Nondiabetic retinal pathology

Prevalence in diabetic retinopathy screening

Nathan Nielsen
Claire Jackson
Geoffrey Spurling
Peter Cranstoun

Objective
To determine the prevalence of photographic signs of nondiabetic retinal pathology in Australian general practice patients with diabetes.

Method
Three hundred and seven patients with diabetes underwent retinal photography at two general practices, one of which was an indigenous health centre. The images were assessed for signs of pathology by an ophthalmologist.

Results
Signs of nondiabetic retinal pathology were detected in 31% of subjects with adequate photographs. Features suspicious of glaucoma were detected in 7.7% of subjects. Other abnormalities detected included signs of age related macular degeneration (1.9%), epiretinal membranes (2.4%), vascular pathology (9.6%), chorioretinal lesions (2.9%), and congenital disc anomalies (2.9%). Indigenous Australian patients were more likely to have signs of retinal pathology and glaucoma.

Conclusion
Signs of nondiabetic retinal pathology were frequently encountered. In high risk groups, general practice based diabetic retinopathy screening may reduce the incidence of preventable visual impairment, beyond the benefits of detection of diabetic retinopathy alone.

Keywords: diabetes mellitus; eye diseases; diabetic retinopathy; screening; general practice; health services, indigenous

Retinal photography is an accepted method of screening for diabetic retinopathy (DR), and is especially useful in situations where there are barriers to accessing regular eye care services.[1,2] Utilising general practitioners to conduct such screening may help to increase access for patients in situations where barriers exist. Many patients who attend DR screening will have ocular pathology unrelated to their diabetes, and detecting this may add extra value to the DR screening process.[3] Indeed, the majority of cases of vision loss in patients with diabetes are due to causes other than DR.[4]

The four most common causes of pathological vision loss in Australia are age related macular degeneration (AMD), cataract, chronic open angle glaucoma (COAG), and DR.[5] Age related macular degeneration and COAG have signs that may be visualised on retinal photography.[6,7] They may also have better outcomes when detected and treated early.[8,9] The prevalence of nondiabetic pathologies in patients with diabetes has been examined in several foreign studies.[10–12] Prevalence of COAG ranged from 4.5–6.5%, while AMD prevalence was variable, ranging from 0.1–9.3%.[10–12] At these rates, these conditions would occasionally be encountered at a typical general practice.

While detecting this incidental pathology is advantageous, general practice based DR screening cannot offer the comprehensive eye assessment provided by ophthalmologists and optometrists, and patients should still be referred for such assessment. However, almost one-half of patients with diabetes may not attend regular DR screening, despite being referred by their GP.[13] Indigenous Australians, and those living in low socioeconomic or rural regions, are at even higher risk of nonattendance.[2,14–16] General practice based DR screening may increase accessibility in these groups, potentially stopping them from 'slipping through the cracks'. In these patients, DR screening may also represent the only opportunity to recognise serious nondiabetic ocular pathology before irreversible loss of vision occurs. This is particularly important as recent evidence suggests that in Indigenous Australians, up to 80% of COAG may be undiagnosed.[17]

Method

The study design was observational, involving two general practices: Inala Chronic Disease Management Service (ICDMS), and Inala Indigenous Health Service (IIHS). Inala is a suburb of Brisbane (Queensland) that has a high level of social disadvantage, and for many patients, there are significant barriers to accessing health services.[18]

Subject recruitment was from patients who attended diabetes 'cycle of care' appointments between October 2007 and April 2009. Subjects had to be 18 years of age or older, with capacity, diagnosed with diabetes, and they had to provide informed consent.

Visual acuity (VA) was performed on each patient, and retinal photographs were taken by trained staff using a digital nonmydriatic retinal camera. Mydriatic eye drops were considered if image quality was likely to be poor due to age-related pupil miosis, or suspected ocular media opacity, or if inadequate images were obtained. Images were viewed by a GP, but grading was performed by an ophthalmologist, to provide a 'gold standard' assessment. Ophthalmologists also assessed the adequacy of photographic quality. As pathology could not be excluded

from inadequate photographs, only patients with adequate photographs from both eyes were included in prevalence calculations. Those with inadequate photographs had them repeated, or were referred for comprehensive eye examination to ensure pathology was not missed. Patients with signs of significant pathology were also referred to a local ophthalmologist.

This study focused on identifying signs that were suspicious for pathology, rather than definitive diagnoses. Such diagnoses were often not possible because further diagnostic testing was unavailable. This was particularly relevant for glaucoma, and without access to additional investigations, subjects with suspicious optic nerve or fundus changes were identified as 'glaucoma suspects'.

Statistical analysis was conducted using SAS 9.2.[19] The characteristics of each practice were examined. The prevalence of abnormalities was reported, and comparisons between the two practices were made.

This study was conducted concurrently with another study in which participants agreed to release their photographs for further research.[20]

Ethics approval was obtained from the Princess Alexandra Hospital Human Research Ethics Committee, and the University of Queensland Medical Research Ethics Committee.

Results

In total, 307 patients underwent retinal photography. Some photographs were of inadequate quality, as shown in *Figure 1*. Further analysis was performed on the 209 patients with adequate photographs. Characteristics of the two practices are displayed in *Table 1*. Almost all of the indigenous participants in this study were seen at IIHS.

A significant number of ocular abnormalities were encountered, as summarised in *Table 2*. *Figure 2* shows the age related distribution of nondiabetic retinal pathology at each practice. Patients from IIHS were more likely to show signs of pathology than those from ICDMS (p=0.0003).

Patients from IIHS were also more likely to be considered glaucoma suspects (p=0.03), despite being younger on average. The prevalence of AMD lesions encountered in this study is detailed in *Table 2*. While macular drusen were common, only four cases of established AMD were detected, all of the atrophic form. There was also a notable difference between the two practices in the rate of vascular pathology, with a significantly higher prevalence among patients from IIHS.

Discussion

The most significant finding was the high prevalence of signs of nondiabetic ocular pathology in patients from both practices. These signs were more common than DR itself. This implies that general practice based DR screening may have additional value beyond that achieved by detection of DR alone. It is important that GPs who consider involvement in retinopathy screening are aware of this, and are proficient at both identifying abnormalities, and recognising their implications. While many abnormalities require investigation, some, such as old chorioretinal scars, have no treatment, and may not represent an immediate threat to vision. While these conditions may not require referral, they may be relevant if new symptoms develop, highlighting the need for GPs to have a good understanding of general ocular pathology.

The significantly higher rate of nondiabetic abnormalities at IIHS may indicate that among patients with diabetes, Indigenous Australians may have a higher prevalence of nondiabetic ocular pathology than non-Indigenous Australians. Indigenous patients also seemed to be more frequently identified as glaucoma suspects, despite evidence suggesting that rates of glaucoma may be similar, and that loss of visual acuity from glaucoma is rare in this population.[17,21] There is some evidence that Indigenous Australians have, on average, greater cup-to-disc ratios than non-Indigenous Australians, possibly contributing to the high number identified as glaucoma suspects in this study.[22,23] This issue is important as a large vertical cup-to-disc ratio is an important trigger for referral to specialist services,[24] which may be difficult to access in remote areas. Practitioners should consider underlying risk factors, such as age and family history, when considering referral, or consider sending images for specialist assessment in difficult cases.

The large sample of Indigenous Australians was an important feature of the study because for sociocultural and geographic reasons, many Indigenous Australians are likely to benefit from general practice based DR screening. Recent research has shown this approach to be effective in detection of DR in this group.[25] The high rate of vascular pathology in Indigenous Australians was concerning, as retinal vessel changes have been linked to increased risk of stroke and coronary artery disease.[26] Almost half of the IIHS patients with these changes were less than 50 years of age. Identifying these patients could help GPs to aggressively manage vascular risk factors, possibly preventing or delaying future cardiovascular events.

In this study, prevalence data were obtained

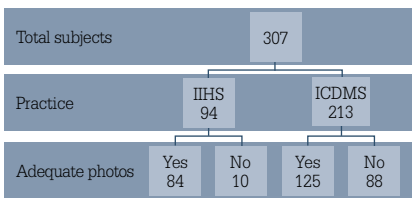

Figure 1. Subject distribution

Table 1. Characteristics for subjects with adequate photographs (95% CI)

Characteristic	Total	IIHS	ICDMS	Significance
Subjects	209	84	125	–
Male (%)	50.2	47.6	52.0	p=0.53 (χ^2=0.39)
Indigenous (%)	41.2	100.0	1.6	p<0.01 (χ^2=200.9)
Abnormal vision* (%)	14.5	14.6	14.4	p=0.96 (χ^2=0.002)
Average age (years)	54.5 (52.8–56.2)	50.3 (47.8–52.7)	57.3 (55.0–59.6)	p<0.01 (t-test=–4.07)

* Subjects with evidence of low vision (VA <6/12 in either eye)

Table 2. Prevalence of abnormalities encountered at each practice

Abnormality	Total (%)	IIHS (%)	ICDMS (%)	Difference* (%)	Significance**
• Diabetic retinopathy	24.9	21.4	27.2	–5.8	p=0.65
• All nondiabetic abnormalities	30.6	41.7	23.2	18.5	p <0.01
• Glaucoma suspects	7.7	13.1	4.0	9.1	p=0.03
• AMD spectrum lesions	12.0	13.1	11.2	1.9	p=0.21
– macular drusen	10.1	11.9	8.7	3.2	
– ARMD (atrophic)	1.9	1.2	2.4	–1.2	
• Vascular pathology	9.6	19.1	3.2	15.9	p<0.01
– hypertensive arteriopathy	7.7	16.7	1.6	15.1	
– branch retinal vein occlusion	1.0	1.2	0.8	0.4	
– old branch retinal vein occlusion	1.4	2.4	0.8	1.6	
– old retinal arterial occlusion	0.5	1.2	0.0	1.2	
• Chorioretinal pathology	2.9	4.8	1.6	3.2	p=0.09
– chorioretinal scar	1.0	1.2	0.8	0.4	
– old central serous retinopathy	1.0	2.4	0.0	2.4	
– choroidal naevi	1.0	1.2	0.8	0.4	
• Optic disc anomalies	2.9	2.4	3.2	–0.8	p=0.76
– tilted disc	1.0	0.0	1.6	– 1.6	
– myelinated nerve fibres	1.4	1.2	1.6	– 0.4	
– disc pallour	0.5	1.2	0.0	1.2	
• Epiretinal membrane	2.4	2.4	2.4	0	p=0.38

* Difference in rates of pathology between the practices

** Significance levels were determined by logistic regression controlling for age

by ophthalmologist assessment. In practice, however, GPs would assess photographs. There is little research regarding GP accuracy in detecting COAG and AMD from retinal photographs. However, there is evidence suggesting that GPs can achieve sufficient accuracy in DR detection.[20] Given appropriate training, this suggests GPs would be able to effectively identify other abnormalities, although additional research would be required to confirm this.

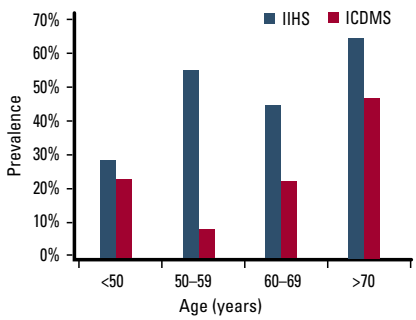

Figure 2. Prevalence of signs of all nondiabetic retinal pathology

Strengths of this study were that the practices involved were good candidates for this screening, yielding results relevant to the target population. Previous studies[10–12] were conducted internationally so their results were not specific to the Australian population. Limitations included the relatively small sample size, and lack of further diagnostic testing, which was unavailable at the practices. Such testing would reveal true disease prevalence rates, as well as information on diagnostic accuracy of retinal photography in this setting. The number of inadequate photographs was also a potential issue. This is most likely explained by initial staff inexperience with the new equipment. However, Spurling et al[25] demonstrated that by repeating photography with experienced staff and judicious use of pupil mydriasis, the proportion of patients with adequate images improved from 70% to 94%.

Conclusion

A significant proportion of retinal photographs from this general practice based DR screening program contained signs that suggest nondiabetic ocular pathology. General practitioners involved in screening must be able to recognise and interpret these abnormalities. Opportunistic detection of pathology may enable early treatment, potentially avoiding cases of preventable blindness in patients with diabetes. This is an important additional advantage of utilising GPs to improve access to DR screening for patients who may not attend conventional eye health services.

Authors

Nathan Nielsen MBBS(Hons), BAppSc(Hons), is Resident Medical Officer, Princess Alexandra Hospital, Brisbane, Queensland. nathan.nielsen@uqconnect.edu.au

Claire Jackson MBBS, FRACGP, MPH, MD, is Professor of General Practice and Primary Health Care, Discipline of General Practice, The University of Queensland

Geoffrey Spurling MBBS, DTM&H, FRACGP, is Senior Lecturer, Discipline of General Practice, University of Queensland

Peter Cranstoun MBBS(Hons), FRANZCO, is an ophthalmologist, Pine Rivers Eye Centre, Brisbane, Queensland.

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correspondence **afp@racgp.org.au**