Association Between Diabetes, Level of Glycemic Control, and Eye Infection: A Cohort Study

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Infections of the eyelids, nasolacrimal duct, conjunctiva, and corneal surface and infectious keratitis have all been suggested to occur more frequently in people with diabetes (1,2). However, despite the widespread assumption that people with diabetes are more susceptible to eye infections (3), there is a paucity of systematically collected data to support these assertions. A recent review of observational studies and clinical trials demonstrated a correlation between poor glycemic control and increased risk of a wide variety of infections in people with diabetes (4). We explored whether infectious disease affecting the external eye and surrounding structures is associated with diabetes and if poor glycemic control increases risk of ocular infection in the population with diabetes.

A two-stranded study was carried out using data from the Royal College of General Practitioners Research and Surveillance Centre database. The two strands consisted of *1*) a whole population cohort study to investigate the frequency of eye infections in people with diabetes compared with those without diabetes and *2*) a cohort study in a population with diabetes to investigate the impact of glycemic control on eye infection rates in people with diabetes. We measured incident infections over 6 years (1 January 2010 to 31 December 2015). Two measures of glycemic control were analyzed: single HbA_{1c} measurement and area under the HbA_{1c} curve during the 6-year period. Other variables examined included age, sex, ethnicity, smoking status, BMI, diagnosis of connective tissue disorder, diagnosis and stage of retinopathy, and presence of maculopathy.

We developed logistic regression models to determine infection risk in a total population of 938,440 without diabetes and 48,584 people with diabetes (3,273 with type 1 diabetes and 45,311 with type 2 diabetes). After adjustment for confounders and amendment of *P* values for multiple comparisons using the Bonferroni and Šidák corrections (5,6), type 1 and type 2 diabetes were associated with increased incidence of conjunctivitis (odds ratio [OR] 1.61, 95% CI 1.38–1.88, $P < 0.0001$, and OR 1.11, 95% CI 1.06–1.16, $P < 0.0001$, respectively). No association was found with blepharitis, stye/chalazion, periorbital cellulitis, keratitis/keratoconjunctivitis, lacrimal gland infection, or endophthalmitis. Glycemic control was not found to be associated with any infection. Diabetes was also associated with an increased incidence of antimicrobial prescriptions (for type 1 diabetes: OR 1.69, 95% CI 1.51–1.88, $P < 0.0001$; for type 2 diabetes: OR 1.17, 95% CI 1.13–1.20, $P < 0.0001$) (Table 1).

We found that conjunctivitis occurs more frequently in people with diabetes. The higher incidence of conjunctivitis and prescriptions for ocular antimicrobial agents in people with diabetes may be explained in part by an increased propensity in this population to consult a doctor and to receive prescriptions. Even given this possibility, these data support the hypothesis that conjunctivitis is more common in people with diabetes; however, hyperglycemia does not appear to be a major predisposing factor to ocular infections. We did not find evidence for the common assertion that diabetes is associated with an increased incidence of other eye infections. We also did not find evidence that glycemic control has any influence on the incidence of eye infections.

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Table 1—ORs (95% CI) for eye infections and antimicrobial prescription use, by diabetes type

	Type 1 diabetes (n = 3,273)		Type 2 diabetes (n = 45,311)	
	OR (95% CI)	*P* value	OR (95% CI)	*P* value
Conjunctivitis	1.61 (1.38–1.88)	<0.0001	1.11 (1.06–1.16)	<0.0001
Blepharitis	1.39 (1.06–1.83)	0.0184	1.04 (0.97–1.11)	0.2944
Stye/chalazion	1.13 (0.88–1.45)	0.3458	1.00 (0.92–1.07)	0.9354
Periorbital cellulitis	0.59 (0.08–4.19)	0.5962	0.89 (0.59–1.34)	0.5723
Infectious keratitis/keratoconjunctivitis	2.80 (0.89–8.79)	0.077	1.11 (0.72–1.72)	0.6226
Lacrimal gland infection	1.45 (0.20–10.40)	0.7105	1.12 (0.69–1.84)	0.6449
Endophthalmitis	No cases	No cases	2.81 (1.40–5.62)	0.0036
Prescriptions	1.69 (1.51–1.88)	<0.0001	1.17 (1.13–1.20)	<0.0001
Infections and prescriptions	1.60 (1.44–1.77)	<0.0001	1.15 (1.11–1.18)	<0.0001
All infections combined	1.44 (1.27–1.64)	<0.0001	1.08 (1.04–1.12)	<0.0001

Models adjusted for age, sex, ethnicity, deprivation (measured by the index of multiple deprivation), BMI, and the presence of connective tissue disorders. Population without diabetes (n = 938,440) used as reference in regression models.

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