

Diabetic retinopathy at diagnosis of type 2 diabetes in the UK: a database analysis

K. Kostev · W. Rathmann

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Abstract

Aims/hypothesis The aim of this study was to estimate the prevalence of and risk factors for diabetic retinopathy in newly diagnosed type 2 diabetes in general practices in the UK.

Methods The Disease Analyzer Database (UK) assembles longitudinal data on diagnoses, prescriptions and laboratory values reported from 674 office-based physicians (97 general practices). Patients with newly diagnosed type 2 diabetes (between 2005 and 2009) were identified and the presence of retinopathy was defined based on the International Classification of Diseases code (E11.3) or on the original diagnosis text. The time period between first diabetes diagnosis and first retinopathy diagnosis was calculated. Logistic regression was used to examine associations of potential risk factors with prevalent diabetic retinopathy.

Results There were 12,524 patients with newly diagnosed type 2 diabetes mellitus in the general practices. The mean age was 65 years with slightly more male patients (56%). The prevalence of diagnosed retinopathy was 19.0% (95% CI 18.3%, 19.7%). The median time to first retinopathy diagnosis was 309 (interquartile range 50–693) days. Factors independently associated with retinopathy in multivariate logistic regression were age (OR 1.02 [95% CI 1.01, 1.03] per year of age), male sex (OR 1.11 [95% CI 1.01, 1.22]), HbA_{1c} (OR 1.12 [95% CI 1.02, 1.22] per 1%

[11 mmol/mol] increase), systolic blood pressure (OR 1.03 [95% CI 1.01, 1.05] per 10 units) and antihypertensive drugs. No significant relationships were observed for obesity and diastolic blood pressure.

Conclusions/interpretation Diabetic retinopathy was diagnosed in about one out of five patients with type 2 diabetes during the first year after diabetes diagnosis in UK general practices. Age, male sex, hyperglycaemia and hypertension were identified as risk factors of early retinopathy in type 2 diabetes.

Keywords Diabetes diagnosis · General practices · HbA_{1c} · Retinopathy · Risk factors · Type 2 diabetes

Abbreviations

ATC Anatomical Therapeutic Chemical Classification System
ICD International Classification of Diseases

Introduction

Diabetic retinopathy is one of the leading causes of visual loss [1]. Therefore patients with type 2 diabetes should have an eye examination shortly after the diagnosis of diabetes [2]. There have been many epidemiological studies assessing the prevalence of retinopathy, although few have looked at patients with newly diagnosed type 2 diabetes [3]. Recently, Looker et al examined the prevalence of, and risk factors for, diabetic retinopathy in people with newly diagnosed type 2 diabetes mellitus, using Scottish national data [4]. In their study, a high prevalence (19.3%) of early retinopathy was reported [4]. The aim of the present study was to estimate the prevalence of and risk factors for diabetic retinopathy in newly diagnosed type 2 diabetes in general practices in the UK using a large nationwide database.

K. Kostev (✉)
IMS Health, Epidemiology,
Darmstädter Landstraße 108,
60598 Frankfurt am Main, Germany
e-mail: kkostev@de.imshealth.com

W. Rathmann
Institute of Biometrics and Epidemiology,
German Diabetes Center,
Düsseldorf, Germany

Methods

The Disease Analyzer Database (IMS Health) has been described in detail elsewhere [5]. Briefly, Disease Analyzer UK assembles longitudinal data on diagnoses, prescriptions and laboratory values reported from 674 office-based physicians (97 general practices). The panel of general practitioners in Disease Analyzer UK is broadly representative of the UK population, although there is under-representation of smaller practices and of practices in Scotland and Northern Ireland, and there is a slight over-representation of younger doctors [5]. For the present study, only patients with continuous visits during the observation period (2005–2009) were included in the analysis, defined as one or more visits each half year. Then all patients with type 2 diabetes were identified on the basis of International Classification of Diseases (ICD-10) codes (E11) (www.who.int/classifications/icd/en/). Finally, patients with diabetes duration <1 year in the age group >40 years were selected. For each study subject, age, sex, diabetes duration, BMI, HbA_{1c}, and systolic and diastolic blood pressure were assessed. In addition, antihypertensive drug prescriptions were assessed on the basis of Anatomical Therapeutic Chemical Classification System (ATC) codes (http://www.whocc.no/atc_ddd_index/; C03, diuretics; C07, β -blockers; C08, calcium antagonists; C09, ACE inhibitors). Presence of retinopathy was defined on the basis of the ICD code (E11.3) or on the original diagnosis text of the physicians. The time period between first diabetes diagnosis and first retinopathy diagnosis was calculated for each patient.

Descriptive analyses were obtained for all variables, and mean \pm SD for normally distributed variables and median

(interquartile range) for continuous variables not normally distributed were calculated. Univariate and multivariate logistic regression was used to examine associations of potential risk factors with prevalent diabetic retinopathy. The level of statistical significance was 5%. All analyses were carried out using SAS, version 9.2 (SAS Institute, Cary, NC, USA).

Results

There were 12,524 patients with newly diagnosed type 2 diabetes mellitus in the general practices. The mean age was 65 years with slightly more male patients (56%). Overall, antihypertensive drugs were commonly prescribed, with a higher prescription prevalence in diabetic patients with retinopathy (75.8% vs 69.6%; $p<0.001$). The prevalence of diagnosed retinopathy was 19.0% (95% CI 18.3%, 19.7%). The median time to first retinopathy diagnosis was 309 (interquartile range 50–693) days.

In univariate logistic regression, age, HbA_{1c}, systolic blood pressure and antihypertensive drug prescriptions were significantly related to presence of diabetic retinopathy (Table 1). Factors independently associated with retinopathy in multivariate logistic regression analyses were age (OR 1.02 [95% CI 1.01, 1.03] per year of age), male sex (OR 1.11 [95% CI 1.01, 1.22]), HbA_{1c} (OR 1.12 [95% CI 1.02, 1.22] per 1% [11 mmol/mol] increase), systolic blood pressure (OR 1.03 [95% CI 1.01, 1.05] per 10 units) and antihypertensive drug prescriptions (OR 1.37 [95% CI 1.24, 1.52]) (Table 1). No significant relationship was observed for obesity and diastolic blood pressure.

Table 1 Characteristics of patients with type 2 diabetes in general practices in the UK (Disease Analyzer Database) stratified by retinopathy status

Characteristic	All	No diabetic retinopathy	Diabetic retinopathy	OR ^a (95% CI)	
				Univariate	Multivariate
<i>n</i>	12,524	10,139	2,385	–	–
Male sex (%)	56.4	56.1	58.0	1.08 (0.99, 1.18)	1.11 (1.01, 1.22)
Age (years)	65.3 \pm 13.1	65.1 \pm 13.2	66.3 \pm 12.8	1.01 (1.01, 1.01)	1.02 (1.01, 1.03)
BMI (kg/m ²) ^b	31.6 \pm 6.6	31.7 \pm 6.6	31.4 \pm 6.6	0.91 (0.83, 1.01)	1.00 (0.99, 1.01)
HbA _{1c} (%) ^c	7.9 \pm 1.9	7.8 \pm 1.9	8.1 \pm 2.0	1.07 (1.04, 1.10)	1.12 (1.02, 1.22)
HbA _{1c} (mmol/mol) ^c	63.0	62.0	65.0	–	–
Systolic BP (mmHg) ^d	141.6 \pm 20.4	141.3 \pm 20.2	142.6 \pm 20.7	1.03 (1.01, 1.06)	1.03 (1.01, 1.05)
Diastolic BP (mmHg) ^d	82.6 \pm 12.4	82.6 \pm 12.3	82.5 \pm 12.7	0.99 (0.96, 1.03)	1.02 (0.99, 1.06)
Antihypertensives (%) ^e	70.7	69.6	75.8	1.34 (1.21, 1.49)	1.37 (1.24, 1.52)

Data are mean \pm SD or proportion (%)

^a ORs were computed using multiple logistic regression (dependent variable, retinopathy status) including all variables

^b ORs for BMI are given for obese vs non-obese (BMI >30 kg/m²)

^c ORs for HbA_{1c} are given per 1% (11 mmol/mol)

^d ORs for blood pressure are given per 10 units

^e ATC: C03, C07, C08, C09

Discussion

Diabetic retinopathy was diagnosed in about one out of five patients with type 2 diabetes during the first year after diabetes diagnosis in UK general practices (2005–2009). This result of the present database study is in line with a current investigation based on national data in Scotland, where 91% of all people newly diagnosed with diabetes have been screened for diabetic retinopathy [4].

The prevalence of retinopathy in newly diagnosed type 2 diabetes is higher than in people with screen-detected diabetes. For example, in the Australian Diabetes, Obesity and Lifestyle Study, retinopathy was present in 6.2% of those with previously undiagnosed diabetes based on an oral glucose tolerance test [3]. Thus, because in the first year after clinical diagnosis about 20% already show evidence of diabetic retinopathy, undetected diabetes is likely to have been present for several years. Recent results of the Prevalence of Diabetic Eye Disease Study (Tayside, Scotland) indicate that the onset of detectable retinopathy occurs 5.8 years (95% CI 4.6, 7.0) before type 2 diabetes diagnosis [6].

The evaluation of risk factors for retinopathy in newly diagnosed diabetes is relevant for prevention of visual impairment [1, 4]. Population-based studies and clinical trials have demonstrated that poor glycaemic and blood pressure control are key risk factors for the development of retinopathy [3, 4, 7]. Also male sex has been reported as a risk factor in some studies [4, 8]. The present study confirms these associations. HbA_{1c}, systolic blood pressure, antihypertensive drug prescriptions and male sex were all independently related to the odds of having diabetic retinopathy in multivariate analyses. In contrast with the study by Looker et al, we found a significant relationship with age [4]. Furthermore, we could not replicate the finding of the Scottish study that lower BMI was associated with retinopathy [4]. In the present study, obesity was not related to retinopathy. This lack of an association is most likely due to the fact that most of the patients with type 2 diabetes were obese. Overall, the evidence supporting a relationship between anthropometry risk factors and retinopathy in type 2 diabetes is inconclusive [7]. Both a higher risk of retinopathy in obese people as well as a protective role for higher BMI has been reported [7, 9].

It should be noted that retrospective primary care database analyses such as the present study are limited by the validity and completeness of data. Assessment of morbidity relied on ICD codes by primary care physicians only. In particular, no information was available on how the retinopathy was diagnosed (e.g. fundus photographs, fundus examinations). Furthermore, valid data on socioeconomic status and lifestyle-related risk factors (smoking,

alcohol, physical activity) were lacking. Finally, although guidelines request screening for retinopathy in newly diagnosed diabetes, the present prevalence estimate is only based on those subjects who had been referred for an eye investigation.

In conclusion, the prevalence of any diabetic retinopathy in patients with type 2 diabetes newly diagnosed in general practices in the UK was 19%. This estimate is lower than those reported in the past (e.g. the United Kingdom Prospective Diabetes Study), but is higher than those from population-based screening [3, 10]. Age, male sex, high systolic blood pressure and hyperglycaemia (HbA_{1c}) were identified as risk factors for early retinopathy in type 2 diabetes.

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Contribution statement Both authors made substantial contributions to the conception and design, analysis and interpretation of data as well as to the drafting and revising the manuscript. In detail, KK undertook the primary data analysis, and WR drafted the article. Both authors approved the final version of the manuscript.

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