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Prevalence of referable, sight-threatening retinopathy in type 1 diabetes and its relationship to diabetes duration and systemic risk factors

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Learning Objectives

Upon completion of this activity, participants will be able to:

1. Assess the prevalence of diabetic retinopathy (DR) in a well-defined UK cohort of patients with type 1 diabetes mellitus
2. Identify potential risk factors for proliferative DR and diabetic maculopathy, based on findings from that UK cohort
3. Determine the clinical implications of findings regarding DR screening in persons with type 1 diabetes

Authors/Editors disclosure information

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CLINICAL STUDY

Prevalence of referable, sight-threatening retinopathy in type 1 diabetes and its relationship to diabetes duration and systemic risk factors

AN Warwick[1], AP Brooks[2], C Osmond[3] and R Krishnan[1]

Abstract

Purpose **The purpose of the study was to provide contemporary estimates for diabetic retinopathy (DR) prevalence in a well-defined UK cohort of patients with type 1 diabetes (T1DM) and investigate potential risk factors for proliferative diabetic retinopathy (PDR) and diabetic maculopathy.**

Patients and Methods **Four hundred and sixty four T1DM patients in North Hampshire had T1DM duration, demographic and systemic risk factor data evaluated retrospectively alongside their DR status in 2010 using logistic regression analysis.**

Results **Overall prevalence of any retinopathy, PDR, and maculopathy was 71.5%, 6.5%, and 10.8%, respectively. PDR and maculopathy prevalence were 0 and 0.7% for <10 years T1DM duration. PDR prevalence was 4%, 8%, and 16% for 10–19.9 years, 20–29.9, years and ≥30 years duration, respectively. Maculopathy prevalence was 15.6%, 18%, and 11% for 10–19.9 years, 20–29.9 years, and ≥30 years duration, respectively. In univariate analysis, PDR was associated with T1DM duration (odds ratio (OR) 1.07/year), age (OR 1.03/year), systolic blood pressure (OR 1.03/mmHg), and antihypertensive therapy (OR 10.63), while maculopathy was associated with duration (OR 1.03/year) and statin therapy (OR 2.83). In multivariate analysis, disease duration (OR 1.07/year) and antihypertensive therapy (OR 6.87) remained significantly associated with PDR, and maculopathy with statin therapy (OR 2.27).**

Conclusion **This study confirms T1DM duration is a strong risk factor for sight-threatening DR. Maculopathy and PDR prevalence within 10 years of T1DM diagnosis is very low. PDR prevalence at 10–20 years was 4% and then doubled for every 10-year interval thereafter up to 16% with ≥30 years duration. Antihypertensive therapy and statin therapy were strongly associated with PDR and maculopathy, respectively.**

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Introduction

Diabetic retinopathy (DR) is an important complication of diabetes and the second most common cause of certifiable blindness in the working age population.[1] It is thought to develop following compromise of the retinal microvascular circulation and can ultimately threaten sight. Early detection through screening can help preserve vision.

The works of Klein *et al*[2,3] published in 1984 gave some of the first estimates for prevalence and natural progression of DR in a large screening population. Their study population were individuals diagnosed with diabetes in Wisconsin USA who were involved in their innovative screening programme. Patients were divided into those under 30 years of age at diagnosis of diabetes and on insulin (group 1) and those over 30 years of age at diagnosis either on insulin or on tablet treatment (group 2). Group 1 is likely to be predominantly, but perhaps not exclusively, type 1 diabetes mellitus (T1DM). The overall prevalence for DR and proliferative diabetic retinopathy (PDR) in group 1 were 70.7% and 25.7%, respectively. Disease duration was identified as a significant risk factor for severe disease with rates of PDR

increasing from 1.2% in patients with T1DM for <10 years to 67% in those diagnosed with diabetes for 35 years or more.[2]

Although the treatment of diabetes has changed significantly since these seminal papers, current prevalence studies for DR in T1DM alone are scarce. There is a particular paucity of data from the UK in global systematic reviews.[4,5] In 2002, Younis *et al*[6] published the first major UK study of DR prevalence in T1DM individuals at entry into a retinal screening programme. In 2015, Thomas *et al*[7] also reported the prevalence of DR in a large community-based screening programme. While their studies also found a strong association between duration of disease and severe DR, the relationship between diabetes duration with diabetic maculopathy and PDR specifically were not investigated. Moreover data on modifiable systemic risk factors were not included.

This study aims to provide a contemporary estimate of the prevalence of DR of all grades, in a UK cohort of T1DM Caucasian patients using data collected by the Southampton Diabetic Eye Screening Programme. Rather than making any assumptions based on age at diagnosis, these patients were diagnosed with T1DM by a consultant diabetologist.[8] A further aim of this study was to investigate the associations between PDR and maculopathy with potential risk factors: age, gender, duration of disease, blood pressure, cholesterol, urine albumin to creatinine ratio (ACR), glycaemic control, and smoking history.

Materials and methods

Study population

The Winchester Cohort comprises 750 Caucasian patients with T1DM of both sexes and all ages who attended regional secondary care diabetes clinics between 1983 and 2010. This represented 90–95% of all people with T1DM from 12 local postcodes. The full epidemiology of the Winchester Cohort has been described elsewhere.[8] The clinical diagnosis of T1DM was made by consultant physicians specialising in diabetes. Clinical data were recorded on the secondary-care diabetes clinic database at each clinic visit. The Southampton Diabetic Eye Screening Programme (DESP) comprises of ~43 000 patients and covers the cohort in this study. It is part of the NHS DESP[9] and therefore holds information regarding the DR status of these individuals either from screening visits or annual information provided from hospital eye units for those patients under hospital care for DR. Data including DR status and visual acuity were collected from the Southampton Diabetic Eye Screening service for patients from the Winchester Cohort between 1 January 2010 and 31 December 2010.

Methods

Best corrected visual acuity was measured using Bailey–Lovie LogMAR charts. Following mydriasis secondary to instillation of G. tropicamide 1%, two digital photographs of each eye were taken, one centred on the macula and one centred on the optic disc. The screening episodes including images are uploaded daily onto the screening software database (Optomize, EMIS Health, Leeds, UK) and graded. The average visual acuity of both eyes was calculated. Contemporaneous data on blood pressure, %HbA1c, urine ACR, total serum cholesterol, smoking history (previous or current), and antihypertensive or statin use were identified for the Winchester T1DM cohort from the secondary-care diabetes clinic database.

Grading

Grading of retinal photographs was performed according to the NHS DESP grading system.[10] The diabetic retinopathy (R) and maculopathy (M) grading used by the DESP is based on a simplified version of the Early Treatment of Diabetic Retinopathy Study (ETDRS) clinical classification.[11] 'R0' denotes no DR (ETDRS 10), 'R1' background DR (ETDRS 20–35), 'R2' pre-proliferative DR (ETDRS 43–53), and 'R3' proliferative DR (ETDRS $\geq$61). The absence or presence of referable maculopathy is denoted by 'M0' or 'M1', respectively. Grading was based on non-stereoscopic colour photographs, M1 grading indicating the presence of hard exudates within 1 disc diameter of the fovea and/or microaneurysms within 1 disc diameter of the fovea with a visual acuity of 0.3 LogMAR (6/12) or worse. M1 is therefore not necessarily always equivalent to oedema although these are surrogate markers suggestive of the presence of central macular oedema.

Grading is performed either by trained and accredited graders or ophthalmologists specialising in medical retina. Grading outcomes are recorded on the Optomize software database (Optomize, EMIS Health). Patients who are referred to hospital eye units are required to feed back the retinopathy (R and M) grades of each eye on at least an annual basis and this is recorded on Optomize. If this data is not provided, the patient is recalled to screening.

Where different levels of disease were present between two eyes from the same patient, those readings from the more severely affected eye were taken as the overall grade to enable analysis.

Statistics

The prevalence of retinopathy and maculopathy was calculated with 95% confidence intervals (CI). Associations between PDR (R3) and maculopathy (M1) with patient age, gender, duration of diabetes, systolic blood pressure, %HbA1c, urine ACR, serum cholesterol, smoking history, antihypertensive, and statin use were analysed using univariate logistic regression. Patient age, gender, and other factors showing a significant association with R3 or M1 were then incorporated into a multivariate logistic regression model. Adjusted odds ratios (OR) with 95% CI's were calculated. Complete data were available for DR grade, patient age, gender, duration of diabetes, and visual acuity. Where some data were missing for other risk factors we used imputation to enable statistical analysis. All tests were two-sided and $P<0.05$ was considered statistically significant. Statistical analyses were performed using SPSS software (Armonk, New York, NY, USA) and performed in conjunction with a statistician.

Table 1 Baseline demographic and clinical characteristics of study group

Total	464
Duration of diabetes/years [464]	17 (8–29)
Age/years [464]	43 (31–54)
Age at diagnosis/years [464]	21 (11–32)
Male/% [464]	53.4
Visual acuity/LogMAR [464]	0.10 (0.0–0.10)
Systolic blood pressure/mm Hg [372]	127.5 ± 15.7
Glycosylated haemoglobin (%HbA1c) [371]	8.4 ± 1.5
Urine albumin:creatinine/mg/mmol [250]	0.5 (0.3–1.0)
Total cholesterol/mmol/l [327]	4.6 ± 0.9
Antihypertensive use/% [383]	17.5%
Statin use/% [337]	32.0%
Smoking history/% [437]	24.5%

Numbers in square brackets denote number of patients for whom data were available for covariate of interest. Data presented as mean ± SD, median (interquartile range), and percentages.

Results

Patient demographics and clinical characteristics

From the Winchester T1DM Cohort, 464 attended for DR screening in Southampton or had data recorded from the hospital eye units between January 2010 and December 2010. The baseline demographics and potential risk factor data for DR in T1DM are shown in Table 1.

The prevalence (95% CI's) of any DR, PDR alone (R3), significant maculopathy alone (M1), or referable retinopathy (M1 or R3, or R2) for the whole cohort, as well as subdivided by disease duration, can be seen in Table 2. All patients with maculopathy concurrently had some degree of retinopathy (R1-R3).

Diabetes duration, age, and gender

Proliferative diabetic retinopathy Increased duration of T1DM and older age, but not gender, were associated with PDR in univariate analysis (Table 3). Multivariate analysis however showed only diabetes duration to be a significantly associated risk factor for PDR. While no patients diagnosed with diabetes for <10 years had PDR, 4.1% of those with 10–19.9 years diabetes duration had PDR and this proportion doubled with every additional 10 years up to 15.7% for patients diagnosed with diabetes ≥30 years ago (Figure 1, Table 2). This was equivalent to an adjusted OR of 2.06 (95% CI 1.43–3.00; $P<0.001$) per 10 years of diabetes duration.

Table 2 Diabetic retinopathy grades according to worst affected eye at screening, age, and visual acuity for all 464 patients with type 1 diabetes mellitus, as well as subdivided by duration of disease

	Total type 1 diabetes mellitus cohort (n = 464)	*Duration of type 1 diabetes mellitus*			
		0–9.9 years (n = 134)	*10–19.9 years (n = 122)*	*20–29.9 years (n = 93)*	*≥30 years (n = 115)*
Retinopathy grade (% (95% CI))					
R0M0	28.5 (24.3–32.6)	61.2 (52.8–69.6)	23.0 (15.4–30.6)	12.9 (6.0–19.8)	8.7 (3.5–13.9)
R1	61.6 (57.2–66.1)	38.8 (30.4–47.2)	68.0 (59.6–76.4)	72.0 (62.8–81.3)	73.0 (64.8–81.3)
R2	3.4 (1.8–5.1)	0 (NA)	4.9 (1.0–8.8)	7.5 (2.1–13.0)	2.6 (0.5–7.4)
R3	6.5 (4.2–8.7)	0 (NA)	4.1 (0.5–7.7)	7.5 (2.1–13.0)	15.7 (8.9–22.4)
M1	10.8 (7.9–13.6)	0.7 (0–4.1)	15.6 (9.0–22.1)	18.3 (10.3–26.3)	11.3 (5.4–17.2)
Referable (R2/R3/M1)	16.4 (13.0–19.8)	0.7 (0–4.1)	18.9 (11.8–25.9)	24.7 (15.8–33.7)	25.2 (17.2–33.3)
Age/years (mean (SD))	43.0 (16.9)	30.5 (14.8)	41.7 (15.5)	47.0 (12.8)	55.9 (12.2)
Visual acuity/LogMAR (median (IQR))	0.10 (0–0.10)	0.05 (0–0.10)	0.08 (0–0.10)	0.10 (0.05–0.15)	0.10 (0.05–0.15)

Abbreviations: CI, confidence interval; IQR, interquartile range; M1, no maculopathy; R0M0, no retinopathy or maculopathy; R1, background; R2, pre-proliferative; R3, proliferative.

Table 3 Univariate and multivariate logistic regression analysis for associations between potential risk factors with the presence of proliferative diabetic retinopathy and diabetic maculopathy at baseline in patients with type 1 diabetes mellitus

	Proliferative retinopathy			*Maculopathy*		
	Odds ratio	*95% confidence interval*	P-*value*	*Odds ratio*	*95% confidence interval*	P-*value*
Univariate analysis						
Duration of diabetes	1.07/year	1.04–1.10	<0.001***	1.03	1.01–1.05	0.015*
Age at screening	1.03/year	1.00–1.05	0.019*	1.02	1.00–1.04	0.058
Male *vs* female	1.54	0.73–3.26	0.254	0.68	0.37–1.23	0.201
Systolic blood pressure	1.03/mmHg	1.00–1.05	0.041*	1.02	1.00–1.04	0.062
%HbA1c	1.21/%HbA1c	0.95–1.56	0.130	1.09	0.88–1.34	0.435
Urine albumin:creatinine	1.12/mg/mmol	0.97–1.28	0.113	0.87	0.61–1.23	0.426
Total cholesterol	0.95/mmol/ml	0.57–1.60	0.853	0.84	0.55–1.28	0.409
Antihypertensive use	10.63	4.06–27.85	<0.001***	1.87	0.89–3.96	0.100
Statin use	2.49	0.98–6.33	0.054	2.83	1.42–5.67	0.003**
Smoking history	1.69	0.73–3.91	0.220	1.10	0.55–2.21	0.789
Multivariate analysis						
Duration of diabetes	1.07/year	1.02–1.11	0.002**	1.02	0.99–1.05	0.166
Age at screening	0.97/year	0.94–1.00	0.085	1.00	0.98–1.02	0.973
Male *vs* female	1.82	0.81–4.10	0.150	0.68	0.37–1.25	0.212
Systolic blood pressure	1.00/mmHg	0.97–1.04	0.827	—	—	—
Antihypertensive use	6.87	2.03–23.3	0.002**	—	—	—
Statin use	—	—	—	2.27	1.05–4.90	0.037*

n = number of patients with available data for covariate of interest. **P*-value of <0.05, ***P*-value of <0.01, ****P*-value of <0.001.

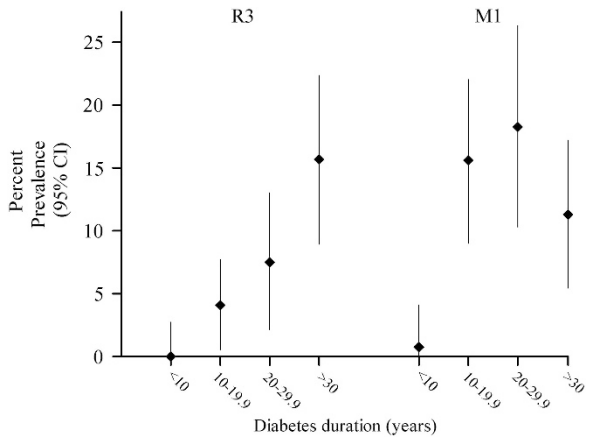

Figure 1 The trend in prevalence of proliferative diabetic retinopathy (R3) and maculopathy (M1) with increasing duration of diabetes.

Diabetic maculopathy Duration of T1DM was significantly associated with maculopathy in univariate analysis, however this did not remain significant in multivariate analysis (Table 3). Age and gender were not associated with maculopathy. The overall prevalence of referable maculopathy (M1) at screening was 10.8%. Only one patient with T1DM duration <10 years had M1. The prevalence of maculopathy rose to 15.6% by 10–19.9 years duration, increased further to 18.3% by 10–29.9 years, then declined to 11.3% for duration more than 30 years (Figure 1, Table 2).

Visual acuity

The average visual acuity was 0.1 LogMAR. Visual acuity slightly deteriorated with increasing duration of T1DM (Table 2) although this was not statistically significant. About 98.3% of all patients had visual acuity equal to or better than 0.3 LogMAR (6/12 Snellen) in their better-seeing eye.

Potential systemic risk factors

Proliferative diabetic retinopathy Univariate analysis showed significant associations between PDR and systolic blood pressure and those on antihypertensive medication. There was no significant correlation between %HbA1c, urine ACR ratio, serum cholesterol, statin use, or smoking history (Table 3). In multivariate analysis, only antihypertensive medication use remained significantly associated with PDR.

PDR was also significantly associated with patients for whom data on antihypertensive medication were missing due to missed diabetic clinic appointments, both in univariate and multivariate analysis ($n = 81$, OR 7.08, 95% CI 2.52–19.88; $P < 0.001$).

Diabetic maculopathy Of all the systemic risk factors investigated, only statin use was associated with diabetic maculopathy. This remained significant in both univariate and multivariate analysis (Table 3).

Discussion

This study provides prevalence rates for DR and maculopathy in a well-defined cohort of Caucasian T1DM patients, as graded by UK national screening programme criteria. Furthermore, this study also includes data on systemic modifiable risk factors and their correlation to DR. The overall prevalence in 2010 for any retinopathy, PDR, and maculopathy was 71.5%, 6.5%, and 10.8%, respectively. The average visual acuity remained good at all durations of T1DM and more than 98% of patients had visual acuity equal to or better than 0.3 LogMAR in their better-seeing eye. 0.3 LogMAR approximates to the legal visual acuity requirement for holding a UK driving license.

Prevalence estimates for DR vary considerably, ranging from 36.5 to 93.6% for any DR in Europe and the USA.[12] A recent meta-analysis estimated the global prevalence of any DR and PDR in T1DM to be 77.3% and 32.4%, respectively.[4] Overall, the prevalence of DR in our cohort was lower than the global average and closer to that found by previous UK studies (Table 4). A landmark UK report of DR prevalence was the Liverpool Diabetic Eye Study in 2002.[6] For 831 T1DM patients, the baseline prevalence of any retinopathy, PDR and sight-threatening maculopathy was 45.7%, 3.7%, and 12.3%, respectively. More recently, Thomas *et al*[7] investigated the prevalence of DR in 5003 T1DM patients at first screening in Wales. The prevalence of any retinopathy, PDR, and maculopathy was 56.2%, 2.6%, and 4.2%, respectively. The mean durations of disease for their studies were shorter than ours, which may partly account for the higher DR prevalence observed in our cohort. Furthermore, our sample differed by the inclusion of patients with referable disease under hospital eye services as well as those under the screening service, giving a truer picture of overall prevalence.

Consistent with previous studies, we found duration of diabetes to be strongly associated with PDR. Although univariate analysis showed both age and disease duration to be correlated with PDR, only disease duration remained significant in multivariate analysis. This implies that age in itself is not a risk factor. We also investigated the natural histories of PDR and maculopathy separately. The prevalence of both PDR and maculopathy was rare in the first 10 years of disease and subsequently increased. However, while PDR doubled in prevalence with every additional 10 years duration up to 15.7% for ≥ 30 years of T1DM, maculopathy prevalence rose to 15.6% for 10–19.9 years duration and remained relatively stable thereafter. This may explain why the correlation between disease duration and maculopathy did not remain statistically significant in multivariate analysis. It is also important to note that all patients with maculopathy also had some concurrent degree of retinopathy. Therefore while not completely independent of one another, these two forms of more advanced DR appear to have distinct natural histories.

A secondary aim of this study was to investigate associations between PDR and diabetic maculopathy with putative modifiable risk factors. Smoking history was not associated with severe DR, as previously shown by others.[13,14] Gender was also not associated, in keeping with a recent global meta-analysis, which found similar rates of DR in males and females.[4] Although we did not find associations between DR with urine ACR and HbA1c, several other studies have shown these to be risk factors for DR.[12] It is possible that our study may have been underpowered to detect these associations, that spot readings might not adequately reflect long-term control, or that they may be more strongly linked to DR progression than prevalence.[15]

The use of antihypertensive medications was significantly associated with PDR but not diabetic maculopathy. PDR and systolic blood pressure were significantly associated in univariate analysis, although this did not remain significant in multivariate analysis. Antihypertensive medication may more accurately represent hypertension status and suggests treated hypertension is still a significant risk factor for PDR. It is interesting that those patients for whom blood pressure readings were unavailable, due to missed appointments, had a significant higher prevalence of PDR. This small group of patients were likely to be poor attenders to medical follow-up and therefore at greater risk of suboptimal diabetes control. A number of

Table 4 Summary table comparing UK studies of diabetic retinopathy prevalence

	Study period	n	*Male (%)*	*Mean age*	*Mean duration of T1DM*	*Prevalence*		
						Any DR (%)	*Proliferative DR (%)*	*Maculopathy (%)*
Younis *et al*[6]	1991–1999	831	58.9	33 years	12.8 years	45.7	3.7	12.3
Thomas *et al*[7]	2005–2009	5003	54.7	37 years	16.7 years	56.2	2.6	4.2
Winchester Cohort	2010	464	53.4	43 years	19.5 years	71.5	6.5	10.8

Abbreviations: DR, diabetic retinopathy; T1DM, type 1 diabetes mellitus.

previous epidemiological studies have identified hypertension as a risk factor for DR.[4,12] The evidence for treating hypertension to reduce DR risk is weaker however and unlike hyperglycaemia, any beneficial effect appears to diminish quickly after cessation of intensive treatment.[16] A recent Cochrane review found no reduction in risk of DR progression with intensive blood pressure control, although there was a modest reduction in incidence.[17]

We found no correlation between total cholesterol levels and DR. However we did find the use of statins, implying a clinical diagnosis of hypercholesterolaemia, to be associated with diabetic maculopathy. Previous reports of dyslipidaemia in diabetes have not consistently identified a single lipid measure as a risk factor for DR.[18] A recent meta-analysis found a strong association between lipid levels and diabetic macular oedema, although this was not confirmed when only including prospective randomised control trials.[19] Although some studies have shown fenofibrate as having some benefit in diabetic macular oedema, statins remain first line as a lipid-lowering agent in T1DM and correspondingly fenofibrate was only used in one patient in the cohort.

There is ongoing national debate regarding diabetic retinal screening intervals, which are currently annual, varying according to risk of progression. In this study, those with a diagnosis of T1DM for <10 years and not on antihypertensive or statin treatment appear to be at lower risk of sight-threatening DR and may be suitable for less frequent screening. It may furthermore be safe to defer screening for some years following diagnosis in T1DM. The significant association between being on antihypertensive medication and PDR in our study suggests increasing the screening interval beyond the present annual standard might not be advisable in these patients. Likewise, those patients on a statin appear to have increased risk of maculopathy, suggesting screening intervals in this group should not be increased. However, it is vital that these findings are corroborated in larger studies before any recommendations for screening intervals can be made.

In summary, this study provides contemporary estimates of DR prevalence in the UK for T1DM. Disease duration is confirmed as a major risk factor for DR and the distinct natural histories of PDR and diabetic maculopathy are illustrated with relation to duration of T1DM. Antihypertensive treatment was significantly associated with PDR while statin therapy was associated with maculopathy, suggesting differences in pathophysiology underlying these two forms of potentially sight-threatening DR. Further T1DM studies of DR progression and larger current studies looking at T1DR prevalence in relation to systemic and other factors are needed to assist in categorising risk of sight-threatening DR, which may have important implications for redefining diabetic retinal screening intervals in the UK.

Summary

What was known before

- Diabetic retinopathy is an important complication of diabetes and the second most common cause of certifiable blindness in the working age population.
- Recent prevalence studies on diabetic retinopathy in type 1 diabetes are scarce and there is a particular paucity of data from the UK.

What this study adds

- This study provides contemporary estimates of diabetic retinopathy prevalence in the UK for type 1 diabetes.
- The natural histories of proliferative diabetic retinopathy and diabetic maculopathy (sight-threatening disease) appear to be distinct.
- Proliferative diabetic retinopathy was associated with antihypertensive therapy, whereas diabetic maculopathy was associated with statin therapy.

Conflict of interest

The authors declare no conflict of interest.

Author contributions

A Brooks created the list of patients comprising the Winchester Cohort, as described in the methods section, and also collected all data excluding diabetic retinopathy status and visual acuity. A Brooks and R Krishnan collaborated to design this study and A Warwick collected diabetic retinopathy status and visual acuity data for the cohort. A Warwick performed the data analysis with guidance from C Osmond. R Krishnan, A Brooks, and C Osmond reviewed and revised the manuscript drafted initially by A Warwick.

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Medscape EDUCATION

Prevalence of referable, sight-threatening retinopathy in type 1 diabetes and its relationship to diabetes duration and systemic risk factors

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1. Your patient is a 47-year-old man with type 1 diabetes mellitus. According to the cohort study by Warwick and colleagues, which of the following statements about the prevalence of diabetic retinopathy (DR) in a well-defined UK cohort of patients with type 1 diabetes is correct?

   A Overall prevalence was 71.5% for retinopathy, 6.5% for proliferative DR, and 10.8% for maculopathy
   B Maculopathy prevalence at 10–20 years was 4% and then doubled for every 10-year interval thereafter up to 16% with a type 1 diabetes duration of at least 30 years
   C Prevalence of proliferative DR was 6% for type 1 diabetes duration of <10 years
   D Prevalence of proliferative DR rose to 15.6% for type 1 diabetes duration of 10–19.9 years and remained relatively stable thereafter

2. According to the cohort study by Warwick and colleagues, which of the following statements about potential risk factors for proliferative DR and diabetic maculopathy is correct?

   A Antihypertensive therapy was strongly associated with maculopathy
   B Statin therapy was strongly associated with proliferative DR
   C In multivariate analysis, type 1 diabetes duration was significantly associated with proliferative DR (odds ratio (OR), 1.07 per year)
   D In univariate and multivariate analyses, systolic blood pressure was significantly associated with maculopathy

3. According to the cohort study by Warwick and colleagues, which of the following statements about the clinical implications of findings regarding DR screening in persons with type 1 diabetes is correct?

   A Patients with a diagnosis of type 1 diabetes for <10 years and are not receiving antihypertensive or statin drugs should have DR screening twice yearly
   B Patients with type 1 diabetes may be screened for DR less frequently if they are receiving antihypertensive medication
   C Patients with type 1 diabetes may be screened for DR less frequently if they are receiving statins
   D Findings of this study need to be confirmed in larger studies before any recommendations for screening intervals can be made

Activity evaluation

1. The activity supported the learning objectives.

Strongly disagree				Strongly agree
1	2	3	4	5

2. The material was organised clearly for learning to occur.

Strongly disagree				Strongly agree
1	2	3	4	5

3. The content learned from this activity will impact my practice.

Strongly disagree				Strongly agree
1	2	3	4	5

4. The activity was presented objectively and free of commercial bias.

Strongly disagree				Strongly agree
1	2	3	4	5