WORLD VIEW

Diabetic retinopathy in Oman: a hospital based study

R Khandekar, J Al Lawatii, A J Mohammed, A Al Raisi

Br J Ophthalmol 2003;**87**:1061–1064

The magnitude of diabetic retinopathy, its determinants, and coverage of laser treatment for diabetic retinopathy among registered people with diabetes in Oman are presented. 2249 randomly selected subjects representing 5564 registered diabetics were examined. WHO recommended definitions of diabetes, retinopathy, and other related conditions were used. Physicians reported the profile of the diabetes while ophthalmologists reported ocular profile and the eye care provided to them. The prevalence of diabetic retinopathy was 14.39% (95% CI 13.46 to 15.31). Men had significantly higher rate of retinopathy than women. The retinopathy rate was higher in age groups 50–59 years and 60–69 years. The rates of background retinopathy, proliferative retinopathy, and diabetic maculopathy were 8.65%, 2.66%, and 5.12%, respectively. The rate was higher among subjects with longer duration of diabetes than those with a shorter duration. Those with an HbA_{1c} level more than 9% had significantly higher rates of diabetic retinopathy than those with an HbA_{1c} level less than 9%. The retinopathy rate was higher in cases with hypertension, nephropathy, and neuropathy. Of those with diabetic retinopathy who were advised to have treatment at the time of registration, only 20% were treated with laser therapy.

Series editors: W V Good and S Ruit

See end of article for authors' affiliations

Correspondence to: D R Khandekar, Eye Health Care, PO Box 393, Pin 113, Muscat, Oman; rajshpp@omantel.net.om

Accepted for publication 3 March 2003

Diabetic retinopathy is the leading cause of visual disability in the industrialised countries. Changes in lifestyle have increased the risk of diabetes as well as blindness in many developing countries[1] and it is important that organised efforts are undertaken to address eye complications of diabetes. Around 20% of people with diabetes are projected to develop retinopathy. Duration of diabetes, type of diabetes, control of blood sugar, associated systemic conditions, age and sex are found to be associated with retinopathy and its progression.[2] However, reliable information on the magnitude and determinants of ocular manifestations of diabetes in many countries, including Oman, is lacking.

Oman's 2.4 million population has undergone rapid socioeconomic development and lifestyle in the past two decades. There has been a marked decline in communicable diseases and nutritional disorders. Non-communicable diseases, like diabetes, have increased.[3] Owing to obesity, a sedentary lifestyle, smoking, consanguinity, and other factors 10% of the Omani population aged over 20 years have diabetes mellitus,[4] resulting in an estimated 80 000 people with diabetes.[5]

The Ministry of Health has promoted health for all and initiated a comprehensive primary healthcare approach. At nearly 140 primary health institutions, health care is provided free of charge and is accessible even in remote places. Trained physicians identify, register, and manage people with diabetes. In 10 secondary institutions, diabetologists assess people with diabetes annually. The "Diabetes Control Programme" initiated the National Diabetes Registry in 2000 and 27 450 people with diabetes were registered by the end of 2001.[6] From June 2000, a system to refer the registered people with diabetes to the ophthalmologist was introduced at all the health institutions.[3]

Since 1995, 75 ophthalmologists have been managing people with diabetes at 25 institutions using a standard protocol. Facilities for laser treatment are available at six centres and two vitreoretinal specialists provide services at two tertiary centres in the capital, Muscat. It is anticipated that the number of people with diabetes will continue to increase.

A national study was undertaken to review the ocular profile of people with diabetes who were screened before the end of 2001. We present findings on the magnitude and determinants of diabetic retinopathy, the coverage of eye screening, and laser treatment of retinopathy and recommend policies for comprehensive eye care of people with diabetes in Oman.

PATIENTS AND METHODS

This was a cross sectional hospital based descriptive study. The study population included 5564 people with diabetes screened by ophthalmologists to determine the ocular changes of diabetes. To represent this population, 2650 subjects were randomly selected. This number was based on the assumption that 20% of the people with diabetes had retinopathy and that we could achieve an estimate with an acceptable 95% confidence interval of 18.5 to 21.5, and a power of 90. To compensate for clustering the initial sample (n=1204) was doubled and to adjust for loss of data, a further 10% sample was included. The sample was stratified into regional subgroups as per the proportion of the registered people with diabetes in each region. Lists of people with diabetes whose eyes were checked were prepared by region. The regional sample was randomly chosen from these lists and the standardised data collection forms of all sampled subjects were reviewed.

The regional ophthalmologists, optometrists, and physicians were the study staff.

Details including age, sex, referring institution, duration of diabetes, blood sugar and HbA_{1c} levels,

Table 1 Characteristics of the examined sample

	Study population		Examined sample for retinopathy	
	No	%	No	%
Sex				
Male	2537	45.6	895	39.8
Female	3021	54.4	1354	60.2
Age group (n=2137)				
Less than 40 years	847	15.2	477	21.2
40–49 years	1371	24.6	700	31.1
50–59 years	1371	24.6	552	24.5
60–69 years	1532	27.5	411	18.3
70 and above	444	8.0	109	4.8
Region				
Muscat	486	8.7	479	21.3
Dhofar	96	1.7	92	4.1
Dhakhiliya	773	13.9	236	10.5
N Sharqiya	957	17.2	113	5.0
S Sharqiya	340	6.1	253	11.2
N Batinah	1860	33.4	480	21.3
S Batinah	475	8.5	277	12.3
Dhahira	301	5.4	298	13.3
Musundam	276	5.0	21	0.9
National	5564		2249	

associated systemic complications of diabetes (nephropathy, neuropathy, hypertension, hyperlipidaemia, coronary artery diseases, etc) were noted by the referring physicians/diabetologists. All subjects were sent to the ophthalmologists for ocular assessment.

The optometrists tested the vision of each eye separately using Snellen distant vision chart at 6 metres. Ophthalmologists evaluated the anterior segment with a biomicroscope and ocular tension was measured by either applanation or indentation tonometer. The retinal examination (+90 D Valk lens and panretinal indirect ophthalmoscope) was carried out after pupil dilatation. Any positive findings were reconfirmed by senior ophthalmologists. In the presence of pre-proliferative retinopathy, proliferative retinopathy and diabetic maculopathy, laser therapy was proposed. Ophthalmologists of four regions without facilities referred the cases to the nearby ophthalmic units. World Health Organization recommended definitions of diabetic retinopathy, vision, and visual disability (ICD 10) were used.[7]

Before the start of the study a retina specialist and the field staff standardised the criteria of diagnosis and treatment. Physicians were trained in accurate record keeping and the data collection form and methodology were pretested in two regions. Mid-level programme managers supervised study activities.

Data were collected in the regions and forwarded to Muscat and a pretested EPI6 format was used for computing the data. Univariate analysis was carried out using SPSS 9 and frequencies, percentage proportion of retinopathy were calculated. The rates were adjusted for the age, sex, and regions. The percentage proportion of age groups and sex previously reported[8] served as the reference. 95% Confidence intervals were estimated and odds ratios and χ^2 values were also calculated.

The consent of the Ministry of Health to use the health records was obtained. The study outcomes were discussed with the members of the national eye healthcare committee and were distributed to the regions. The results were used to improve the care of people with diabetes and their eye complications. Those having ocular complications were given free of charge care.

It should be noted that the people with diabetes who visited the eye departments for screening might differ from those who did not present and the rates of diabetic retinopathy noted in this study should be extrapolated to the registered diabetic population with caution.

RESULTS

In all, 5564 people with diabetes were screened by the ophthalmologists to determine diabetic complications in the eye. Among the 2650 selected sample 2520 (95%) were examined. Among them, the ocular media of 2249 (85%) were clear enough to visualise retinal details in at least one eye.

There were marked differences in age, sex, and regions (Table 1). Information on age was missing for 112 subjects.

Among the 2249 examined, 365 had diabetic retinopathy, giving a prevalence of diabetic retinopathy of 14.4% (95% CI 13.5 to 15.3). Men had significantly higher rates of diabetic retinopathy (18.46%) than women (10.2%) and varied significantly ($p<0.001$) by age (Table 2).

Of the 365 cases of diabetic retinopathy, 218 had background retinopathy (8.6% of sample) while 67 subjects (2.3%) had proliferative retinopathy; 129 (5.1%) had maculopathy in addition to the background retinopathy changes. Maculopathy was also present in 20 of 2176 (1.3%) but without retinopathy. Diabetic maculopathy was significantly higher in cases of diabetic retinopathy compared to those without diabetic retinopathy (odds ratio = 38.45 (95% CI 23.2 to 64.36))

The duration of diabetes was defined as the interval between the first diagnosis of diabetes by health personnel and the present screening. Information on the duration of diabetes was available for 2065 subjects. The prevalence of diabetic retinopathy was higher in those with a longer duration of diabetes than with the shorter duration ($p<0.0001$) (Table 3).

The type of diabetes was noted in 2013 subjects; 41 of 207 (19.8%) with type 1 diabetes had retinopathy while 271 of 1806 (15%) with type 2 diabetes had retinopathy (differences not statistically significant).

Table 2 Magnitude of diabetic retinopathy and its variants

Demographic parameter	Frequency	%	Estimated cases	Adjusted rates†	95% CI
Sex					
Male	191	21.34	468	18.46	16.95 to 19.97
Female	174	12.85	312	10.12	9.04 to 11.20
Age group (n=2137*)					
<40 years	37	7.76	51	6.03	4.43 to 7.64
40–49 years	105	15.00	182	13.29	11.49 to 15.08
50–59 years	86	15.58	207	15.08	13.18 to 16.97
60–69 years	94	22.87	294	19.18	17.21 to 21.15
70 and above	17	15.60	40	9.09	6.42 to 11.77
National	365	16.23	800	14.39	13.46 to 15.31

*Age information of 122 diabetics was missing.
†Adjusted rates using indirect method of age sex standardisation.

Table 3 Diabetic retinopathy by duration of diabetes

Duration of diabetes (n= 1954*)	Present (312)		Absent (1642)		Total	χ^2 test 162.5	
<5 years	124	9.0	1187	85.8	1384	df = 3	
6–10 years	111	22.8	350	71.9	487		p=<0.001
11–15 years	45	35.7	73	57.9	126		
16 years and more	32	47.1	32	47.1	68		
National	365		1884				

*Information of duration of diabetes was missing in 295 subjects (53 with retinopathy and 242 without retinopathy).

Table 4 Diabetic retinopathy and associated systemic diseases in diabetics

Associated systemic condition (n=2358*)			Diabetic retinopathy			
			Present (n=365)	Absent (n=1993)		
Type	No (%)		No	No	OR	95% CI
Nephropathy	66 (2.6)	Present	18	44	2.30	1.26 to 4.15
		Absent	347	1949		
Hypertension	608 (21.8)	Present	103	461	1.31	1.01 to 1.69
		Absent	262	1532		
Hyperlipidaemia	381 (15.1)	Present	63	304	1.16	0.85 to 1.45
		Absent	302	1689		
Neuropathy	101 (4)	Present	28	63	2.55	1.57 to 4.12
		Absent	337	1930		
Coronary artery diseases	112 (4.4)	Present	21	78	1.5	0.88 to 2.52
		Absent	344	1915		

*Information on associated pathology of 292 enumerated diabetics was missing.

The HbA_{1c} level was tested in 374; diabetic retinopathy was observed in 30 of 247 (12.1%) with an HbA_{1c} level <9% and in 36 of 127 (28.3%) with an HbA_{1c} level = 9%. The prevalence of diabetic retinopathy was generally higher in those with co-morbidities such as nephropathy, hypertension, and neuropathy (Table 4).

Of the 365 retinopathy cases, laser treatment was recommended in 50 eyes of 25 subjects, among whom 10 eyes (five patients) were treated with laser therapy (coverage 20%).

DISCUSSION

In order to reduce visual disabilities and improve the quality of life of people with diabetes, information on diabetic retinopathy is crucial.

Since the study sample was randomly selected from the all cases (both old and new) at the time of their first registration, it represents the prevalence rate of diabetic retinopathy of those registered. Although the registration and screening were done at different times, the data should be considered as point prevalence.

People with diabetes with an opaque media in both eyes, as a result of either trachomatous or non-trachomatous corneal opacity, are not more or less likely to have diabetic retinopathy. Hence loss of this information should not have introduced systematic bias.

The prevalence of diabetic retinopathy in our study, 14.4%, is considerably lower than the findings from a study of an Omani population in Dhahira region in 1998, which reported a prevalence of diabetic retinopathy of 42.2%.[9] The limited sample in the previous study and differences in definitions between the two studies could account for the different prevalence rates.

Global projections suggest that 20% of diabetic cases will develop diabetic retinopathy.[9] It is reported as low as 6.7% in south India,[10] 11.6% in Saudi Arabia,[11] and 16.9% in China.[12] Studies in Ethiopia, France, and Japan demonstrated higher rates.[13–15] The large number of early diabetic cases during the initial phases of the screening programme could have resulted in the relatively low prevalence rate in the present study.

In Oman, men had significantly higher rates of diabetic retinopathy than women, which is in contrast with a study in Sweden where women had higher rates than men.[16] Other studies have suggested non-significant differences in diabetic retinopathy by sex.[17 18] With only marginal sex differences in the prevalence of diabetes in the Omani population,[9] our observed higher rates of retinopathy in men should be investigated further.

The retinopathy rates increased with age until the age of 70 years; however, the small number of people with diabetes in this age group limits our ability to interpret the findings. Furthermore, the large number of cases with an opaque media in this age group rendered examination impossible.

The positive association between diabetic retinopathy and duration of diabetes is noted in the literature. The retinopathy rate in southern India was 7% in individuals with a short duration of diabetes (less than 10 years), 26% in those with 10–14 years' duration and 63% in those with 15 years and more duration of diabetes.[19] Similar observations were found in our study.

Patients with type 1 diabetes are known to have higher risk of diabetic retinopathy than those with type 2 diabetes[20 21] and this was true in Oman too (19.8%).

As found elsewhere, in Oman people with diabetes with HbA_{1c} levels of more than 9% have higher rates of diabetic retinopathy. It is recommended that glycaemic control be strongly promoted and that HbA_{1c} investigations routinely carried out.

The diabetic maculopathy rate was 6.3% in our study. The rate of maculopathy was 6.4% in India[22] and 8% in Japan.[23] In view of such higher rates of macular involvement, resources for laser therapy should be planned with special focus on care for diabetic maculopathy.

The prevalence of diabetic retinopathy was higher in those with hypertension (103/365), which is similar to other studies[21 24] As was also reported in Japan,[18] neuropathy in

Omani people with diabetes is associated with the diabetic retinopathy. This suggests a need for promoting management of retinopathy integrated with the treatment of co-morbidities.

The use of laser treatment is low compared to the need. This could increase the backlog of untreated retinopathy cases resulting in more visually disabled people with diabetes. The underlying causes of low use (lack of awareness, lack of access, or lack of resources) should be addressed through a comprehensive approach to improve screening and management of diabetic retinopathy.

Authors' affiliations
R Khandekar, Eye and Ear Health Care, DSDC, DGHA, Ministry of Health, Oman
J Al Lawatii, Diabetes Control Program, NCD, DGHA, Ministry of Health, Oman
A J Mohammed, Ministry of Health, Oman
A Al Raisi, Ophthalmology Department, Al Nahdhah Hospital, Oman

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Br J Ophthalmol 2003 87: 1061-1064
doi: 10.1136/bjo.87.9.1061