Prevalence of Diabetic Retinopathy among Newly Diagnosed Type 2 Diabetes Mellitus Patients in Abha City, Saudi Arabia

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Abstract

Objectives: To estimate the prevalence of DR and to compare the difference in the prevalence rate according to different patient's characteristics among newly diagnosed type 2 diabetic patients in Abha, Kingdom of Saudi Arabia.

Study design: A cross sectional study

Methods: This study was conducted at the ophthalmology clinic in Abha General Hospital, Saudi Arabia. All newly diagnosed diabetic type 2 patients attending primary health care centers in Abha during the period of study (39 PHCCs) were referred to the ophthalmology department in Abha General Hospital for diabetic retinopathy screening until the required sample size was reached. After adequate mydriasis, the examination of the posterior segment was carried out using slit-lamp biomicroscope with 90-dioptor lens. The intraocular pressure was measured using applanation tonometry. Diabetic retinopathy was classified using Friedman's standards.

Results: The study included 393 newly diagnosed type 2 diabetic patients. Their age ranged between 21 and 96 years with a mean of 52.9 years and standard deviation of 11.8 years. Female patients represented (242) 61.6% of them. The prevalence of diabetic retinopathy among newly diagnosed type 2 diabetic patients was (13) 3.3%. All DR cases were classified using Friedman's standards as background or non-proliferative diabetic retinopathy. The prevalence of DR among female newly diagnosed type 2 diabetic patients was (13) 5.4% compared to none among males. This difference was statistically significant, p=0.002. The prevalence of DR was (13) 4.3% among not working type 2 diabetic patients compared to none among working patients. This difference was statistically significant, p=0.027. Intra-ocular pressure was within normal values for all patients in both eyes.

Conclusion: The prevalence of retinopathy in newly diagnosed type 2 diabetes mellitus patients was found to be relatively low in this study compared to international studies.

Key words: Diabetic retinopathy; Diabetes mellitus; Prevalence; Diagnosis; Ophthalmology

Introduction

Diabetic retinopathy (DR) is a complication of diabetes mellitus (DM) that affects the blood vessels of the retina and leads to blindness. The progression of retinopathy is gradual, advancing from mild abnormalities, characterized by increased vascular permeability, to moderate and severe non-proliferative diabetic retinopathy, characterized by the growth of new blood vessels on the retina and posterior surface of the vitreous.(1)

Individuals with diabetes are 25 times more likely to become blind than individuals without this disease.(2) In many developed countries, diabetic retinopathy is the leading cause of new cases of visual impairment and blindness among adults aged 20-74 years.(3) Among people who have type 2 diabetes, around 21% have retinopathy at diagnosis,3 and more than 60% have diabetic retinopathy during the first two decades of the disease.(4)

The Wisconsin epidemiological study of diabetic retinopathy (WESDR) concluded that 1.6% of those diagnosed with type 2 DM were legally considered blind. For type 2 DM, blindness was related to retinopathy in 33% of the cases.(5) The prevalence of DR is probably around 30% in type 2 DM, but notably was above this level in five out of six studies reported from the Asian and pacific island nations of the Western Pacific Region.(6) The annual incidence of retinopathy requiring ophthalmological follow up or treatment has been reported to average 1.5% after one year.(7) The same source estimates that 6-9% of patients with proliferative retinopathy or severe non-proliferative disease would become blind each year.(7) Moreover, growing evidence also suggests that after 15 years of diabetes, approximately 2% of patients develop blindness, while about 10% develop severe visual handicap.(7) Thus, the early detection of sight-threatening retinopathy and the timely intervention with laser photocoagulation has been shown to be effective in preventing severe visual loss.

Diabetes-related blindness is a personal catastrophe to the individual and costs the United States approximately $500 million annually.(8) However, risk of vision loss due to diabetic retinopathy can be reduced by effective control of serum glucose and blood pressure and by its early detection and timely treatment.(9-11) The efficacy and cost-effectiveness of early detection and treatment of diabetic retinopathy is well established.(12, 13)

Several factors have been identified as determinants for the development of DR and its progression; including, type and duration of DM, age, gender, glycemic control, hypertension, body mass index (BMI), smoking, serum lipids and presence of microalbuminuria (MA)(14-18).

Methodology

Study design: A cross-sectional method.

Study setting: This study was conducted at the ophthalmology clinic in Abha General Hospital, Aseer region, Saudi Arabia.

Study population: Newly diagnosed diabetic type 2 patients attending primary health care centers (39 PHCCs) in Abha during the period of study from September 2013 until April 2014. They were requested to participate in the study. They were referred to the ophthalmology department in Abha General Hospital for diabetic retinopathy screening.

Sample size and sampling technique: The sample size was estimated to determine the prevalence of diabetic retinopathy among newly diagnosed diabetic patients type 2 of 12% (according to average of previous regional studies in the literature), with a 3% absolute error (25% of prevalence) and finite population correction, at 95% level of confidence. The newly diagnosed type 2 diabetic patients in Abha in 2012 was 3059 patients.

Using the single proportion equation for dichotomous variables in Raosoft software package, and the previous information to answer the following questions: What margin of error can you accept? (3%); What confidence level do you need? (95%); What is the population size? (3059) and What is the response distribution? (12%). Accordingly, the required sample size is 393 patients.(19)

All newly diagnosed type 2 diabetic patients referred to the ophthalmology department in Abha General Hospital were invited to be included in the study until the required sample size was reached.

Inclusion criteria: Diabetic type 2 patients who were diagnosed within two years, All ages (more than 20 years old), Both genders.

Exclusion criteria: Those who refused to participate in the study, With chronic debilitating diseases (hypertension, asthma …) and With serious eye problems (cataract, glaucoma…)

Study tool and procedure:
All patients referred to ophthalmologists at the Abha General Hospital underwent detailed eye examination. After adequate mydriasis, the examination of the posterior segment was carried out using slit-lamp biomicroscope with 90-dioptor lens. The intraocular pressure was measured using applanation tonometry.

Diabetic retinopathy was classified using Friedman's (2005) standards, and was as follows:

i) Background or non-proliferative diabetic retinopathy: haemorrhages, exudates, cotton wool spots, microaneurysms, intraretinal microvascular abnormalities, venous beading;
ii) Severe NPDR ("4-2-1 rule"): defined as any one of the following: 4 quadrants of hemorrhages/MAs, 2 quadrants of venous beading, 1 quadrant of IRMA;
iii) Very Severe NPDR: defined as 2 or more of the above;
iv) Proliferative (PDR): neovascularization (NV) of disc or elsewhere;

v) High-risk proliferative (HR-PDR): defined as any one of the following:
1. NVD ≥ 1/4 to 1/3 disc area,
2. Any NVD with vitreous haemorrhage,
3. NVE ≥ 1/2 disc area with vitreous haemorrhage.(20)

Then, a data collection sheet was filled in by the researcher including the following:
- Demographic variables including: age, gender, marital status, job and educational level;
- Medical history including diabetic complications other than DR, diabetic coma, treatment and treatment satisfaction;
- Ophthalmological examination regarding DR and its grade was done by the ophthalmologist.

Data management and statistical analysis:
SPSS package, version 20 was used for data entry and analysis. Descriptive statistics were applied as follows: Frequency and percentage were used to describe categorical variables while mean and standard deviation were used to describe continuous variables. Chi-square test was applied to test for the association and/or difference between categorical variables. Fisher exact test was applied instead of chi-square test in case of small frequencies. Differences were considered statistically significant when the p-value was less than 0.05.

Results

The study included 393 newly diagnosed type 2 diabetic patients. Their age ranged between 21 and 96 years with a mean of 52.9 and standard deviation of 11.8 years. More than half of them 213 (56%) were over 50 years. Female patients represented 242 (61.6%) of them. The majority of them 256 (90.6%) were married. Most of them 299 (76.1%) were not working. Among working patients 94 (23.9%), governmental employees 28 (29.8%) and teachers 27 (28.7%) were the most common reported jobs. Slightly less than half of them 186 (47.3%) were illiterate and 49 (12%) finished university and postgraduate studies (Table 1).

Table 1: Personal characteristics of newly diagnosed type 2 diabetic patients who participated in the study (n=393)

Personal Characteristics	Categories	Frequency	Percentage
Age in years	20-30	18	4.5
	31-40	36	9.2
	41-50	119	30.3
	51-60	158	40.2
	>60	62	15.8
Gender	Males	151	38.4
	Females	242	61.6
Marital status	Single	18	4.6
	Married	356	90.6
	Divorced	4	1.0
	Widowed	15	3.8
Job status	Not working	299	76.1
	Working	94	23.9
	-Teacher	27	28.7
	-Military	11	11.7
	-Governmental Employee	28	29.8
	-Retired	22	23.4
	-Others	6	6.4
Education	Illiterate	186	47.3
	Primary	89	22.6
	Intermediate	22	5.6
	Secondary	49	12.5
	University	45	11.5
	Postgraduate	2	0.5

The prevalence of diabetic complications (other than diabetic retinopathy) among newly diagnosed type 2 diabetic patients was 7(1.8%). This complication was diabetic neuropathy.

Newly diagnosed type 2 diabetic patients had history of diabetic coma which accounted for 12 (3.1%). Regarding treatment among newly diagnosed type 2 diabetic patients, oral hypoglycemic drugs were the most commonly reported 270 (76.6%), followed by diet regimen 76 (27.2%). Insulin was the line of treatment among 12 (3.1%) of them while a combination of oral hypoglycemic drugs and insulin was the type of treatment for 4 (1%) of them.

Almost two-thirds 272 (69.2%) of type 2 diabetic patients were very satisfied with their disease therapy while 97 (24.7%) were somewhat satisfied with it.

Diabetic Retinopathy

The prevalence of diabetic retinopathy among newly diagnosed type 2 diabetic patients was 13 (3.3%). All DR cases were classified using Friedman's standards as background or non-proliferative diabetic retinopathy.

The prevalence of DR was 4 (6.5%) among newly diagnosed type 2 diabetic patients over 60 years compared to none among those aged between 20 and 40 years. However, the difference was not statistically significant, p=0.210 (Table 2).

Table 2: Prevalence of diabetic retinopathy according to personal characteristics, diabetes therapy and satisfaction therapy

Characteristics	Diabetic Retinopathy		Chi-square	p-value
	No N (%)	Yes N (%)		
Age (years)				
20-30 (n=18)	18 (100)	0 (0.0)		
31-40 (n=36)	36 (100)	0 (0.0)		
41-50 (n=119)	113 (95.0)	6 (5.0)		
51-60 (n=158)	155 (98.1)	3 (1.9)		
>60 (n=62)	58 (93.5)	4 (6.5)	**5.86**	**0.210**
Marital status				
Single (n=18)	18 (100)	0 (0.0)		
Married (n=356)	343 (96.3)	13 (3.7)		
Divorced (n=4)	4 (100)	0 (0.0)		
Widowed (n=15)	15 (100)	0 (0.0)	**1.40**	**0.706**
Educational level				
Illiterate (n=186)	177 (95.2)	9 (4.8)		
Primary (n=89)	85 (95.5)	4 (4.5)		
Intermediate (n=22)	22 (100)	0 (0.0)		
Secondary (n=49)	49 (100)	0 (0.0)		
University+ (n=47)	47 (100)	0 (0.0)	**5.79**	**0.215**
Diabetes therapy				
Diet regimen (n=76)	76 (100)	0 (0.0)		
Oral hypoglycemics (n=270)	257 (95.2)	13 (4.8)		
Insulin (n=12)	12 (100)	0 (0.0)		
Oral hypoglycemics and insulin (n=4)	4 (100)	0 (0.0)	**6.13**	**0.190**
Satisfaction with therapy				
Very satisfied (n=272)	259 (95.2)	13 (4.8)		
Somewhat satisfied (n=97)	97 (100)	0 (0.0)		
Neutral (n=22)	22 (100)	0 (0.0)		
Somewhat dissatisfied (n=2)	2 (100)	0 (0.0)	**5.98**	**0.113**

Table 3: Prevalence of diabetic retinopathy according to patient`s gender, job status, diabetic complications

Characteristics	Diabetic Retinopathy		p-value of Fisher exact test
	No N (%)	Yes N (%)	
Gender			
Male (n=151)	151 (100)	0 (0.0)	
Female (n=242)	229 (94.6)	13 (5.4)	**0.002**
Job Status			
Not working (n=299)	286 (95.7)	13 (4.3)	
Working (n=94)	94 (100)	0 (0.0)	**0.027**
Diabetic complications			
No (n=386)	373 (96.6)	13 (3.4)	
Yes (n=7)	7 (100)	0 (0.0)	**0.789**
Diabetic coma			
No (n=381)	368 (96.6)	13 (3.4)	
Yes (n=12)	12 (100)	0 (0.0)	**0.664**

The prevalence of DR was 13 (3.7%) among married newly type 2 diabetic patients compared to none among singles, divorced and widowed patients. However, the difference was not statistically significant, p=0.706 (Table 2).

DR was more reported among lower educated diabetic type 2 patients 9 (4.8%) and 4 (4.5%) among illiterate and primary educated patients compared to none of higher educated patients. However, this difference was not statistically significant, p=0.215 (Table 2).

The prevalence of DR among female newly diagnosed type 2 diabetic patients was 13 (5.4%) compared to none among males. This difference was statistically significant, p=0.002 (Table 3).

The prevalence of DR was 13 (4.3%) among not working type 2 diabetic patients compared to none among working patients. This difference was statistically significant, p=0.027 (Table 3).

There was no statistically significant association between DR and other diabetic complications among newly diagnosed type 2 diabetic patients, p=0.789. Also, there was no statistically significant association between DR and history of diabetic coma among newly diagnosed type 2 diabetic patients, p=0.664. DR was more reported among diabetic type 2 patients treated by oral hypoglycemic drugs (4.8%) compared to none among patients treated by diet regimen, insulin and a combination of insulin and oral hypoglycaemic drugs. However, this difference was not statistically significant, p=0.190. There was no statistically significant association between DR and satisfaction of diabetic patients with their therapy, p=0.113 (Table 3).

Intra-ocular Pressure

Intra-ocular pressure was within normal values for all patients in both eyes (10 mmHg and 21 mmHg).

Discussion

The prevalence of retinopathy in patients with newly diagnosed Type 2 diabetes mellitus was found to be relatively lower in this study (3.3%) compared to international data.

Diabetes Prevention Program Research Group(21) reported 12.6% prevalence of retinopathy in recent onset diabetes in the diabetes prevention programme. Wahab et al in Pakistan reported that 15% (95% CI 14.7, 15.3) of patients were found to have diabetic retinopathy within two months of diagnosis of type 2 diabetes mellitus.(22)

Multiple clinic-based studies conducted on newly diagnosed diabetes patients have shown varied prevalence; Abdollahi et al.(23) from Iran reported 13.8%, Agarwal et al.(24) reported 11.7%, while Rema and associates reported 5.1% and 7.3% respectively.(25,26) Klein et al.(27) reported the prevalence of 10.2% in newly discovered type 2 diabetic patients in Beaver Dam Eye Study. Kohar and associates(28) have reported 39% and 35% prevalence of retinopathy in men and women respectively in the United Kingdom Prospective Diabetes Study.

In a study on 1640 Pima Indians of 15 years and older, 18% of those with two-hour post-load plasma glucose levels of equal to or greater than 200 mg/dl had some evidence of retinopathy.(29)

Two studies performed in Australia showed the prevalence of diabetic retinopathy in newly diagnosed type 2 non-treated diabetic patients to be 14%-20%.(30, 31)

In Kenya, overall, the prevalence of diabetic retinopathy and clinically significant macular oedema was 30.4% and 8.7% respectively among newly diagnosed black African patients.(32)

The differences in the reported prevalence of retinopathy in people with newly discovered type 2 diabetes might be due to variation in the time between onset and detection of diabetes. This could be a result of socioeconomic factors, which determine the access to and availability of medical care, the health care seeking behaviour of the specific group studied, as well as variation in the definitions used to define the presence of diabetes.

The low prevalence in the current study could be attributed to the fact that the Saudi health system is free of charge and results in early diagnosis of diabetic patients. Similarly, in a population-based study in Denmark, the prevalence of DR was reported to be 5%-8%. They suggested that the low prevalence is due to the Danish health system which is free of charge and results in early diagnosis of diabetic patients.(33)

In accordance with others,(22,34) DR was more prevalent among older diabetic patients in the present survey although it is not statistically significant. This could be due to the small number of patients (n=13) who developed DR in the present study. In addition, the present study reports a significant association between prevalence of DR and female gender and not working status. This could be due to the confounding effect of age with these two factors. Again, due to the small number of patients who developed DR, we could not perform Logistic regression analysis to control for the effect of age on the development of DR.

Evaluation of diabetic patients who sought ophthalmologic consult for the first time in Farabi Hospital in Iran showed that 48.4% of patients were diagnosed as non-PDR and 45.4% of them were PDR.23 In the present study, all DR cases were classified using Friedman's standards as background or non-proliferative diabetic retinopathy.

In addition, the average time to seek ophthalmologic consult after diagnosis of diabetes mellitus was 11.5± 5.5 years in Farabi Hospital`s study. All the data revealed that those patients designated as newly diagnosed diabetes mellitus have had the disease for a significant duration of time and after diagnosis of their disease their ophthalmologic examination was postponed until it was too late for effective treatment of diabetic retinopathy. It is believed that undiagnosed type 2 diabetes mellitus may occur 4-12 years before its clinical diagnosis and that diabetes may be present for five years before the onset of retinopathy.(35,36) Undiagnosed type 2 diabetes is thus not a benign condition. The unknown duration (years) of undiagnosed diabetes in our patients is likely to be a more important contributory factor to retinopathy than the known (weeks) duration of diagnosis. This is further supported in the present study by the fact that patients with diabetic retinopathy were older than those without.

This existence of DR among newly diagnosed diabetic type 2 patients may be also due to the fact that patients are more likely to consult a medical doctor than eye care professionals in dealing with signs and symptoms of medical conditions such as DM. Optometrists are also more likely perceived by patients as professionals who deal more with refractive conditions rather than medical problems, especially amongst the elderly population. However, the role of optometrists as part of primary health care in the screening and management of diabetic retinopathy has been recognized and documented in the National Service Framework in Britain and the Strategy Implementation plan in Australia.(37,38)

Among important limitations of the present study, we did not include other factors that could be associated with the development of DR in newly diagnosed diabetic patients such as glycemic control, hypertension, body mass index (BMI), smoking, serum lipids and presence of microalbuminuria (MA) due to lack of sufficient time and resources. Due to the cross-sectional nature of the survey, we cannot draw definitive causal conclusions about the observed relationships between demographic and disease characteristics and DR.

Conclusion

The prevalence of retinopathy in newly diagnosed type 2 diabetes mellitus patients was found to be relatively low in this study. The prevalence was significantly higher among female and not working patients. All DR cases were classified using Friedman's standards as background or non-proliferative diabetic retinopathy. Intra-ocular pressure was within normal values for all patients.

Recommendations

Although, we reported a relatively low prevalence rate of diabetic retinopathy, there is a need for intensifed efforts for early diagnosis of type 2 diabetes mellitus and careful fundus biomicroscopic examination of all newly diagnosed type 2 diabetics in our community where diabetes type 2 is highly prevalent.

1. Population-based studies are suggested with larger sample sizes to determine a better estimation of DR prevalence among Saudi newly diagnosed diabetic patients and study its associated risk factors.
2. There should be emphasis for all optometrists to become competent in the diagnosis and management of ocular manifestations of systemic conditions such as diabetes.
3. Further prospective longitudinal studies are recommended for diabetic patients free from DR at the onset to confirm the causal association between DR and possible associated factors as well as to enable a more precise determination of the onset of diabetic retinopathy.
4. Screening program for early diagnosis of type 2 diabetes mellitus, and consequently diminishing its complications including retinopathy, should be encouraged.

Ethical and administrative considerations: All the necessary official permissions were fully obtained before study conduction. The collected data were kept strictly confidential and used only for research purposes. Verbal informed consent was obtained from all participants.

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