

The incidence of Parkinson's disease in the North-East of England

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Abstract

Background: Parkinson's disease is a common disorder among older people. Accurate epidemiological information is essential to identify possible aetiological factors, plan health services and set priorities for medical research.

Objective: to determine the incidence of idiopathic Parkinson's disease in a defined geographical area in the North-East of England.

Methods: using a prospective, longitudinal design, we sought to identify every new case of Parkinson's disease arising in the Newcastle and Gateshead area in the North-East of England. The base population comprised 488 576 individuals and multiple sources of case ascertainment were employed. All the patients with newly diagnosed idiopathic Parkinson's disease or parkinsonism between 1 June 2009 and 31 May 2011 were invited to participate. Patients were examined by a specialist and followed longitudinally to permit diagnostic review.

Results: we identified 257 potential cases, of whom 181 had suspected idiopathic Parkinson's disease. After a follow-up period of 18 months, 155 patients retained a clinical diagnosis of probable Parkinson's disease. The mean age at diagnosis was 72.4 ± 10 years. The crude incidence of PD in Newcastle and Gateshead was 15.9 per 100 000 persons per year (95% CI: 13.4–18.4). Age-standardised to the European population the incidence of Parkinson's disease was 12.0 per 100 000 (95% CI: 10.1–14.0). We found a higher crude incidence among men 17.7 per 100 000 (95% CI: 14.0–21.4) than women 14.0 per 100 000 (95% CI: 10.7–17.4).

Conclusion: in this prospective longitudinal study, the incidence rate of Parkinson's disease in North-East England is similar to that of other modern European and American studies.

Keywords: Parkinson's disease, incidence, parkinsonism, older people

Introduction

There are estimated to be 127 000 people living with Parkinson's disease (PD) in the UK [1], making it the second most common neurodegenerative disorder after Alzheimer's disease (AD) [2]. It is principally a disease of the older person, and with our growing population of older people it is expected that the number of those with PD will also rise. Accurate information regarding the epidemiology of PD is essential to identify possible aetiological factors, inform health service

development, set priorities for medical research and provide a platform for the translation of biomedical advances.

Incidence studies have reported annual incidence figures between 8 and 22.4 per 100 000 [3–7]. Many older studies, by current standards, suffer methodological flaws limiting their ability to accurately describe the incidence of PD [3]. These include the lack of standardised clinical criteria for the diagnosis of PD; reliance on retrospective case-note reviews; small base-denominator populations and inadequate procedures for case ascertainment. Crucially, many studies have

only used a single time point of clinical assessment and yet it is known that longitudinal follow-up improves diagnostic accuracy through reducing the rate of misdiagnosis in parkinsonian and akinetic-rigid syndromes [3].

Diagnosing PD can be difficult. Other neurodegenerative akinetic-rigid syndromes have similar clinical presentations to PD, particularly early in the disease course; furthermore, mild parkinsonian signs are common in older people and may be caused by other pathological processes such as cerebral small vessel disease [8]. The Queen Square Brain Bank criteria for the diagnosis of idiopathic PD improves diagnostic accuracy and also predicts the pathological diagnosis of PD which remains the gold-standard for the diagnosis of definite PD [9, 10]. Studies which have adopted Brain Bank criteria and a prospective longitudinal design with follow-up report crude annual incidence rates ranging from 9.03 to 19.7 per 100 000 [4, 5, 7, 11, 12]. Common alternate diagnoses after follow-up include dementia with Lewy bodies (DLB), multiple system atrophy (MSA), progressive supranuclear palsy (PSP) and other tremor syndromes [4, 11–13].

The aim of this study was to determine the incidence of idiopathic PD in a defined population in the North-East of England using accurate case ascertainment methods, validated diagnostic criteria and longitudinal assessment.

Methods

The study was approved by Newcastle and North Tyneside Research Ethics Committee and satisfied Caldicott guidelines regarding patient identifiable information. All the patients provided written informed consent after receiving written information regarding the details of the study. This study forms part of the Incidence of Cognitive Impairment in Cohorts with Longitudinal Evaluation – Parkinson's disease (ICICLE-PD) study, a prospective longitudinal study of patients with incident PD from the Newcastle-Gateshead area of the North-East of England [14].

We sought to identify every incident case of PD in Newcastle-upon-Tyne and Gateshead over a 24-month period from 1 June 2009 to 31 May 2011. Because this was the first epidemiological study performed in our area, a 3-month run-in period beginning 1 March 2009 was included prior to the official record of incident cases. These cases were not included in the incidence analyses but ensured our mechanism for patient referral was robust. Similarly, a 3-month run-out period was included after the 24-month period to ensure all referrals were received. Since every person in the UK should be registered with a general practitioner (GP), we based our denominator population on the residents of the geographical boundaries of 70 general practices located within Newcastle and Gateshead. The study populations in Newcastle and Gateshead comprised 283 393 and 205 183 people, respectively, resulting in a study population denominator of 488 576. Practice list size by age and sex structure was obtained from North of Tyne Primary Care Trust for Newcastle and based on figures available on 1 April

2011, while the Gateshead General Practice list size was based on figures up to 1 July 2010 supplied by the South of Tyne and Wear Primary Care Trust.

In England Wales, National Institute of Clinical Excellence guidance for PD [15] encourages GPs to refer all the patients with suspected parkinsonism to a specialist in movement disorders for clinical assessment. Written notification was sent to GPs to encourage referral of all the patients with extrapyramidal symptoms or signs (tremor, rigidity, bradykinesia, micrographia, loss of dexterity, hypomimia, reduced arm-swing or parkinsonian gait) to a movement disorders specialist for clinical evaluation. Throughout the study period, GPs were regularly reminded in writing to refer all such patients. In addition the Primary Care Research Network screened GP lists for new diagnoses of PD. Neurologists ($n = 20$), geriatricians ($n = 15$) and PD nurse specialists ($n = 5$) managing older people or those with neurological conditions resident within the geographical area were contacted and invited to refer all the patients with PD or parkinsonism without clear cause. Regular written requests for referrals were made throughout the study period to this group to encourage recruitment. Staff from the local topic-specific NIHR Dementia and Neurodegenerative Disease Network screened out-patient clinic lists for patients with new diagnoses of PD. All the patients resident within the study area identified through these methods were invited to participate. Those who declined to participate in the clinical study were counted as an incident case for completeness and continued their routine clinical care without further contact from the study team.

The diagnosis of probable PD was made according to Queen Square Brain Bank criteria [9]. All the patients were assessed by a physician with experience in movement disorders and where diagnostic uncertainty existed; dopamine transporter imaging with FP-CIT or a second specialist opinion was obtained. The date of onset was defined as the date of clinical diagnosis. Exclusion criteria were patients with parkinsonism who were diagnosed prior to the onset of the study, because they were prevalent rather than incident cases; patients with early cognitive impairment at presentation (defined as Mini-Mental State Examination score < 24 [16]) who presented within 1-year of motor symptom onset, or meeting DSM IV criteria [17] for dementia at presentation or criteria for DLB [18]; patients without capacity to consent to participate in the study (in accordance with the Mental Health Act) [19]. Patients were evaluated to exclude other parkinsonian disorders: drug-induced parkinsonism secondary to exposure to dopamine receptor blocking agents at the onset of symptoms, vascular parkinsonism (diagnosed when there was the presence of at least two of the following: history of previous strokes, abrupt onset with stepwise progression, hypertension, wide-based gait with small steps, cognitive decline and pseudobulbar or pyramidal signs) and other akinetic-rigid syndromes including PSP, MSA or corticobasal degeneration, according to accepted diagnostic criteria [20].

Patients who consented to the follow-up clinical study underwent medical assessment. After a mean period of 18 months, patients who consented to participate in the clinical

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study were re-assessed by a physician specialising in movement disorders. For those patients who had declined follow-up we asked their provider of routine clinical care to inform us whether, in their opinion, these patients still had PD or if an alternate diagnosis had been made.

Statistical analysis

Statistical analyses were performed with SPSS 19.0 (SPSS, Chicago, IL, USA). Data were examined for normality using

visual histograms and the Kolmogorov–Smirnov test. Data with a normal distribution were analysed with *t*-tests. Differences in proportions were studied using Pearson Chi-squared tests. Calculation of age- and gender-specific incidence rates was performed by dividing the number of incident cases by the person-years at risk. The 95% confidence intervals (CI) were based on the Poisson distribution. The age-adjusted incidence rate was based upon the European standard population. Incidence rates per 100 000 were stratified by age and gender.

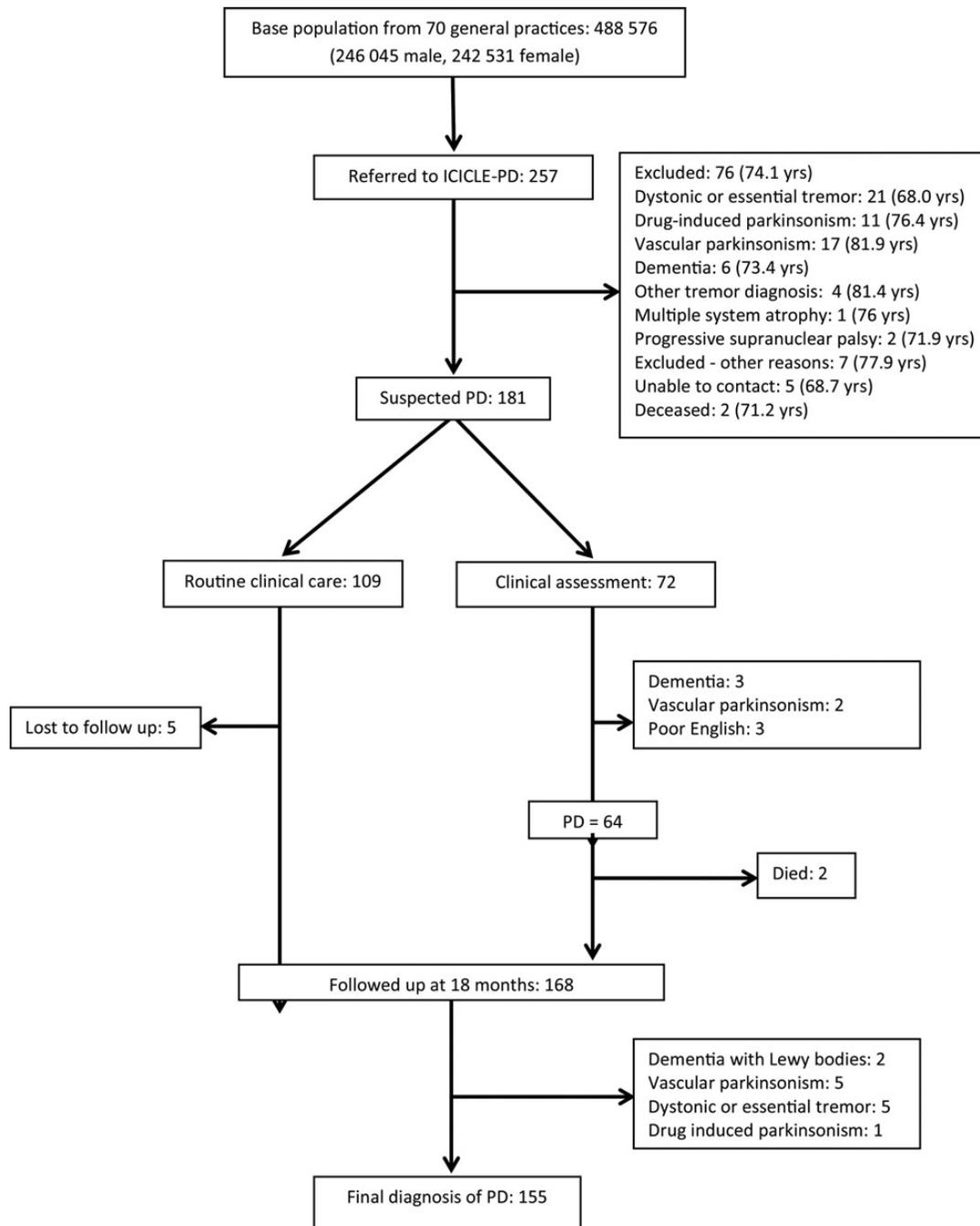


Figure 1. Flowchart showing the path of 257 patients referred to the study. Mean ages in years of the excluded patients are given. Incidence estimates were calculated on average 18 months after diagnostic clinical visit.

Study funding

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Table 1. Demographic and clinical characteristics of patients with probable idiopathic Parkinson's disease who consented to participate in the clinical study and those who declined

	Consented (<i>n</i> = 72)	Declined (<i>n</i> = 109)	All (<i>n</i> = 181)
No. with clinical diagnosis of probable PD after 18 months	61	94	155
Male, <i>n</i> (%)	37 (60.7)	50 (53.2)	87 (56.1) ^a
Age at baseline, years ^c	67.9 (9.82)	75.5 (8.6)	72.4 (10.0) ^b
Disease duration, months	3.33 (5.14)		
MDS-UPDRS III ^c	28.5 (12.9)		
Hoehn and Yahr Stage			
Hoehn and Yahr 1, <i>n</i> (%)	15 (24.5)		
Hoehn and Yahr 2, <i>n</i> (%)	32 (52.5)		
Hoehn and Yahr 3, <i>n</i> (%)	14 (23)		

^aChi-squared test.

^bIndependent *t* test.

^cData given as median (inter-quartile range) unless otherwise stated mean (SD). MDS-UPDRS III, Movement Disorder Society revised Unified Parkinson's Disease Rating Scale; PD, Parkinson's disease.

Results

During the 24-month incidence period, 257 patients from the geographical catchment area were referred. A summary of the screening, diagnoses and results of longitudinal evaluation is given in Figure 1. Seventy-four patients had other causes of parkinsonism. At baseline, 181 patients fulfilled criteria for possible and probable PD, 109 declined further clinical evaluation and continued with routine clinical care. The demographic and clinical characteristics of the study participants are shown in Table 1. Seventy-two patients were assessed by a member of the study team, after which eight subjects were excluded. Participants in the clinical study were significantly younger (67.9 ± 9.8 years) than those who declined (75.5 ± 8.6 years, $P < 0.001$).

Crude age- and sex-specific incidence figures are shown in Table 2. From the denominator population of 488 576, we identified 155 patients with PD, giving an overall crude annual incidence of 15.9 per 100 000 (95% CI: 13.4–18.4). Adjusted to the European standard population the annual incidence was 12.0 per 100 000 (95% CI: 10.1–14.0). The incidence rate was higher among men than women, 17.7 per 100 000 (95% CI: 14.0–21.4) and 14.0 per 100 000 (95% CI: 10.7–17.4), respectively; or 14.0 per 100 000 (95% CI: 11.8–18.2) and 9.5 per 100 000 (95% CI: 7.1–11.9) when adjusted to the European population. Peak age of onset was in the 8th decade for both sexes.

After 18 months, five patients were lost to follow-up and six had died, none of whom was re-diagnosed with an alternate cause for their parkinsonism. A diagnosis of probable

Table 2. Age and gender-specific crude incidence rates of probable Parkinson's disease in Newcastle-Gateshead

Age group (years)	Denominator population	Number of suspected cases in 24 months	Number of cases with probable PD after 18 months follow-up	Crude incidence per 100,000 per year (95% CI)
Male				
0–39	134 423	1	1	0.4 (0–1.1)
40–49	36 227	1	1	1.4 (0–4.1)
50–59	29 939	4	4	6.7 (0.1–13.2)
60–69	23 037	23	22	47.8 (27.8–67.7)
70–79	15 091	49	47	155.7 (111.2–200.2)
80+	7328	14	12	81.9 (35.6–128.2)
All ages	246 045	92	87	17.7 (14.0–21.4)
Female				
0–39	127 231	1	1	0.4 (0–1.2)
40–49	32 754	4	4	6.1 (0.1–12.1)
50–59	28 035	4	4	7.1 (0.1–14.1)
60–69	23 529	12	12	25.5 (11.1–39.9)
70–79	18 085	32	26	71.9 (44.3–99.5)
80+	12 897	23	21	81.41 (46.6–116.2)
All ages	242 531	76	68	14.0 (10.7–17.4)
All				
0–39	261 654	2	2	0.4 (0–0.9)
40–49	68 981	5	5	3.6 (0.5–6.8)
50–59	57 974	8	8	6.9 (2.1–11.7)
60–69	46 566	35	34	36.5 (24.2–48.8)
70–79	33 176	81	73	110.0 (84.8–135.2)
80+	20 225	37	33	81.6 (53.8–109.4)
All ages	488 576	168	155	15.9 (13.4–18.4)

PD remained in 155 patients. Alternate diagnoses are shown in Supplementary data available in *Age and Ageing* online, Table S3 in Appendix 1; 13 patients initially given a diagnosis of PD subsequently had their diagnoses revised: two developed early dementia and were reclassified as DLB; three patients with dystonic tremor following normal FP-CIT SPECT scans and one was diagnosed with essential tremor. One patient refused to have FP-CIT, but because of the lack of progression and the absence of bradykinesia was re-diagnosed with dystonic tremor. One patient was considered to have drug-induced parkinsonism and five patients had vascular parkinsonism. The baseline clinical characteristics of the 155 patients with a final diagnosis of PD are given in Table 1.

Discussion

We report a crude annual incidence of PD of 15.9 per 100 000 (95% CI: 13.4–18.4) or 12.0 per 100 000 (95% CI: 10.1–14.0) when adjusted to the European Standard population. Although, this figure is at the lower end of the range reported in a systematic review which reported an overall annual incidence of 16–19 per 100 000, it is consistent with previous reports which have used similar case ascertainment, recruitment and follow-up methods (Supplementary data are available in *Age and Ageing* online, Table 4 in Appendix 2) [4–6, 11, 12]. In keeping with previous research, we observed a higher incidence among men than women [4, 11, 12]. The incidence of PD in our population peaked in the eighth decade and 68% of those with a new diagnosis of PD were aged over 70 years. Although the drop-off in incidence after the age of 80 in our study is consistent with the work of others [4, 5, 11, 21], it is not a universal finding [7, 12] and may represent an underestimation of the true incidence within this group. Frail older people are more likely to remain undiagnosed in the community [22] with other co-morbidities contributing to the clinical presentation.

This study was performed in line with the recommendations suggested by Twelves *et al.* [3] for performing high-quality incidence studies of PD. Our large-study base-denominator population of 486 576 was within the suggested suitable population size of 250 000–500 000. To facilitate comparison with other modern incidence studies and enhance the relevance of our findings we have reported both crude and age-standardised incidence rates. We adopted a prospective longitudinal design to maximise case ascertainment and ensure diagnostic accuracy through clinical and diagnostic review. Through extensive advertising and reminders to colleagues in primary and secondary care we used multiple sources to identify possible cases. We used standardised diagnostic procedures and, where necessary dopamine transporter SPECT imaging to ensure identification and classification of potential PD cases. Our cohort is part of a prospective longitudinal observational study which facilitates the monitoring of disease evolution and identification of

alternate diagnoses. The addition of a run-in and run-out period ensured that all potential cases were included.

Limitations of this study include potential for under recognition of cases. Studies with a referral-based design can underestimate the incidence of PD because early untreated cases and individuals who do not attend their medical practitioner may be missed. An alternative approach would have been to use a targeted screening strategy which may have increased our number of cases, particularly among the elderly [22, 23]. The use of the Brain Bank Criteria diagnostic criteria may have led to exclusion of patients with very mild tremor-dominant PD [24]. We also did not follow patients in whom we diagnosed other akinetic-rigid syndromes such as PSP or MSA. Although in early cases the diagnosis may be challenging and some of these may later be shown to have PD, published work suggests that this is uncommon [25, 26] and it is more likely for such patients to be given a diagnosis of PD initially before being later reclassified [24]. For those with dystonic tremor diagnosis may be more difficult [27]; however, the increased availability of functional imaging improves differentiation of idiopathic PD from other tremor syndromes such as essential tremor or dystonic tremor which may be confused with early PD in up to 15% of cases [28]. We used the date of clinical diagnosis by a specialist as our date of disease onset. The recommendations from Twelves *et al.* [3] suggest that date of onset should ideally be based on specific symptom onset rather than date of diagnosis, but in practice this is challenging because of the insidious development of motor features. Moreover, the increasing recognition that non-motor symptoms are present not only at the time of clinical diagnosis but often precede the classical motor features poses a further challenge to clinicians [29]. Thus, in the absence of a reliable biomarker, determining true timing of disease onset is currently impossible.

The uptake of patients for the clinical assessment and follow-up aspect of the study was lower than we had initially anticipated. The patients who declined to participate were significantly older. This may reflect our inclusion of geriatric medicine clinics as sources of referral which aimed to enhance our ability to include patients who may have been missed otherwise. Employing domiciliary visits may have increased participation and has been adopted successfully in other studies [6, 7]. We also speculate that apathy and depression played a role in the refusal to participate; both are common in early PD [14]. In addition to potentially influencing the incidence figures presented here, this has implications for the design of natural history and interventional trials which often involve younger patients with fewer comorbid diseases. Furthermore, the spectrum of neuropathology is broader in older people with a greater burden of amyloid deposition contributing towards increased heterogeneity of clinical features such as axial and cognitive impairments [30]. With the prospect of possible disease-modifying therapies, clarifying such issues will become of paramount importance for the recruitment of patients to clinical trials.

In summary, using a primary and secondary care-based case identification strategy, we have found a crude annual

incidence of PD of 15.9 per 100 000 (95% CI: 13.4–18.4). These data will inform the planning of healthcare services in our region and enhance our research capabilities at both the local and national level. Our study also highlights the continued diagnostic challenges faced by clinicians in making an accurate diagnosis of PD, particularly in the older person.

Key points

- The incidence of PD in the North-East of England is similar to other high-quality studies performed in Europe and America.
- The incidence of PD increases with age.
- Even in specialist centres, the diagnosis of PD should be regularly reviewed to enhance diagnostic accuracy.

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Conflicts of interest

None declared.

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Supplementary data

Supplementary data mentioned in the text are available to subscribers in *Age and Ageing* online.

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Experience and opinions on post-graduate dementia training in the UK: a survey of selected consultant geriatricians

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Abstract

Introduction people with dementia are more likely to come into contact with a geriatrician than any other hospital specialty. Whilst it is known that there are some geriatricians with a special interest in dementia, it is unclear how this group of clinicians gained experience, and what their opinions are on current training.

Methods we obtained a list of geriatricians known to have an interest in dementia care (known as dementia champions) from the British Geriatric Society Dementia and Similar Disorders Special Interest Group. We contacted 100 'dementia champions' with an invitation to respond to a questionnaire relating to their role, experience and opinions on current training in dementia within geriatric medicine.

Results fifty-five geriatricians responded. Ninety-one per cent were consultant physicians, and 71% were not involved in outpatient diagnostic services. Fifty-six per cent reported that their experience was via clinical attachments with old age psychiatry, and 47% regarded themselves as 'self-taught'. The majority felt that current training was inadequate with a need for more structure and time spent on attachments, less geographical variation, more training at undergraduate level and throughout other specialties and better collaboration with psychiatry.