Impact of Diabetes on Physical Function in Older People

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OBJECTIVE — To explore the nature of functional impairment in older people with diabetes.

RESEARCH DESIGN AND METHODS — A population-based case-control study with detailed assessment of diabetes and functional status was undertaken.

RESULTS — Altogether, 403 case subjects and 403 matched control subjects were studied (median age 75 years, 51% female). Subjects with diabetes had more comorbidities than control subjects (mean 2.5 vs. 1.9, $P < 0.0001$) and were more likely to have severe functional impairment (4 vs. 1%, Barthel score <5, $P < 0.001$). Health status pertaining to physical function was reduced in case subjects (SF36 60 vs. 40, $P < 0.0001$). In a multivariate model controlling for age, hypertension, cerebrovascular disease, chronic obstructive pulmonary disease, cancer, osteoarthritis, and dementia, diabetes remained significantly associated with mobility limitation (odds ratio 2.1, $P < 0.001$).

CONCLUSIONS — Older people with diabetes have considerable functional impairment associated with reduced health status. This population may benefit from comprehensive geriatric assessment and tailored diabetes management.

Diabetes Care 31:233–235, 2008

Diabetes is associated with a considerable personal health burden (1), but until recently this was considered to result primarily from vascular complications and associated medical comorbidities. Functional impairment and physical disability directly attributable to diabetes have been less frequently studied, although these are direct threats to personal independence and quality of life (2,3).

We report data from a large community-based case-control study that examined in detail the nature of the functional impairment in subjects with diabetes and sought to determine factors identifying those at highest risk of functional impairment.

RESEARCH DESIGN AND METHODS

— Participants were recruited as part of a case-control study. We included those known to have diabetes, aged 65 years or over, from a sample of rural and urban general practices in Wales. At the time of recruitment, all of the case subjects met the World Health Organization criteria for the diagnosis of diabetes (4). The control group of nondiabetic participants was frequency matched with the case subjects for age, sex, and general practice. Matching by ethnicity was not possible because of the small numbers of non-Caucasians.

Laboratory testing was used to confirm that the entire control group had normal glucose tolerance, as evidenced by fasting plasma glucose <6.5 mmol/l and no evidence of glycosuria. All study participants were interviewed by trained research nurses; a comprehensive assessment was carried out including demographic, medical, social, and functional details with information corroborated from family members and medical records when necessary. Specific questionnaires used and reported in this study were the Barthel index, a validated scale measuring basic activities of daily living from 0 to 20 with higher scores indicating greater independence (5); the Nottingham Extended Activities of Daily Living Scale, measuring extended activities of daily living such as shopping and driving from 0 to 22, with higher scores indicating greater independence (6); and the SF-36 health status questionnaire, a generic measure of health-related quality of life, with scores ranging from 0 to 100, higher scores indicating greater satisfaction (7). Data were also collected on cognition and visual acuity, reported elsewhere (8,9).

Univariate and multivariate regressions analysis were used, with summary results presented as odds ratios (ORs) and 95% CIs. Model parameters were retained if they were clinically important potential confounders or were statistically significant at the 0.05 level in univariate analysis.

RESULTS

— The study population consisted of 403 case subjects and 403 matched control subjects. The median (interquartile range [IQR]) age was 75 years (69–80), and 51% were female. More of the subjects with diabetes lived in a care home compared with control subjects (7 vs. 4%, $P < 0.001$). Participants with diabetes were on diet alone (24%), oral hypoglycemics (59%), or insulin (17%); the mean (95% CI) for A1C was 7.8% (7.6–8.0), mean random glucose was 11.2 mmol/l (10.7–11.7), and median (IQR) duration of diabetes was 7 years (3–14). In both cohorts, 51% were current or ex-smokers. Diabetic subjects had more comorbidities than control subjects (mean 2.5 vs. 1.9, $P < 0.0001$), especially cardiovascular disease (Table 1).

There were significant differences in

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Received for publication 11 September 2007 and accepted in revised form 10 November 2007.

Published ahead of print at http://care.diabetesjournals.org on 16 November 2007. DOI: 10.2337/dc07-1784.

Abbreviations: COPD, chronic obstructive pulmonary disease; IQR, interquartile range.

Table 1—*Comorbidities and complications in older people with diabetes (case subjects) and control subjects*

	Case subjects	Control subjects	OR (95% CI)	*P*
n	403	403		
Age (years)	75 ± 7.1	75 ± 6.9		
Male sex	197 (49)	197 (49)		
BMI (kg/m^2)	27.6 ± 4.8)	26.5 ± 4.4		
Hypertension	170 (42)	136 (34)	1.44 (1.08–1.93)	0.012
Myocardial infarction	83 (21)	42 (10)	2.23 (1.49–3.35)	<0.0001
Peripheral vascular disease	150 (38)	78 (19)	2.50 (1.80–3.46)	<0.0001
History of dementia	30 (7)	22 (5)	1.39 (0.79–2.46)	0.252
Stroke	89 (22)	49 (12)	2.04 (1.39–3.00)	0.0002
Peripheral neuropathy	184 (46)	99 (25)	2.63 (1.93–3.58)	<0.0001
History of osteoarthritis	165 (41)	177 (44)	0.89 (0.67–1.18)	0.427
History of COPD	91 (23)	101 (25)	0.87 (0.63–1.21)	0.409
History of cancer	56 (14)	42 (10)	1.4 (0.91–2.14)	0.125
History of Parkinson's disease	9 (2)	4 (1)	2.28 (0.69–7.48)	0.162

Data are means ± SE and *n* (%).

the distribution of Barthel scores between cohorts (case subjects median 20 [IQR 17–20], control subjects 20 [19–20], $P < 0.0001$). The main differences were seen at the lower end of the Barthel score, with 4 versus 1% being highly dependant (Barthel 0–5) and 4 versus 2% being moderately dependant (Barthel 6–11).

Significant differences were seen in mobility measured by the Nottingham extended activities of daily living scale; median (IQR) for subjects with diabetes 0.5 (0–1) compared with 5 (3–6) for control subjects ($P < 0.0001$).

Subjects with diabetes were more likely to use a mobility aid than control subjects: 7 versus 2% used a wheelchair regularly, 7 vs. 3% a frame, and 33 vs. 26% a walking stick. Overall, 187 of 403 of case subjects (46%) compared with 125 of 403 control subjects (31%) used some form of mobility aid ($P < 0.0001$).

There were significant differences in the physical function domain of the SF36; the median (IQR) SF36 for physical function was 60 (30–85) in control subjects versus 40 (10–70) in those with diabetes ($P < 0.0001$).

Mobility limitation

We ascribed use of a mobility aid as a marker of perceived mobility limitation. In a multivariate model controlled for age, hypertension, cerebrovascular disease, COPD, cancer, osteoarthritis, and dementia, diabetes remained significantly associated with mobility limitation: OR (95% CI) 2.10 (1.50–2.83) ($P < 0.001$).

CONCLUSIONS — The main findings of this study are a reduction in physical function and health status in patients with diabetes compared with age- and sex-matched control subjects living in the same community. Along with our previous findings of impaired cognition in this cohort (8), we have provided additional evidence of the impact of diabetes on global function.

Likely explanations for lower-limb dysfunction are peripheral neuropathy and peripheral vascular disease caused by diabetes. Other important contributors to mobility limitation include age, hypertension, cerebrovascular disease, COPD, cancer, osteoarthritis, and dementia.

There is growing recognition that older people with diabetes have needs over and above those related to management of the metabolic disturbance and its complications alone, in particular relating to lower-limb mobility and function (1,016). The increase in functional limitation in diabetes seen in this study is similar to that reported in studies from the U.S. (1,012) (17,18) and Hong Kong (19); one previous study from Norway has also shown a link between lower-limb disability and quality of life (20).

There is a growing body of evidence demonstrating that physical activity, in particular resistance training (21), is a key component in the management of diabetes in older people, and it is likely that exercise will have benefits both in terms of metabolic control and improving daily function, especially mobility. Older people with diabetes are at increased risk of falls, through mechanisms such as lower-limb dysfunction, cardiovascular disease, polypharmacy, and impaired balance (22). There is robust clinical evidence supporting the role of targeted exercise programs (23) and comprehensive geriatric assessment (16,24) and interventions in falls prevention. Given the multifactorial problems facing the older person with diabetes, it would seem reasonable to recommend a comprehensive intervention, similar to that used in falls prevention programs (25).

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