Prevalence of Diabetic Retinopathy and its Associated Factors among Diabetic Patients in Primary Care Clinics, Kuantan, Pahang

Mohd Aznan MA[a,b], Khairidzan MK[c], Razman MR[d], Fa'iza A[a,b]

[a]*Department of Family Medicine, Kulliyyah of Medicine, International Islamic University Malaysia, Kuantan, Pahang*

[b]*Non-Communicable Diseases Research Unit, Kulliyyah of Medicine, International Islamic University Malaysia, Kuantan, Pahang*

[c]*Department of Ophthalmology, Kulliyyah of Medicine, International Islamic University Malaysia, Kuantan, Pahang*

[d]Department of Community Medicine, Kulliyyah of Medicine, International Islamic University Malaysia, Kuantan, Pahang

ABSTRACT

Introduction: Diabetic retinopathy (DR) is one of the commonest complications of diabetes mellitus. This study was to determine the prevalence of DR and its association with chronic kidney disease (CKD), high HbA1c and dyslipidemia among diabetic patients in government primary care clinics. **Materials and Methods:** A cross sectional study was carried out. The respondents were selected from diabetic registry at two government primary care clinics in Kuantan, Pahang via stratified random sampling method during the study period from May 2010 to April 2011. The respondents were interviewed and assessed clinically using a structured questionnaire. Retinal examination was performed by accredited staff using non-mydratic retinal imaging and DR was classified according to the International Clinical Diabetic Retinopathy Disease Severity Scale. **Results:** Out of 400 respondents, 58.8% were diagnosed with diabetes less than 5 years and 51.0% had uncontrolled blood pressure (>130/80 mmHg). The prevalence of DR and maculopathy were 33.5% and of 17.8% respectively. Most of these patients (22.3%) had mild non-proliferative DR. DR patients had higher percentages CKD (17.9% vs. 6.8%; p<0.001) and a higher mean of HbA1C (8.69 vs. 8.11; p=0.015) compared to non-DR patients. The study revealed that DR was independently associated with CKD {OR: 3.46, 95% CI (1.76, 6.80)} and high HbA1c {OR: 1.12, 95% CI (1.02, 1.23)}. Those with dyslipidemia however, has 39% less risk of DR {OR: 0.61, 95% CI (0.39, 0.94)}. **Conclusion:** This study showed that diabetic patients with CKD and high HbA1c have greater risks to develop DR but has protective risk with dyslipidemia.

KEYWORDS: diabetic retinopathy (DR), non-mydratic retinal camera, primary care clinic.

INTRODUCTION

Diabetes mellitus (DM) is an important public health concern. Globally there is a rising trend in the prevalence of DM due to many factors such as aging, urbanization and increasing prevalence of obesity and physical inactivity. The International Diabetes Federation (IDF) predicts that the prevalence of DM in South East Asia will increase by two folds by the year 2025.[1]

The World Health Organization (WHO) has estimated that in the year 2030, Malaysia would have a total of 2.48 million people with DM.[2] In Malaysia, the first National Health and Morbidity Survey I (NHMS I) conducted in 1986 reported a DM prevalence of 6.3% which had risen to 8.3% and 14.9% in the NHMS II (1996) and NHMS III (2006) respectively.[3] In the latest NHMS IV 2011 report, the overall prevalence of DM was 15.2% and 20.8% in those aged above 18 and 30 years respectively.[4] NHMS I and II involved subjects aged above 30 years while NHMS III and IV were conducted among subjects above 18 years of age.[4]

Corresponding Author:
Assoc. Prof Dr Mohd Aznan Md Aris
Department of Family Medicine,
Kulliyyah of Medicine,
International Islamic University Malaysia,
25200 Kuantan, Pahang, Malaysia.
Tel: +6095704571, Fax: +6095716978
Email: aznan@iium.edu.my

DM is a complex disease with multiple complications namely nephropathy, neuropathy, retinopathy, dermatopathy and cardiovascular disease.[13] Diabetic retinopathy (DR) is the leading cause of acquired blindness in the United States in patients aged 20 to 74 years.[5-7] Studies showed that early detection of diabetes, better glucose control, and early detection and treatment of DR can slow the progression of DR and prevent the development of blindness.[8,9] Vulnerable populations, including minorities and the elderly are disproportionately affected by diabetes. They have less access to medical care and are therefore disproportionately affected by the diabetic complications, including DR.[10,11] Effective screening and treatment programs can greatly reduce the burden of blindness in these populations.[12]

In Malaysia, diabetic eye disease is the commonest cause of visual loss among adults of working age. Prevalence of DR is closely linked to the duration of DM. At the time of diagnosis, less than 5% will have retinopathy while the prevalence rises to 40 - 50% after 10 years. Almost all patients with type 1 diabetes mellitus (T1DM) and more than 60% patients with type 2 diabetes mellitus (T2DM) have some degree of retinopathy after 20 years of the disease.[2]

Hence, effort to detect DR at an early stage is crucial. International and national guidelines for screening of this disease have been published, in which an annual fundus examination is mandatory for all diabetic patients.[13] Effective screening and treatment programmes can greatly reduce the burden of blindness in the vulnerable population.[12] The aim of this study was to measure the prevalence of DR in Kuantan population and its associated factors by using the Topcon TRC-NW6S Non-Mydriatic Camera as a sole screening instrument, in implementing effective screening and treatment programmes for diabetic patients with DR in primary care setting.

METHODOLOGY

A cross sectional study was carried out. The study adhered to the tenets of the declaration of Helsinki and was approved by Kulliyyah of Medicine research committee. The respondents were selected through stratified random sampling from the list of patients aged 18 years and older who attended the diabetic clinic in selected government primary care clinics in Kuantan, Pahang during the study period from 1st May 2010 to 30rd April 2011.

The data were collected in two parts. The first part used the questionnaire which consists of the socio-demographic and clinical characteristics of respondents. The clinical characteristics such as body mass index (BMI), waist circumference, blood pressure, systemic co-morbidity such as treated hypertension and dyslipidemia, chronic kidney disease (CKD), visual impairment and HbA1c were collected during the first visit.

The second part was to screen the presence of diabetic retinopathy (DR) by using the non-mydratic retina camera. There were two non-mydratic retina cameras available at government primary care clinics in Kuantan located at Klinik Kesihatan (KK) Jaya Gading and KK Balok. All selected respondents were given appointments at these clinics for retinal photography.

Retinal photography was taken using the Topcon TRC-NW6S Non-mydriatic Retinal Camera. It was performed by accredited technical staff using the nine-field photography. All photos were taken by the technicians in both clinics. The photographic images were then read by a trained primary care physician who is the main author and the final findings were confirmed by the consultant ophthalmologist. The retinal abnormalities were classified according to the International Clinical Diabetic Retinopathy Disease Severity Scale and the International Clinical Diabetic Macular Oedema Disease Severity Scale.[14]

The data was analyzed using the IBM Corp. SPSS Statistics for Windows, Version 19 Armonk, NY: IBM Corp. Descriptive analysis was carried out by calculating the frequencies and percentages for the categorical variables, while continuous variables were summarized as mean and standard deviation (SD). Chi-square analysis was used for categorical variables and for numerical variables; independent sample t-test was used to look for statistical significance of association. Logistic regression analyses were performed to estimate the odds ratios (ORs) and 95% confidence interval (CI) as the measure of association between CKD, high HbA1c and dyslipidemia with DR.

The 95% CI and adjusted OR (aOR) were reported. A *p* value of < 0.05 was considered as statistically significant.

Participation in the study was voluntary and each participant could withdraw from the study at any time. The questionnaire was accompanied by a cover letter explaining the purpose of the study and reassuring respondents of the confidentiality of the survey. Ethics approval was obtained from Kulliyyah Ethics Meeting No. 3/2009.

RESULTS

During the study period, 400 respondents agreed to be enrolled in the study. The mean (SD) age of patients was 51(11.1) years old. Majority were Malays (92.8%) and females (66.7%) with secondary education background (50.5%). Most of them were diagnosed to have diabetes mellitus (DM) for less

Table I: Socio-demographic characteristics of diabetic mellitus patients (n=400)

Variable		No	(%)
Age (years)		51	(11.1) [a]
Gender	Male	133	(33.3)
	Female	267	(66.7)
Race	Malay	371	(92.8)
	Chinese	16	(4.0)
	Indian	10	(2.5)
	Others	3	(0.8)
Education	No formal	78	(19.5)
	Primary	96	(24.3)
	Secondary	202	(50.5)
	Higher	23	(5.8)
Duration DM (years)	< 1	74	(18.5)
	1-5	161	(40.3)
	> 5	165	(41.3)
Smoking	No	365	(91.3)
	Yes	35	(8.5)

[a]*mean (SD)*

Table II shows the clinical characteristics of respondents in this study. Majority of these diabetic patients have systemic co-morbidities such as hypertension and dyslipidemia. About 10.5% of them have chronic kidney disease (CKD). Majority still have good vision (81%) and almost half of them have uncontrolled blood pressure. They also have uncontrolled DM as shown by high mean HbA1c level (8.3%).

Table II: Clinical characteristics of diabetic patients (n=400)

Variable		No	(%)
Systemic co-morbidity	No	68	(17.0)
	Yes	332	(83.0)
Hypertension	No	98	(24.5)
	Yes	302	(75.5)
Dyslipidemia	No	173	(43.3)
	Yes	227	(55.6)
Chronic kidney	No	358	(89.5)
diseases	Yes	42	(10.5)
Visual Impairment	Right eye	84	(21.1)
	Left eye	109	(27.3)
Total Visual	No	324	(81.0)
Impairment	Yes	76	(19.0)
Blood pressure	≤ 130/80	204	(51.0)
(mmHg)	> 130/80	196	(49.0)
HBA1c (%)		8.3	(2.3[a])
BMI (kg/m^2)		27.8	(5.35[a])
Waist circumference		94.5	(11.53[a])

[a]*mean (SD)*

This study revealed that 134 diabetic patients had DR with a prevalence of 33.5%. It was also found that 71 (17.8%) of them had both DR and diabetic maculopathy (Figure 1). Majority of these patients (22.3%) had mild non-proliferative diabetic retinopathy (NPDR) based on the total of number of eyes of diabetic patients (Figure 2). Examples of retinal photography taken in the study are shown in Figures 3 and 4.

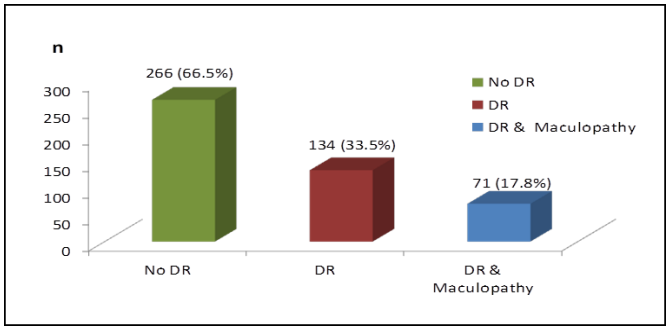

Figure 1: Number and percentages of diabetic retinopathy (DR) status in 400 diabetic patients

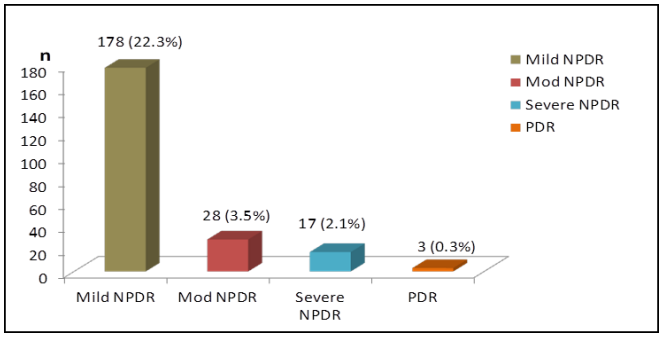

Figure 2: Types of diabetic retinopathy (DR) in the total eyes of respondents (n = 800)

Figure 3: Normal or no diabetic retinopathy of left eye

Figure 4: Mild non-proliferative diabetic retinopathy NPDR with maculopathy of right eye

There were no statistically significant differences in terms of age, gender, education background, duration of DM, history of smoking, presence of systemic co-morbidity and visual impairment between both groups of 'Diabetic Retinopathy' (DR) and 'No Diabetic Retinopathy' (NDR). Diabetic patients with DR have higher percentages of CKD (17.9% vs. 6.8%; p<0.001) and a higher mean of HbA1c (8.69 vs. 8.11; p=0.015) (Table III).

Table III: The clinical characteristics of Diabetic Patients by Status of DR

		Patients without diabetic retinopathy (n = 266) No.(%)	Patients with diabetic retinopathy (n = 134) No.(%)	*p* value[a]
Systemic co-morbidity	No	42 (15.8)	26 (19.4)	0.364
	Yes	224 (84.2)	108 (80.6)	
Hypertension	No	60 (22.6)	38 (28.4)	0.203
	Yes	206 (77.4)	96 (71.6)	
Dyslipidemia	No	108 (40.8)	65(48.5)	0.132
	Yes	158 (59.2)	69 (51.5)	
Chronic kidney didease	No	248 (93.2)	110 (82.1)	<0.001
	Yes	18 (6.8)	24 (17.9)	
Visual impairment	Right eye	58 (21.8)	26 (19.4)	0.578
	Left eye	74 (27.8)	35 (26.1)	0.719
Total visual impairment	No	212 (79.7)	112(83.6)	0.350
	Yes	54(20.3)	22(16.4)	
Blood pressure (mm/Hg)	≤130/80	144(54.0)	60 (44.8)	0.077
	> 130/80	122(46.0)	74 (55.2)	
HbA1c (%)		8.11 (2.34)[b]	8.69 (2.16)[b]	0.015
BMI (kg/m^2)		28.1 (5.74)[b]	27.5 (4.47)[b]	0.202
Waist circumference		94.3 (11.76)[b]	94.7 (11.13)[b]	0.769

Unless otherwise specified, number and % values are given, [a]comparing between status of DR, [b]mean (SD).

The study also revealed that DR was independently associated with CKD {OR: 3.46, 95% CI (1.76, 6.80)}, high HbA1c {OR: 1.12, 95% CI (1.02, 1.23)} and dyslipidemia {OR: 0.61, 95% CI (0.39, 0.94)} (Table IV).

Table IV: Multivariate Analysis* of factors associated with diabetic retinopathy (n = 134)

	aOR	95% CI	*p* value
Dyslipidemia	0.61	0.39, 0.94	0.028
HbA1c	1.12	1.02, 1.23	0.014
Chronic kidney disease	3.46	1.76, 6.80	<0.001

**Logistic regression*

DISCUSSION and CONCLUSION

The overall prevalence of diabetic retinopathy (DR) and maculopathy in this study were 33.5 % and 17.8% respectively. This result is lower than the national[15] and Singapore Malay eye[16] studies which showed the prevalence of DR as 36.8% and 35% respectively, but with higher in the prevalence of maculopathy (9.5% and 5.7% respectively). Another study at a primary care clinic in Muar showed a higher prevalence of DR and maculopathy (47.4% and 59.2% respectively).[17] Most of these patients had mild non-proliferative diabetic retinopathy (NPDR), which is similar to previous studies.[15-17]

In this study, the mean of DM duration with DR was 5.9 years. This result is similar to previous study conducted at Muar[17] but lower than National Eye Database 2007 study[15] which had a mean of DM with DR of 9.9 years. It's well known that the longer a patient being diagnosed with DM, the greater the risk of attaining diabetic retinopathy.[2]

Majority of DR patients (81%) in this study had good vision and only 19% of the respondents had visual acuity of 6/12 or worse in the better eye. Hence many of these diabetic patients may delay seeking early treatment for DR. This result is almost similar with previous study at a primary clinic in Muar.[17]

The development of DR greatly depends on the duration of DM and the control of glucose level, which is measured by the level of HbA1c with odds ratio (OR) ranging from 1.07 to 8.62.[16,18-21] In addition to uncontrolled glucose level other risk factors also played their role in the development of DR. This include the age of the patient, smoking status, the existence of other co-morbidities such as hypertension and dyslipidemia, body mass index, central obesity and renal function.[16,18-21]

In this study, we found that uncontrolled diabetes as shown by high mean HbA1c (OR 1.12) or presence of chronic kidney disease (CKD) (OR 3.46) have high risks of developing DR. Interestingly, the study also found that diabetic patient with dyslipidemia has 39% lower risk to develop DR which goes against previous studies.[18-21] The use of statins in most of diabetic patients with dyslipidemia was shown to prevent the progression of DR.[22-23]

In conclusion, the overall prevalence of DR in this study was 33.5% and most of these patients has had diabetes for less than 5 years and still presented with good vision. Hence, many of these diabetics may not be inclined to seek early eye check-up and treatment for DR. Diabetic patients with CKD had the highest risk (3.4 folds) of developing DR, which is followed by high HbA1c status (1.1 folds). Dyslipidemia on treatment was shown to have a protective effect from developing DR among diabetic patients in this study. With appropriate training, primary health care providers can contribute and support diabetic eye screening program.

CONFLICTS OF INTEREST

The authors declare that they have no conflict of interest.

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