PREVALENCE AND FACTORS ASSOCIATED WITH DIABETIC RETINOPATHY, A MULTI-CENTRIC STUDY IN KUWAIT

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ABSTRACT

Background: *Diabetic retinopathy (DR) remains one of the major causes of vision loss and blindness in young adults despite the availability of effective treatment.*
Objective: *To determine the prevalence of DR among adult diabetic patients attending primary health care centers in Kuwait and to identify factors that could be associated with DR.*
Methods*: The current study is a part of a larger multi-centric one. The first phase of the study is a cross sectional one to determine the prevalence of DR among diabetic patients attending the selected primary health care centers. The second one was a nested case-control study, whereas all patients with DR (case group n = 216) were compared with all other diabetic patients without DR (control group n = 488) to determine the associated factors with cases. A pre-designed questionnaire included socio-demographic, clinical data, in addition to health care characteristics and personal practice. Basic univariate analyses were followed by multiple logistic regression analysis.*
Results: *The prevalence of DR among adult diabetic patients attending primary health care centers was 43.6%. Of the personal factors examined, age was the only significant determinant of DR (OR = 2.2, 95% CI: 1.1 – 5.2) and (OR = 4.6, 95% CI: 2.0 – 11.0) for age groups 50 – 59 and $\geq$ 60 as compared with those < 40 years respectively. Among clinical factors, patients with type 2 – insulin treated diabetes were more prone to have DR (OR = 8.0, 95% CI: 3.5 – 19.4). Duration of diabetes was a significant predictor of DR (OR = 2.6, 95% CI: 1.61 – 4.2) and (OR = 2.8, 95% CI: 1.5 – 5.5) for a duration of 10 – 19 and $\geq$ 20 years as compared with < 10 years respectively. Also, poor glycemic state and uncontrolled hypertension were associated factors (OR = 2.0, 95% CI: 1.2 – 2.8) and (OR = 3.1, 95% CI: 2.0 – 4.9) respectively. Cardiovascular complications, neuropathy, nephropathy and diabetic foot were significantly associated with DR. Within patients' practice, regular follow-up was proved to be a protective factor (OR = 0.5, 95% CI: 0.3 – 0.8)*
Conclusion: *Regular follow-up is the strongest modifiable risk factor for DR. Old patients with longer duration of diabetes particularly those having other types of long term diabetic complications and on insulin therapy are more prone and should be regularly screened for DR.*
Keywords: *Diabetic retinopathy - prevalence - associated factors*

INTRODUCTION

Diabetes mellitus (DM) has long been recognized as a major health problem, not only for its adverse health impact on individuals, but also for its economic burden on health care system and society at large.[(1)] Diabetic eye disease refers to a group of eye problems that people with diabetes may face as a complication of diabetes. Diabetic retinopathy (DR) is the most common diabetic eye disease and a leading cause of blindness in adults. It is caused by changes in the blood vessels of the retina. The progression of DR begins with prolonged hyperglycemia, which results in expression of factors which stimulate vascular endothelial proliferation and increased capillary permeability.[(2)]

As the prevalence rates of diabetes increase, there is increasing concern of potential increased number of patients at risk for DR.[(3)] It remains one of the major causes of vision loss and blindness in young adults despite the availability of effective treatment.[(4)]

The prevalence of DR shows wide variations between countries. In type 1, it ranges from 14% (India) to 80% (Finland) and in Type 2 it ranges from17% (Switzerland) to 52% (United Kingdom).[(5)]

Several risk factors for development and progression of retinopathy in diabetic patients have been considered. So far, the duration of diabetes has been shown to be the most powerful predictor of DR.[(6)] Other factors are the age of onset of diabetes, the level of glycemic control, blood pressure, proteinuria.[(2)] Problems related to health care, patient compliance with visit schedules, dietary and therapeutic recommendations can have a major impact on accessibility of medical recommendation. Factors such as co-morbidity, socio-economic status, social support are equally important in determining a good compliance and adequate self car.[(7)]

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Few studies have been carried in Kuwait on diabetic retinopathy. However, none of these studies have been conducted on both types of DM or in a multi-centric population. Also, these studies either considered Kuwaiti population only or did not consider the control for possible confounding effect of the variables.[8-10]

In a country with a high prevalence of DM, like Kuwait, revealing the extent and factors associated with DR is a high public health priority. The aim of the present study is to determine the prevalence of DR among adult diabetic patients attending primary health care centers in Kuwait and to identify factors that could be associated with DR especially those factors that can be considered avoidable.

METHODS

This study was carried out in five primary health care centers representing the five health regions in Kuwait. The field duration of the study covered 5 months starting from June to October 2006. The current study is a part of a larger multi-centric descriptive one. The details of the methodology can be found elsewhere.[11] In brief, all diabetic patients attending to the selected centers were sequentially recruited. Two index days were randomly defined for each of the selected centers for collection of data. Newly discovered cases were excluded from the study. The sampling unit was diabetic patient who had been diabetic for at least 2 years. Also, they should be fully examined by an ophthalmologist with an ophthalmic report in their medical record. Selection criteria included age $\geq$ 18 years. All eligible subjects were asked to participate in the study. The final studied sample size was 704 adult diabetic patients.

Study Questionnaires

The structured interview method has been adopted to collect data for this study with a specially designed questionnaire. It was derived from other published studies dealing with the same topic as well as from our own experience. It included socio-demographic characteristics (age, gender, nationality, education, occupation, marital status, housing and family income) and clinical data (type of DM, treatment, glycemic state, presence of hypertension, co-morbid conditions, obesity and chronic diabetic complications), in addition to pattern of care and patient' practice (need of help to reach health care center, regular follow-up, compliance with diet recommendations, regular use of drug, regular check of urine glucose, regular check of blood glucose, self monitoring of blood glucose (SMBG), smoking, physical activity). Biochemical investigations included fasting blood glucose, Hb_{A1c}, total cholesterol, high density lipoprotein (HDL), low density lipoprotein (LDL), triglycerides and micro-albuminuria.

The present study could be differentiated into two phases. The first one was a cross sectional study to determine the prevalence of DR among adult diabetic patients attending the selected centers. The second one was a nested case-control study, whereas all patients with DR (case group, n = 216) were compared with all other diabetic patients without DR (control group, n = 488) to determine the associated factors with cases. Patients were considered eligible as cases if they had type 1 or type 2 diabetes for at least 2 years and DR had been diagnosed by an ophthalmologist in one or both eyes. Patients were considered eligible as control if they had type 1 or type 2 diabetes for at least 2 years and had never been affected by any diabetic eye complications.

Verbal consent was obtained from all the subjects, after explanation of the purpose and importance of the research, prior to conducting the survey.

Measurements:

Trained physicians in the chosen centers collected data by interviewing patients and reviewing their medical records. In order to ensure uniformity of data measuring methods that relied on clinical judgment, all participating physicians were trained on data collection and the questionnaire was thoroughly tested for clarity before it was accepted.

Patients were considered as having type 1 diabetes if their age at diagnosis was < 30 years and insulin was used continuously from the time of diagnosis. They were considered as having type 2 diabetes if their age at time of diagnosis was $\geq$ 30 years. Three blood pressure measurements were obtained by trained physicians using a standardized sphygmomanometer after a 5-minute sitting rest. Hypertension was considered as uncontrolled by treatment on the basis of clinical judgment and confirmed by the presence of systolic blood pressure value > 140 mmHg and/or diastolic pressure > 90 mmHg.[12]

Patients were classified as having diabetic neuropathy or cardiovascular complication on the basis of the presence of clinical symptoms and signs and confirmed by medical reports in their records. Nephropathy was considered if patient had microalbuminuria (albumin excretion < 30 mg per 24 hours), clinical proteinuria, or subjected to dialysis. The glycemic state of patient referred to the last value of Hb_{A1c} and it was considered adequate if < 7%. Normal levels for blood lipids were identified as 5.6 mmol/L for total cholesterol, 2.1 mmol/l for triglycerides, 3.4 mmol/L for LDL, and 0.91 mmol/L for HDL. Major limb complications included foot ulcer, claudication, gangrene, persistent ischemic pain or amputation. Co-morbidity included conditions that had been already present prior to the diagnosis of DM (angina pectoris, hypertension, renal disease, endocrine dysfunction, dyslipidemia and liver diseases).

Physical activity was considered if it was practiced for 30 minutes at least 3-4 times a week. For height and weight measurement, we used the Detecto-Scale Instrument, which was calibrated once a day before use. Body mass index was calculated as weight in kg/ height in square meters.

Statistical analysis:

Analysis was initially carried out based on a series of univariate comparisons. In order to control simultaneously for possible confounding effect of the variables, multiple logistic regression was used for the final analysis. In the univariate analysis Chi-square test was used to detect the association between retinopathy and explanatory variables. In multiple logistic regression analysis, the association between exposure and outcome was expressed in terms of odds ration (OR) together with their 95% confidence intervals (95% CI).

All the explanatory variables included in the logistic model were categorized into two or more levels (R = reference category): gender: male^{R}, female; age (years): < 40^{R}, 40 – 49, 50 – 59, ≥ 60; nationality: Kuwaiti^{R}, non-Kuwaiti; education: primary or less^{R}, intermediate / secondary, university or higher; occupation: unemployed^{R}, worker, clerk, professional; marital state: married^{R}, unmarried; housing: villa^{R}, middle income, limited income, flat; family income / month (KD): < 500^{R}, 500 – 999, 1000 – 1499, ≥ 1500; type of diabetes: type 1^{R}, type 2, type 2 – insulin treated; duration of diabetes (years): < 10^{R}, 10 – 19, ≥ 20; treatment: none^{R}, oral, insulin, oral + insulin; glycemic state: good control^{R}, poor control; hypertension: no^{R}, yes uncontrolled, yes controlled; co-morbid conditions: no^{R}, yes uncontrolled, yes controlled; obesity: no^{R}, overweight, obese, severely obese; cardio-vascular complications: no^{R}, yes; nephropathy: no^{R}, yes; neuropath: no^{R}, yes; diabetic foot: no^{R}, yes; need of help to reach health care center: no^{R}, yes; regular follow-up visits: no^{R}, yes; compliance with diet recommendations: no^{R}, yes; regular check of urine glucose: no^{R}, yes; regular check of blood glucose: no^{R}, yes; SMBG: no^{R}, yes; smoking: no^{R}, yes; physical activity: no^{R}, mild, moderate. Analysis was performed using SPSS package.

RESULTS

Among 704 diabetic patients participated in the study 216 were diagnosed as having DR with an overall 30.7% prevalence rate.

A total of 216 diabetic patients with DR were compared with 488 patients with no eye complications. The socio-demographic, clinical, health care related characteristics and personal factors together with the results of unvariate analyses were presented in tables I – III. The results of the final analysis using multiple logistic regression were summarized in table IV. No significant association between DR and socio-demographic factors was detected except for age. Patients in the age group 50 – 59 had double risk of DR than those under forty (OR = 2.2, 95% CI: 1.1 – 5.2) and those ≥ 60 years had more than four times risk (OR = 4.6, 95% CI: 2.0 – 11.0).

Among clinical factors, type of diabetes was significantly associated with DR. Patients with type 2 insulin treated diabetes had an increased risk of DR as compared with type 1 (OR = 8.0, 95% CI: 3.5 – 19.4). Longer duration of diabetes seamed to increase the risk DR. Patients who had diabetes for 10 – 19 years had more than double the risk as compared with those who had diabetes for less than ten years (OR = 2.6, 95% CI: 1.6 – 4.2) and patients with diabetes for 20 years or more had about triple the risk of DR (OR = 2.8, 95% CI: 1.5 – 5.5). Poor glycemic state and uncontrolled hypertension were significant associated factors with DR (OR = 2.0, 95% CI: 1.2 – 2.8) and (OR = 3.1, 95% CI: 2.0 – 4.9) respectively.

Other long term diabetic complications as cardiovascular disease, neuropathy, nephropathy and diabetic foot were significantly associated with the outcome of interest (OR = 1.7, 95% CI: 1.1 – 2.7), (OR = 2.3, 95% CI: 1.4 – 3.7), (OR = 1.9, 95% CI: 1.1 – 4.1) and (OR = 3.7, 95% CI: 2.3 – 5.9) respectively.

Among health care and patients' practice, regular follow-up was the only amenable factor that could be proved to be a significant protective factor against DR (OR = 0.5, 95% CI: 0.3 – 0.8)

Table I: Socio-demographic characteristics of diabetic patients with and without retinopathy

Variables	Retinopathy				Significance
	No (n=488)		Yes (n=216)		
	No.	%	No.	%	
Gender					
Male	246	50.4	97	44.9	$X^2 = 0.18$
Female	242	48.6	119	55.1	$P = 0.10$
Age (years)					
< 40	83	17.0	9	4.2	
40 - 49	165	33.8	37	17.1	$X^2 = 96.45$
50 - 59	155	31.8	59	27.3	$P < 0.001$
≥ 60	83	17.4	111	51.4	
Nationality					
Kuwaiti	248	50.8	146	67.6	$X^2 = 17.09$
Non-Kuwaiti	240	49.2	70	32.4	$P < 0.001$
Education					
Primary or less	163	33.4	87	40.3	$X^2 = 8.92$
Intermediate / Secondary	165	33.8	82	38.0	$P = 0.01$
University or higher	160	32.8	47	21.8	
Occupation					
Unemployed	132	27.0	121	56.0	
Worker	261	53.5	61	28.2	$X^2 = 58.18$
Clerk	61	12.5	18	8.3	$P < 0.001$
Professional	34	7.0	16	7.4	
Marital state					
Married	396	81.1	160	74.1	$X^2 = 4.51$
Unmarried	92	18.9	58	25.9	$P = 0.04$
Housing					
Villa	172	35.2	96	44.4	
Middle income	50	10.2	40	18.5	$X^2 = 20.67$
Limited income	49	10.0	14	6.5	$P < 0.001$
Flat	217	44.5	66	30.6	
Family income / month (KD)					
< 500	251	51.4	83	38.4	
500 – 999	118	24.2	70	32.4	$X^2 = 10.46$
1000 – 1499	74	15.2	39	18.1	$P = 0.02$
≥ 1500	45	9.2	24	11.1	

Table II: Clinical characteristics of diabetic patients with and without retinopathy

Variables	Retinopathy				Significance
	No (n=488)		Yes (n=216)		
	No.	%	No.	%	
Type of diabetes					
Type 1	54	11.1	9	4.2	$X^2 = 61.48$
Type 2	376	77.0	128	59.3	$P < 0.001$
Type 2 – insulin treated	58	11.9	79	36.6	
Duration of diabetes (years)					
< 10	361	74.0	82	38.0	$X^2 = 90.84$
10 - 19	98	20.1	84	38.9	$P < 0.001$
≥ 20	29	5.9	50	23.1	
Treatment					
None	24	4.9	3	1.4	
Oral	348	71.3	123	56.9	$X^2 = 31.84$
Insulin	75	15.4	44	20.4	$P < 0.001$
Oral + insulin	41	8.4	46	21.3	
Glycemic state					
Good control	151	30.9	39	18.1	$X^2 = 12.62$
Poor control	337	69.1	177	81.9	$P < 0.001$
Dyslipidemia					
No	148	30.3	52	24.1	$X^2 = 2.88$
Yes	340	69.7	164	75.9	$P = 0.09$
Hypertension					
No	346	70.0	125	57.9	$X^2 = 23.24$
Yes uncontrolled	35	7.2	41	19.0	$P < 0.001$
Yes controlled	107	21.9	50	23.1	
Co-morbid conditions					
No	291	59.6	109	50.5	$X^2 = 15.44$
Yes uncontrolled	135	27.7	54	25.0	$P < 0.001$
Yes controlled	62	12.7	53	24.5	
Obesity					
No	95	19.5	29	13.4	
Overweight	192	39.3	77	35.6	$X^2 = 6.96$
Obese	108	22.1	57	26.4	$P = 0.07$
Severely obese	93	19.1	53	24.5	
Waist circumference					
Normal	221	45.3	78	36.1	$X^2 = 5.16$
Obese	267	54.7	138	63.9	$P = 0.02$
Cardio-vascular complications					
No	384	78.7	107	49.5	$X^2 = 60.30$
Yes	104	21.3	109	50.5	$P < 0.001$
Nephropathy					
No	454	93.0	163	75.5	$X^2 = 42.68$
Yes	34	7.0	53	24.5	$P < 0.001$
Neuropath					
No	393	80.5	85	39.4	$X^2 = 116.49$
Yes	95	19.5	131	60.6	$P < 0.001$
Diabetic foot					
No	351	71.9	54	25.0	$X^2 = 134.94$
Yes	137	28.1	162	75.0	$P < 0.001$

Table III: Pattern of care and patients' practice of diabetic patients with and without retinopathy

Variables	Retinopathy				Significance
	No (n=488)		Yes (n=216)		
	No.	%	No.	%	
Need of help to reach health care center					
No	428	87.7	146	67.6	$X^2 = 40.23$
Yes	60	12.3	70	32.4	$P < 0.001$
Regular follow-up visits					
No	69	14.1	81	37.5	$X^2 = 48.63$
Yes	419	85.9	135	62.5	$P < 0.001$
Compliance with diet recommendations					
No	266	54.5	141	65.3	$X^2 = 7.12$
Yes	222	45.5	75	34.7	$P = 0.01$
Regular use of drugs*					
No	45	9.7	43	20.2	$X^2 = 14.20$
Yes	419	90.3	170	79.8	$P < 0.001$
Regular check of urine glucose					
No	471	96.5	212	98.1	$X^2 = 1.38$
Yes	17	3.5	4	1.9	$P = 0.24$
Regular check of blood glucose					
No	*336*	68.9	141	65.3	$X^2 = 0.88$
Yes	*152*	31.1	75	34.7	$P = 0.35$
SMBG					
No	448	91.8	199	92.1	$X^2 = 0.02$
Yes	40	8.2	17	7.9	$P = 0.88$
Smoking					
No	384	78.7	169	78.2	$X^2 = 1.11$
Yes	71	14.5	36	16.7	$P = 0.57$
Ex- smoker	33	6.8	11	5.1	
Physical activity					
No	175	35.9	116	53.7	$X^2 = 23.98$
Mild	200	41.0	76	35.2	$P < 0.001$
Moderate	113	23.2	24	11.1	

*: Excluding patients not on hypoglycemic drugs

Table IV: Factors associated with diabetic retinopathy, results of multivariate logistic regression analysis

Variables	Odds Ratio	95% CI
Age (years)		
< 40 [R]	1	
40 - 49	1.9	(0.8 – 4.5)
50 - 59	2.2	(1.1 – 5.2)
≥ 60	4.6	(2.0 – 11.0)
Type of diabetes		
Type 1 [R]	1	
Type 2	2.0	(0.9 – 4.6)
Type 2 – insulin treated	8.0	(3.5 – 19.4)
Duration of diabetes (years)		
< 10 [R]	1	
10 - 19	2.6	(1.6 – 4.2)
≥ 20	2.8	(1.5 – 5.5)
Hypertension		
No [R]	1	
Yes uncontrolled	3.1	(2.0 – 4.9)
Yes controlled	1.1	(0.9 – 1.2)
Glycemic state		
Good control [R]	1	
Poor control	2.0	(1.2 – 2.8)
Cardio-vascular complications		
No [R]	1	
Yes	1.7	(1.1 – 2.7)
Neuropathy		
No [R]	1	
Yes	2.3	(1.4 – 3.7)
Nephropathy		
No [R]	1	
Yes	1.9	(1.1 – 4.1)
Diabetic foot		
No [R]	1	
Yes	3.7	(2.3 – 5.9)
Regular follow-up visits		
No [R]	1	
Yes	0.5	(0.3 – 0.8)

[R] = Reference category, OR = Odds ratio, CI = Confidence interval

DISCUSSION

The current study is the first one conducted in a multi-centric population including Kuwaiti and non-Kuwaiti-population and focusing on care related risk factors that could be considered amenable for change. Also, within the studies conducted in Kuwait, few had considered adjustment for confounding between the studied factors.

In the present study DR was detected in 43.6% of the 704 adult diabetic patients attending PHC centers and participated in the study. A similar rate was reported in Oman.[13] This relatively high rate could be attributed partially to the new diagnostic criteria. Also, this goes in accordance with reports from the EURODIAB IDDM complication study,[14] a large multicentric cross-sectional study from European diabetic centers, whereas a prevalence of DR of 46% were demonstrated. Moreover, the Wilconsin Epidemiology Study of Diabetic Retinopathy (WESDR),[4] a large population-based study, reported the prevalence of DR varied from 17% to

97.5% in insulin treated young-onset diabetic patients with duration of diabetes of less than 5 years to 15 years or more, respectively. The corresponding figures found in India, Singapore and Nepal were 34%, 35.0% and 44.7% respectively.[15-17] However, lower rates had been reported in many studies. A relatively low rate was reported from a study that was conducted in Tehran (8.6%). The authors rated this low rate due to the underestimation as a result of lack of fundus photography.[18] These wide variations may be due to the study design, setting, population sample and ophthalmic technique used for diagnosis of retinopathy. The overall prevalence of DR found in this study is higher than that reported in a previous study conducted on type 2 diabetes in Kuwait. This difference may be because we included type 1 and type 2 diabetes that may increase the prevalence since retinopathy is more likely to occur in insulin treated patients and those with longer duration.[15]

In the present study, various factors have been identified as determinants of DR as age, type, and duration of diabetes, elevated glycemic state, uncontrolled hypertension, presence of cardiovascular complication, neuropathy, nephropathy and diabetic foot, in addition to regular follow-up.

The study demonstrated an increasing risk of DR with an increased age. This confirmed the results found by Chatthakul et al who reported increasing prevalence of DR with increasing age from ten to 39 year-old with a slight decrease of DR prevalence after the age of forty.[19]

In a similar study, that was conducted in Oman, El-Haddad et al[13] had defined many associated factors with DR, mainly age of patients, duration of diabetes, presence of heart disease, hypertension, high blood glucose level and dyslipidemia. However, after adjustment for covariates, duration of diabetes was the only risk factor associated with DR.

In many previous studies, age of onset of diabetes has been proved to be a determinant of DR. Moreover, Wong et al demonstrated that age of onset of type 2 diabetes influences inherent susceptibility of DR, independent of disease duration and degree of hyperglycemia.[20] In the present study, it could not be detected as a significant covariate for DR after adjustment for confounding with the duration of diabetes. This could be also due to recall bias. This goes with the results that was conducted by Shersha et al who reported that 21% of the known diabetics had evidence of various grades of DR although 75.3% of the enrolled patients had history of diabetes of less than 10 years.[21]

Duration of diabetes has been proved to be closely associated with DR in many previous studies.[13, 16, 22-25] In the present study the risk of DR is more than double folds in patient with diabetes for more than 10 years as compared with those with diabetes for less than 10 years. Duration of diabetes reflects total glycemic control and risk factor exposure over time.[26]

In accordance with other studies, it was found that insulin-treated patients were more liable to have DR in the present study.[15, 27] A possible explanation could be that DR may be the result of prolonged hyperglycemia that is more likely to be seen in insulin treated patients. Also, DR may result from certain metabolic state of retina that is more likely to be present in patients with type 1 diabetes than in type 2 diabetics. Another fact that insulin therapy is started after oral anti-diabetic drugs failure and these cases of type 2 diabetes have a longer duration of diabetes.[15,28] Cupta and Ambade declared that poor acceptance insulin delays the treatment towards better control for years and patients together with physicians go on oral drugs treating to avoid insulin.[15]

Metabolic factors such as composed of blood pressure, serum triglyceride, serum creatinine and proteinuria, seem to be important for the development of DR.[19] In the present study, diabetic patients with hypertension are more prone to have DR especially if hypertension is uncontrolled. It was proved that hypertension had an increasing impact with longer duration of diabetes and higher Hb_{A1c} values.[24,29] The UK Prospective Diabetes Study showed a 34% reduction in the progression of retinopathy in those treated intensively for hypertension.[30] In a previous study, it has been shown that 21.9% of DR patients had uncontrolled hypertension.[24] Improving monitoring and control of hypertension in diabetic patients could reduce the number of people developing DR.[23] However, in the present study, dyslipidemia could not be detected as a significant associated factor with DR. This could be attributed to the fact that patients with long term diabetic complications usually tend to check their serum lipids and that the levels of serum lipids before the development of DR were not available at the time of conducting the study.

The results went in accordance with many previous studies that confirmed the association between the development of DR and glycemic state.[16,27] In the EURODIAB studies,[14] they found that a higher Hb_{A1c} level was a significant factor related with moderate to sever DR. In addition, the WESDR[4] also demonstrated that a higher Hb_{A1c} level was significantly associated with retinopathy level in type 1 diabetes patients with any duration of diabetes. It was documented that an intensive insulin therapy would be effective to delay the onset and also slows the progression of DR in the DCCT,[31] so that strict glycemic control was recommended in all appropriate patients.

In the present study, DR was significantly associated with other types of long-term diabetic complications as cardiovascular diseases, diabetic nephropathy and neuropathy in addition to diabetic foot. The same results were reported by Wong et al.[16] Cheung et al reported that microvascular disease might play a more prominent role in the pathogenesis of diabetic cardiomyopathy and that persons with DR were more likely to develop heart failure.[32] It was postulated that there are common factors that predispose to microvascular diseases in diabetic patients.[33] Also, Reavan et al reported that there is an important relationship between retinopathy and extent of coronary artery calcium suggesting the potential to identify and treat risk factors for those common micro- and macrvascular complications.[17] Mobora et al[34] reported that diabetic foot patients with retinopathy have increased plasma levels of uric acid and ceruloplasmin. These plasma compounds could be important in the pathogenesis of retinal disease. Regarding the association between retinopathy and nephropathy, it was found that graded increases in the severity are recognized in both diseases. Banerjee et al[35] found that the predictive value of one lesion for the other was high in cases with longer duration.

Within care-related factors, regular follow-up was found to decrease the risk of DR by 50% in the present study. New advance in the care of diabetic patients recommended that all patients should be examined annually by ophthalmologist in addition to an initial examination at the time of diagnosis of diabetes.[36]

We acknowledge some limitations in our study. As we relied upon patient interview and record study, the data obtained might be, to certain extent, affected by the quality of recording. Also, as in any case control study, the design of the study is by definition retrospective and is subjected to recall bias. There is a limitation with accuracy of the duration of diabetes as it was based on self reports from diabetic patients. Nevertheless, the results are consistent with those coming from cohort studies.

Conclusion:

With the increasing prevalence of diabetes the number of people with DR will continue to rise. DR is both a treatable and often a preventable condition. Regular screening for DR particularly in those with other types of long term diabetic complications, and more aggressive management of glycemia and hypertension could reduce the prevalence of DR.

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REFERRENCES

1. Al-Maskari F, El-Sadig M, Obinche E. Prevalence and determinants of microalbuminuria among diabetic patients in the United Arab Emirate. BMC Nephrology 2008; 9: 1-18.
2. Chang S. Diabetic retinopathy. The CAMS 2000 Semi-Annual Scientific Meeting. Chinese American Health Issues. World Diabetes Foundation. JR (ed). Lyngby Denmark.
3. Varma R, Choudhury F, Klein R, Chung J, Torres M, Azen SP; Los Angeles Latino Eye Study Group. Four-year incidence and progression of diabetic retinopathy and macular edema: the Los Angeles Latino Eye Study. Am J Ophthalmol 2010, 149: 752-61.
4. Klein R, Klein BE, Moss SE, David MD, DeMets DL. Wisconsin epidemiologic study of diabetic retinopathy. II. Prevalence and risk of diabetic retinopathy when age at diagnosis is less than 30 years. Arch Ophthalmol 1984; 102: 520-6.
5. Amos SF, McCarty DJ, Zimmer P. The rising global burden of diabetes and its complications: estimates and projections of to the year 2010. Diabetic Medicine 1997; 14 (suppl .5): S1-85.
6. Stolwijk TR, van Bes JA, Oosterhuis JA, Swart W. Corneal autofluorescence: an indicator of diabetic retinopathy. Investigative Ophthalmology and Visual Science 1992; 33: 92-7.
7. El-Shazly M, Zeid M, Osman A. Risk factors for eye complications in patients with diabetes mellitus: development and progression. EMHJ 2000; 6: 313-25.
8. Al-Shammari F, Al-Meraghi O, Nasif A, Al-Otaibi S. The prevalence of diabetic retinopathy and associated risk factors in type 2 diabetes mellitus in Al-Naeem area (Kuwait). Middle East Journal of Family Medicine 2005; 3: 1-8
9. Al-Kharji F, Alshemmari N, Mehrabi L, Hafez M, Fakher O. Prevalence and risk factors for diabetic retinopathy among Kuwaiti diabetics. KMJ 2006; 38: 203-6.
10. Al-Adasani AM. Risk factors for diabetic retinopathy in Kuwaiti type 2 diabetic patients. Saudi Med J 2007; 28: 579-83.
11. Jumah NA, Al-Hajeri SS, Al-Ali KA, Ismaiel AE, Kamel MI. Epidemiological, clinical, and biochemical profile of type 2 diabetes in Kuwait. Bull Alex Fac Med 2009; 45: 77-85.
12. El-Nesf Y, Kamel MI, El-Shazly M, Sadek A, Makboul G, Al-Sayed A, Al-Fararji A. Survey of chronic non communicable diseases risk factors. Report of EMAN study in Kuwait 2008, Ministry of Health, Kuwait
13. El-Haddad OA, Saad MK. Prevalence and risk factors for diabetic retinopathy among Omani diabetics. Br J Ophthalmol 1998; 82: 901-6.
14. Sjolie AK, Stephenson J, Aldington S, Kohner E, Janka H, Stevens L, Fuller J. Retinopathy and

vision loss in insulin dependent diabetes in Europe. The EURODIAB IDDM Complication Study. Ophthalmology 1997; 104: 252-60.
15. Gupta S, Ambade A. Prevalence of diabetic retinopathy and influencing factors amongst type 2 diabetics from central India. Int J Diab Dev Countries 2004; 24: 75-8.
16. Wong TY, Cheung N, Tay WT, Wang JJ, Aung T, Saw SM, Lim SC, Tai ES, Michell P. Prevalence and risk factors for diabetic retinopathy. The Singapore Malay Eye Study. Ophthalmology 2008; 115: 1869-75.
17. Shrestha MK, Paudyal G, Wagle RR, Gurung R, Ruit S, Onta SR. Prevalence of and factors associated with diabetic retinopathy among diabetics in Nepal: a hospital based study. Nepal Med Coll J 2007; 9: 225-9.
18. Hatef E, Fotouhi A, Hashemi H, Mohammed K, Jalali KH. Prevalence of retinal diseases and their pattern in Tehran: the Tehran eye study. Retina 2008; 28: 755-62.
19. Chetthakul T, Likitmaskul S, Plengvidhya N, Suwanwalaikom S, Kosachunhanun N, Deerochanawong C, Krittiawong S, Benjasuratwong Y, Bunnag P, Prathipanawatr T, Ngarmukos C, Mongkolsomlit S, Rawdaree P. Thailand Diabetes Registry project: Prevalence of diabetic retinopathy and associated factors in type 1 diabetes mellitus. J Med Assoc Thai 2006; 89: S17-S26.
20. Wong J, Molyneaux L, Constantino M, Twigg SM, Yue DK. Timing is everything: age of onset influences long term retinopathy risk in type 2 diabetes, independent of traditional risk factors. Diabetes Care 2008; 31: 1985-90.
21. Shretha S, Malla Ok, Karki DB, Byanju RN. Retinopathy in diabetic population. Kathmandu Univ Med J 2007; 5: 204-9.
22. Marshall G, Garg SK, Jackson WE. Factors influencing the onset and progression of diabetic retinopathy in subjects with insulin dependent diabetes mellitus. Ophthalmology 1992; 100: 1133-9.
23. Klein R, Klein BEK, Moss SE, David MD, DeMets DL. Wisconsin epidemiologic study of diabetic retinopathy. A review. Diabet Metab Rev 1989; 5: 559-70.
24. Tapp RJ, McCarty D, Shaw JE,Taylor HR, Harper CA, Welborn TA, De Courten MP, Zimmet PZ, Balkau B. The prevalence and factors associated with diabetic retinopathy in the Australian population. Diabetes Care 2003; 26: 1731-7.
25. McKay R, McKarty CA, Taylor HR. Diabetic retinopathy in Victoria, Australia: the Visual Impairment Project. Br J Ophthalmol 2000; 84: 865-70.
26. Dowse GK, Humphrey ARG, Collins VR, Plehwe W, Gareeboo H, Fareed D, Hemraj F, Taylor HR, Tuomilehto J, Alberti KGMM, Zimmer PZ. Prevalence and risk factors for diabetic retinopathy in the multiethnic population of Mauritius. Am J Epidemiol 1998; 147: 448-57.
27. Pradeepa R, Anitha B, Mohan V, Ganesan A, Rema M. Risk factors for diabetic retinopathy in a South Indian type 2 diabetes population – the Chennai Urban Rural Epidemiology Study (CURES) Eye Study 4. Diabet Med 2008; 25: 536-42.
28. Mayurasakorn K, Somthip N, Caengow S, Chulkarat N, Wanichsuwan M. Glycemic control and microvascular complications among type 2 diabetes at primary care units. J Med Assoc Thai 2009; 92: 1094-101.
29. Manaviat MR, Rashidi M, Afkhami-Ardekani M. Four years incidence of diabetic retinopathy and effective factors on its progression in type II diabetes. Eur J Ophthalmol 2008; 18: 572-7.
30. UK Prospective Diabetes Study (UKPDS) Group. Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes. UKPDS 38. BMJ 1998; 317: 703-13.
31. The Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long term complications in insulin dependent diabetes mellitus. N Eng J Med 1993; 329: 977-86.
32. Cheung N, Wang JJ, Rogers SL, Brancati F, Klein R, Sharrett AR, Wong TY: ARIC Study Investigators. Diabetic retinopathy and risk of heart failure. J Am Coll Cardiol 2008; 51: 1573-8.
33. Cardoso CR, Salles GF. Predictors of development and progression of microvascular complications in a cohort of Brazilian type 2 diabetic patients. J Diabetes Complications 2008; 22: 164-70.
34. Mohora M, Virgolici B, Coman A, Muscurel C, Gaman L, Gruia V, greabu M. Diabetic foot patients with and without retinopathy and plasma oxidative stress. Rom J Intern Med 2007; 45: 51-7.
35. Banerjee S, Ghosh US, Basu AK, Bandyopadyay S. Diabetic maculopathy: the retinal-related link. J Indian Med Assoc 2004; 102: 410-3.
36. Puent BD, Nichols KK. Patients' perspectives on noncompliance with diabetic retinopathy standard of care guidelines. Optometry 2004; 75: 709-16.