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Prevalence of blindness and visual impairment among Jordanian diabetics

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PURPOSE. *To investigate the prevalence of blindness and visual impairment among a population of Jordanian diabetics.*
METHODS. *A total of 986 diabetic patients were fully assessed, including complete history, examination, and laboratory tests. All patients underwent detailed eye examination, which included visual acuity, slit-lamp examination, tonometry, funduscopy, and fundus fluorescein angiography (FFA).*
RESULTS. *Of all patients examined, 53.2% were male and 46.8% were female. The mean age and duration of diabetes were 55.3 and 11.9 years. Of all patients, 93.3% had type 2 while 6.7% had type 1 diabetes mellitus (DM). Over half (50.3%) were on oral hypoglycemic agents, 34% on insulin, and 14.5% on both types of treatment, whereas only 1.2% were on diet alone. The mean value for HbA1c was 7.7%. The prevalence of blindness among participants was found to be 7.4%, while 10.1% were visually impaired. Diabetic retinopathy (DR) was present in 64.1%, 37.8% had cataract, and 8.7% had undergone cataract surgery. Using multivariate logistic regression analysis, visual impairment was significantly associated with age, treatment of diabetes, and DR, while only age and retinopathy were significantly related to blindness.*
CONCLUSIONS. *DM is a common disease in Jordan and DR is highly prevalent among Jordanian diabetics. National screening and educational programs are highly needed to reduce the risk of blindness and visual impairment among diabetic patients. (Eur J Ophthalmol 2005; 15: 62-8)*

KEY WORDS. *Blindness, Diabetic retinopathy, Visual impairment*

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INTRODUCTION

Diabetes mellitus (DM) is a complex multifactorial disease, often associated with progressive visual loss. Diabetic retinopathy (DR) has been, and probably remains, one of the major causes of blindness in the western world (1, 2). While most diabetes-associated blindness is due to complications of DR, many non-retinal ocular abnormalities may contribute to visual loss and should be considered in the management of diabetic patients. Those include corneal diseases, glaucoma, lens abnormalities, optic nerve diseases, cranial nerve abnormalities, and infectious diseases.

In Jordan, DM is a common disease among adult Jordanians with overall prevalence of 13.4% over the age of 25 years (3). In a hospital-based study, DR was shown to be the leading cause of blindness above the age of 20 years (4).

This study is part of a major pilot project investigating the chronic complications of DM among Jor-

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danian diabetics. The purpose of this article is to report on the prevalence of blindness and visual impairment, as well as their correlates, among this group of patients. Our data will be useful for future comparisons and provide baseline information to monitor progress toward St. Vincent's targets of reduction of blindness due to DR, which was declared by the WHO Regional Office for Europe in 1992.

METHODS

A cross-sectional study was performed on 990 patients with type 1 and type 2 DM, all with DM for more than 3 years' duration. Patients were assessed fully at the National Center for Diabetes, Endocrinology and Genetics (NCDEG), Amman, Jordan.

The assessment was conducted by the Center's staff and physicians and included detailed medical history and examination, blood pressure, and body mass index (BMI). The patients also underwent laboratory tests, which included fasting blood sugar (FBS), HbA1C, cholesterol, lipid profile, and kidney function tests.

All patients underwent detailed eye examination, which included best vision obtained by pinhole or glasses using Snellen chart, ocular muscle movement, pupillary reflexes, and detailed slit lamp examination.

Applanation tonometry was done for all patients and fundus examination was carried out by slit lamp biomicroscopy.

The assessment was completed by fundus fluorescein angiography (FFA) for all patients. MIA-T and MDA-B carried out the ophthalmic assessment.

In this study, we used the World Health Organization (WHO) definition of visual impairment and blindness, where normal vision, impaired vision, severe impairment of vision, and blindness were defined as visual acuity (VA) of 1.0 to 0.3 (6/6–6/18), <0.3 to 0.1 (<6/18–6/60), <0.1 to 0.05 (<6/60–3/60), and <0.05 (<3/60), respectively.

For the classification of DR, the modified Airlie House classification, as introduced by the Early Treatment Diabetic Retinopathy Study (ETDRS) (5), was used, where DR is classified into nonproliferative (NPDR), proliferative (PDR), and maculopathy. NPDR is further subdivided into mild (microaneurysms confined mainly to the area temporal to the fovea), moderate (vascular changes seen in one to two quadrants of the retina), and severe (vascular changes seen in more two quadrants). PDR is classified into neovessels at the disc (NVD), neovessels elsewhere (NVE), and advanced PDR. In our study, maculopathy has been defined as exudative: exudates and/or edema in the macular region; ischemic: capillary dropout, as shown by FFA; mixed: both types together; exudative + clinically significant macular edema (CSME): exudates and criteria of CSME; and mixed + CSME: ischemia by FFA and CSME criteria.

CSME as defined by the ETDRS is retinal edema within 500 µm of the foveal center, or hard exudates within 500 µm of the foveal center that may be associated with retinal thickening that is outside the 500 µm limit, or retinal edema that is 1 DD or larger, any part of which is within 1 DD of the foveal center.

Data analysis was carried out using the Statistical Package for Social Sciences (SPSS). Frequency distributions for categorical variables and means (± standard deviations) for continuous variables were obtained. Bivariate analysis was used to assess the association between visual impairment and a number of variables. Multivariate logistic regression analysis was used to assess the independent effect of a given variable after adjusting for the effect of other potential confounders. Separate analyses were performed for the right and left eyes of the population. Because of close similarity in the findings, we present findings of the right eyes only (applies only with the multivariate logistic regression).

RESULTS

Demographic

Out of the 990 patients examined at the NCDEG, 4 patients with gestational diabetes were excluded, with a total of 986 patients left: 525 (53.2%) were male and 461 (46.8%) were female. The mean age was 55.3 years (SD=12.5) ranging from 9 to 86 years. Over 50% of patients were within the age group of 40 to 59 years (Tab. I).

In our study, the mean duration of DM was 11.9 years (SD=6.3), range 3–40. Close to half of the patients had duration of diabetes of 10 to 19 years (Tab. I). Of the 986 patients, 920 (93.3%) had type 2 and 66 (6.7%) had type 1 DM (Tab. I). Five patients with type 1 diabetes were known

to have DIDMOAD (Wolfram) syndrome. With respect to treatment, only 1.2% of patients were on diet alone, the rest were on oral hypoglycemic agents 50.3%, insulin 34.0%, or on both types of treatment 14.5% (Tab. I).

The mean value for FBS was 178 mg/dl (SD=7.1), while the mean value for HbA1C was 7.7% (SD=1.5). High values for HbA1C (>8.0%) were found in 37.1% of patients (Tab. II).

Ocular complications

Out of 1,972 eyes examined, we had data on 1,961 eyes (missed data on 11 eyes), and according to the WHO definition of blindness mentioned previously, 7.4% were blind, 9.6% had impaired vision, and 0.7% had severe impairment. The remaining 82.2% had normal vision. The prevalence of cataract was 37.8% and 8.7% of patients had cataract surgery.

Other non-retinal abnormalities are shown in Table III.Overall, out of the 1,961 eyes examined, 1,258 eyes (64.1%) were found to have DR: NPDR was detected in 54.8%, 9.3% had PDR, and 30.8% had diabetic maculopathy (Tab. IV). Of all participants, 23.5% had NPDR and maculopathy together, while 7.6% were found to have both PDR and maculopathy.

Concerning NPDR, PDR, and maculopathy in both types of DM, our study showed a prevalence of 28%, 15.9%, and 12.1%, respectively, for type 1 and 56.8%, 8.6%, and 32.1%, respectively, for type 2 (Fig. 1).

Bivariate analysis showed a significant association of sex, age, and duration of DM with visual acuity (Tab. V). Severe impairment and impaired vision were combined for the purpose of this analysis and referred to as visual impairment.

Findings of logistic regression analysis are shown in Tables VI and VII. In the first model, the outcome variable was all degrees of visual impairment together vs normal visual acuity (Tab. VI). Each variable was

TABLE I - SOCIO DEMOGRAPHIC CHARACTERISTICS OF THE STUDY POPULATION (No.=986), JORDAN, 2003

Variable	Frequency	%
Sex		
Males	525	53.2
Females	461	46.8
Age group (mean 55.3 yr, SD= 12.5)		
9 – 19	20	2.0
20 - 39	63	6.4
40 – 59	494	50.1
≥ 60	409	41.5
Duration of DM (mean 11.9 yr, SD= 6.3)		
3 – 9	372	37.7
10 – 19	481	48.8
20 – 29	115	11.7
≥ 30	18	1.8
Type of DM		
1	66	6.7
2	920	93.3
Treatment for DM		
Oral hypoglycemic agents	496	50.3
Insulin	335	34.0
Both	143	14.5
Diet alone	12	1.2

DM= Diabetes mellitus

TABLE II - HbA_{1C} AMONG THE STUDY POPULATION, (No.=986), JORDAN, 2003

Variable	Frequency	%
HbA_{1C} (mean 7.7 %, SD 1.5)		
≤ 7.0	354	36.0
7.1 – 8.0	265	26.9
> 8.0	365	37.1

TABLE III - NON RETINAL OCULAR FINDINGS AMONG THE STUDY POPULATION, JORDAN, 2003

Variable	No. / total*	%
EOM	5/1947	0.3
RAPD	22/1969	1.1
Rubeosis	23/1967	1.2
Aphakia	25/1970	1.3
Pseudophakia	142/1967	7.4
Cataract	741/1962	37.8
Mean IOP= 14.6 mmHg (SD= 3.37)		
IOP>21		1.9
IOP≥30		0.2

* Variability in totals is due to missing values on some variables

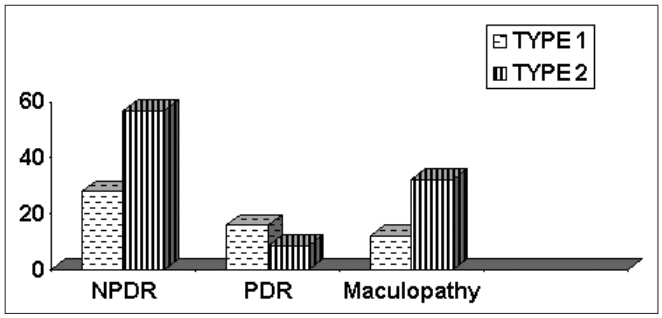

Fig. 1 - *Diabetic retinopathy and type of diabetes.*

adjusted to all other variables in the table and to duration of diabetes, HbA1C, hypertension, and hypercholesterolemia.

As shown in Table VI, visual impairment was significantly related to age, treatment, and retinopathy. Patients with maculopathy were 3 times more likely to have visual impairment as compared to patients without retinopathy (OR=3.1, p=0.000). Patients with PDR were more than 10 times more likely to have visual impairment compared to those with no retinopathy (OR=10.5, p=0.000).

Patients with NPDR seem to have no excess risk of visual impairment. Insulin therapy (OR=2.1, p=0.001) and combined therapy with insulin and oral hypoglycemic agents (OR=1.9, p=0.21) were associated with increased risk of visual impairment compared to patients on oral hypoglycemic therapy alone.

In the second model, factors independently related to blindness were assessed. Results of this analysis are shown in Table VII. Age and retinopathy were significantly related to blindness after adjustment for potential confounders. Again, maculopathy (OR=3.8, p=0.004) and PDR (OR=17.0, p=0.001) were strongly related to blindness while NPDR seemed to have no relation to blindness.

TABLE IV - RETINOPATHY AMONG THE STUDY POPULATION (No.=986), JORDAN, 2003

Variable	Frequency	%
NPDR		54.8
Mild	466	23.7
Moderate	290	14.8
Severe	319	16.3
PDR		9.3
NVD	41	2.1
NVE	53	2.7
Advanced	89	4.5
Maculopathy		30.8
Exudative	260	13.2
Ischemic	115	5.9
Mixed	70	3.6
Exudative + CSME	121	6.2
Mixed + CSME	38	1.9

PDR= Proliferative Diabetic Retinopothy; NVD= Neovessels at the Disc; NVE= Neovessels Elsewhere; CSM= Clinically Significant Edema

TABLE V - VISUAL ACUITY BY A NUMBER OF VARIABLES (No.=986), JORDAN, 2003

Variable	Visual acuity %	Visual Blind %	Normal impairment %	p-value
Sex				
Male	5.9	9.6	84.5	
				p=0.0208
Female	9.2	11.3	79.6	
Age group (yr)				
9 – 19	0 5	95		
20-39	3.2	4.1	92.7	
				p=0.000
40 – 59	4.5	7.8	87.7	
≥ 60	12	14.6	73.4	
Duration of DM (yr)				
3 – 9	4.5	6.2	89.3	
10 – 19	7.2	11.4	81.4	
				p=0.000
20 – 29	17	18.3	64.8	
≥ 30	14.3	17.1	68.6	

Normal vision = VA 1.0-0.3
Visual impairment = VA < 0.3 - 0.05
Blindness = VA < 0.05

DISCUSSION

Our study measured the prevalence of blindness and visual impairment among a group of diabetic patients attending the National Center for Diabetes, Endocrinology and Genetics in Amman. The Center is national and receives patients from all over the country, either directly or referred from other clinics in the kingdom. Many of those patients come to the center after years of diabetes and frequently because of diabetic complications. Therefore we believe that patients included in this study are not representative of all patients with diabetes in Jordan, but rather a selected group with more advanced disease. Our data represent the first assessment of blindness and visual impairment among diabetic patients in Jordan. The study showed that blindness, visual impairment, and retinopathy are common complications of DM in Jordan. The fact that DM is a common disease in this country raises the need for programs for early detection and prompt treatment of DM to avoid its serious complications and, at least, to delay blindness from DR. The prevalence of DR among our patients was 64%. Studies from Australia (6), Denmark (7), Iceland (8), Sweden (9, 10), United States (11, 12), and United Kingdom (13) showed large differences in the prevalence of DR, ranging from 24 to 62%. In our region, the prevalence of DR seems to be high: 31.3% in Saudi Arabia (14) and 42.4% in Oman (15).

Similar to the results of other studies (12), our data showed a higher prevalence of PDR in type 1 diabetics but a higher prevalence of maculopathy among type 2 diabetics.

We examined the prevalence of blindness and visual impairment among our diabetic population. The prevalence of blindness (7.4%) and visual impairment (10.3%) were found to increase significantly with increasing age and duration of DM. It was also higher in females (Tab. V). Similar results have been reported from the United States, Europe, and our region (16-22) as well. Using logistic regression analysis, there was a strong association between the prevalence of blindness and age, insulin treatment, PDR, and maculopathy. The same association was noted between visual impairment and age, PDR, and maculopathy. It should be noted that the markedly elevated risks of blindness as well as visual impairment among patients on insulin or combined insulin and oral therapy compared to patients on oral therapy alone reflect the severity of diabetes among those patients rather than causal implications.

Because the primary risk factor for the development of PDR and maculopathy mainly consists of lack of diabetes control (23, 24) (other factors might be specifically related to diabetics in Jordan and may contribute to the previously mentioned high rate of eye complications, such as lack of screening facilities, poor patient education, living in remote areas from the capital, and lacking health insurance), and early detection

TABLE VI - LOGISTIC REGRESSION ANALYSIS OF VISUAL IMPAIRMENT AMONG THE STUDY POPULATION (No.=986), JORDAN 2003

Variable	Adjusted Odds Ratio	p- value
Age (1 year increase)	1.05	0.000
Treatment		
Oral hypoglycemics	1	
Insulin	2.1	0.001
Both insulin and oral	1.9	0.021
Diet alone	0.01	0.667
Retinopathy		
No retinopathy	1	
NPDR	0.73	0.283
PDR	10.5	0.000
Maculopathy	3.1	0.000

Each variable is adjusted to all other variables in the table and to duration of disease, HbA_{1C} , hypertension and hypercholesterolemia. The outcome variable was all degrees of visual impairment together vs normal visual acuity

TABLE VII - LOGISTIC REGRESSION ANALYSIS OF BLINDNESS AMONG THE STUDY POPULATION (No.=986), JORDAN 2003

Variable	Adjusted Odds Ratio	p- value
Age (1 year increase)	1.08	0.000
Retinopathy		
No retinopathy	1	
NPDR	0.97	0.953
PDR	17.0	0.001
Maculopathy	3.8	0.004

Each variable is adjusted to all other variables in the table and to duration of disease; HbA_{1C} , hypertension and hypercholesterolemia
The outcome variable was blindness vs others

and laser treatment are key factors to prevent or decrease the risk of blindness from DM (25, 26), the establishment of national programs to educate both patients and general practitioners about control of DM and the early detection and treatment of DR is critical.

CONCLUSIONS

DM is a common disease in Jordan and DR is highly prevalent among Jordanian diabetics. Therefore, further research is a national priority in order to draft and implement a plan for early detection and treatment of DR to reduce the risk of blindness and visual impairment among relatively young age groups of the Jordanian population.

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