Grisso JA, Kelsey JL, Strom BL, Chiu GY, Maislin G, O'Brien LA, Hoffman S, Kaplan F. Risk factors for falls as a cause of hip fracture in women. N Engl J Med 1991; 324: 1326–31.

13. Dargent-Molina P, Favier F, Grandjean H *et al*. Fall-related factors and risk of hip fracture: the EPIDOS prospective study. Lancet 1996; 348: 145–9.
14. Ranstam J, Elffors L, Kanis JA. A mental-functioning score for prediction of hip fracture. Age Ageing 1996; 25: 439–42.
15. Cummings SR, Melton LJ. Epidemiology and outcomes of osteoporotic fractures. Lancet 2002; 359: 1761–7.
16. Sato Y, Kikuyama M, Oizumi K. High prevalence of vitamin D deficiency and reduced bone mass in Parkinson's disease. Neurology 1997; 49: 1273–8.
17. Taggart H, Crawford V. Reduced bone density of the hip in elderly patients with Parkinson's Disease. Age Ageing 1995; 24: 326–8.
18. Beyer PL, Palarino MY, Michalek D, Busenbark K, Koller WC. Weight change and body composition in patients with Parkinson's Disease. J Am Dietetic Assoc 1995; 95: 979–83.
19. Toth MJ, Fishman PS, Poehlman ET. Free-living daily energy expenditure in patients with Parkinson's Disease. Neurology 1997; 48: 88–91.
20. Levi S, Cox M, Lugon M, Hodgkinson M, Tomkins A. Increased energy expenditure in Parkinson's Disease. BMJ 1990; 301: 1256–7.
21. Davies KN, King D, Davies H. A study of the nutritional status of elderly patients with Parkinson's Disease. Age Ageing 1994; 23: 142–5.
22. Margolis KL, Ensrud KE, Schreiner PJ, Tabor HK. Body size and risk for clinical fractures in older women. Ann Intern Med 2000; 133: 123–7.
23. Hla MM, Davis JW, Ross PD *et al*. A multicentre study of the influence of fat and lean mass on bone mineral content: evidence for differences in their relative influence at major fracture sites. Am J Clin Nutr 1996; 64: 354–60.
24. Greenspan SL, Myers ER, Maitland LA, Resnick NM, Hayes WC. Fall severity and bone mineral density as risk factors for hip fracture in ambulatory elderly. JAMA 1994; 271: 128–33.
25. Sato Y, Manabe S, Kuno H, Oizumi K. Amelioration of osteopenia and hypovitaminosis D by 1a-hydroxyvitamin D3 in elderly patients with Parkinson's Disease. J Neurol Neurosurg Psychiatry 1999; 66: 64–8.
26. Chapuy MC, Arlot ME, Duboeuf F *et al*. Vitamin D_3 and calcium to prevent hip fractures in elderly women. N Engl J Med 1992; 327: 1637–42.
27. Dawson-Hughes B, Harris SS, Krall EA, Dallal GE. Effect of calcium and vitamin D supplementation on bone density in men and women 65 years of age or older. N Engl J Med 1997; 337: 670–6.
28. McClung MR, Geusens P, Miller PD *et al*. Effect of risedronate on the risk of hip fracture in elderly women. N Engl J Med 2001; 344: 333–40.

Received 3 February 2004; accepted 21 June 2004

Age and Ageing 2005; **34:** 24–30
doi:10.1093/ageing/afh214

Published electronically 20 October 2004

Older people's use of Accident and Emergency services

AMY DOWNING[1], RICHARD WILSON[2]

[1]Public Health and Epidemiology, University of Birmingham, Edgbaston, Birmingham B15 2TT, UK
[2]South Birmingham PCT, Moseley Hall Hospital, Alcester Road, Birmingham B13 8JL, UK

Address correspondence to: A. Downing, Public Health and Epidemiology, University of Birmingham, Edgbaston, Birmingham B15 2TT, UK. Fax: (+44) 121 414 7878. Email: a.downing@bham.ac.uk

Abstract

Introduction: it has previously been reported that patients aged over 65 years account for 15% of Accident and Emergency (A&E) attendances. Despite this, there have been few studies looking at older people's use of A&E. This study describes the A&E attendance patterns of older people, defined as those aged 65 years and over, using data from an NHS region over a number of years. Their attendances are also compared with those of the rest of the population.
Data and methods: A&E attendance data were collected for 14 Acute Trusts in the West Midlands for the period from 1 April 1999 to 31 March 2002 via the West Midlands Accident and Emergency Surveillance Centre.
Results: patients aged 65 years and over accounted for 18% of all attendances. Attendance rates were highest in those aged over 80 years. Older patients were significantly more likely to attend during the morning and early afternoon, during the winter months, arrive by ambulance and require admission to hospital. Older patients were significantly more likely to attend with non-injury, particularly cardiac-related conditions. Injuries accounted for 33.1% of attendances in the over-65s compared with 59.9% in the 0–64s.