

Prevalence of Diabetic Retinopathy (Proliferative and Nonproliferative) in Type 2 Diabetic Patients in Sulaimani Diabetic and Endocrine Center

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ABSTRACT

Background: There is increasing incidence of diabetes around the world. Moreover, diabetic retinopathy (DR) is one of the complications of diabetes mellitus and the leading cause of blindness among working age adults. This study aimed to evaluate the prevalence of DR in type 2 diabetic patients and to estimate the risk factors and their relationship to the development of DR. **Patients and Methods:** A case-control study was done on 262 type 2 diabetic patients with DR compared to 262 diabetic patients without DR. Further, retrospective cross-sectional study was done on cases with DR in Sulaimani/Iraq. Data were collected from January 1, 2017, to December 31, 2017. Association between variables was tested by Chi-square test; $P \leq 0.05$ was regarded as significant. **Results:** The prevalence of DR was 8.6%. The mean age of the patients with DR was 59.65 ± 7.55 years, with female being 31%. Age, gender, body mass index, and serum triglycerides were not associated with increasing risk for the development of DR ($P = 0.147, 0.536, 0.573, 0.111$, respectively), while cases with poor glycemic control, longer duration of diabetes mellitus, history of hypertension with elevated systolic and diastolic blood pressure ($P < 0.001$), and high serum cholesterol ($P = 0.005$) associated with increasing risk of DR. **Conclusions:** Poor glycemic control, history of hypertension, duration of diabetes >10 years, and high serum cholesterol are regarded as risk factors for the development of DR in diabetic patients.

Keywords: Diabetes mellitus type 2, diabetic retinopathy, Sulaimani Diabetic and Endocrine Center

INTRODUCTION

Diabetes mellitus (DM) is group of a chronic and progressive metabolic disorder characterized by high blood glucose with disturbances of carbohydrate, fat, and protein metabolism, resulting from defect in insulin secretion, insulin action, or both.^[1] Its incidence increased in recent decades because of change in life style and increasing prevalence of obesity and longevity.^[2] DM is known to be the leading cause of long list of complications and dysfunction of various organs, especially blood vessels, heart, kidneys, nerves, and eyes.^[3] Vasculopathy complications associated with diabetes are divided into two main subtypes: first, the diabetes-specific microvascular complications (nephropathy, neuropathy and retinopathy), and second, the atherothrombotic macrovascular complications of myocardial infarction, hypertension, and peripheral arterial disease.^[4]

Diabetic retinopathy (DR) is one of the most common microvascular complications of diabetes^[5] and the leading cause of blindness among age working adults.^[6] The progression of DR is from mild nonproliferative diabetic retinopathy (NPDR) abnormalities characterized by increased vascular permeability, to moderate and severe NPDR characterized by vascular closure, to proliferative diabetic retinopathy (PDR) characterized by growth of new vessels on retina and posterior substance of vitreous.^[7] Factors that influence the prevalence of DR include duration of diabetes,

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type of diabetes, poor control of blood sugar, dyslipidemia, hypertension, and higher level of urinary albumin-to-creatinine ratio.^[8,9] There are increasing cases of diabetes throughout the world; by 2000, it was estimated that there were 171 million people throughout the world living with diabetes; and by 2030, this number will increase to 366 million with the most significant increase occurring in developing countries, as DR is the main ocular complication of DM. DR is regarded the major cause of blindness throughout the world.^[10]

Objectives

1. To measure the prevalence of DR (proliferative and nonproliferative) in cases with type 2 diabetes mellitus
2. To assess the association of DR with sociodemographic factors
3. To find some risk factors for the development of DR.

PATIENTS AND METHODS

This study was done in two steps:

1. A cross-sectional study was conducted on 3026 diabetic patients who were undergoing ophthalmologic examination by ophthalmoscopy during their follow-up visit to the Sulaimani Diabetic and Endocrine Center for a period from January 1, 2017, to December 31, 2017
2. A case-control study was done included 262 patients with type 2 DM diagnosed with DR compared to 262 patients with diabetes but had no DR well matched in terms of age and gender as a control group. Both groups were selected among diabetic patients who were visiting the center for ophthalmological examination.

The patients with type 1 diabetes and gestational diabetes were excluded from the study.

Information for this study was taken from electronic database that contains all patients' medical records.

Data that were obtained for each of the cases and the control include age, gender, duration of diabetes, history of hypertension, systolic and diastolic blood pressure, fasting blood sugar and glycated hemoglobin (HBA1c), serum triglyceride cholesterol, and body mass index (BMI). Clinical chart was first selected for the presence or absence of DR.

It was based on current American Diabetic Association guideline^[11] to establish the target for glycemic controls (HBA1C $\leq 7\%$, fasting blood sugar < 126 mg/dl). While hypertension was set as blood pressure $\geq 140/90$, dyslipidemia set as triglyceride ≥ 150 mg/dl, and total cholesterol ≥ 200 mg/dl.^[12] DR was clinically defined, diagnosed, and treated based on the retinal vascular disease detected by ophthalmoscopy.^[13] Classification of BMI was done using the WHO guidelines for body weight classification in adults.^[14]

- Underweight < 18.5
- Normal weight 18.5–24.9
- Overweight 25.0–29.9
- Obesity ≥ 30.0 .

Data analysis was performed utilizing Statistical Package for the Social Sciences version 25 (SPSS version 25 Armonk, NY:IBM). and involved construction of frequency distribution, verifying the presence of association between DR and risk factors using Chi-square test. For all significance tests, level was kept at $P \leq 0.05$.

This study was approved by the ethic committee and scientific research units in Kurdistan Board for Medical Specialist; informed consent was taken from Directorate of Health Manager in Sulaimani.

RESULTS

In this study, the prevalence of DR was 8.6% (5.9% had NPDR and 2.7% had PDR).

The mean $\pm$ standard deviation of age of cases with DR was 59.65 ± 7.55 years versus 57.81 ± 7.26 years in controls (without DR), $P = 0.101$. The highest number of cases with DR was within the age group of 60–69 years (52.1%) with no statistical significance ($P = -0.147$) [Table 1]. Concerning gender, DR was found in 18.9% of males and in 31.1% of females. No significant association was detected between patients' gender and DR ($P = 0.536$).

Table 2 shows some clinical and laboratory finding of both cases and control patients.

Concerning glycemic control, it was observed that individuals with poor glycemic control (fasting blood sugar and HBA1c) had risk of 53.4% and 63.2%, respectively, for DR. Similarly, diabetic duration was significantly associated with the development of DR. It was observed a positive relationship between duration of DM and DR, with higher risk in those with diabetic duration > 10 years (83.8%) ($P < 0.001$). Regarding history of hypertension, high systolic and diastolic blood pressure, high risk of DR observed in patients with positive history of hypertension and high systolic and diastolic blood pressure, $P < 0.001$.

Other comorbidities studied were BMI and dyslipidemia. There is no statistical significant association observed between BMI and serum triglyceride ($P = 0.573$ and 0.111 , respectively).

Regarding serum cholesterol, there is high risk of DR in 59.0% of patients with serum cholesterol ≥ 200 mg/dl ($P = 0.005$). Table 3 shows The distribution of study groups according to type of diabetic retinopathy (N PDR and PDR)

Table 1: The distribution of study group according to age group and diabetic retinopathy

Age group (years)	No DR ($n=262$), n (%)	DR ($n=262$), n (%)	P
40–49	39 (56.5)	30 (43.5)	0.147
50–59	109 (52.4)	99 (47.6)	
60–69	104 (47.9)	113 (52.1)	
≥ 70	10 (33.3)	20 (66.7)	

DR: Diabetic retinopathy

Table 2: The distribution of study groups according to some clinical and laboratory finding

Risk factors	No DR, n (%)	DR, n (%)	P
Duration of diabetes (years)			
≤10	214 (93.9)	14 (6.1)	<0.001
>10	48 (16.2)	248 (83.8)	
History of hypertension			
Yes	128 (41.8)	178 (58.2)	<0.001
No	134 (61.5)	84 (38.5)	
Systolic blood pressure (mmHg)			
<140	202 (63.7)	115 (36.27)	<0.001
≥140	60 (29.0)	147 (71.0)	
Diastolic blood pressure (mmHg)			
<90	261 (57.7)	191 (42.3)	<0.001
≥90	1 (1.4)	71 (98.6)	
Fasting blood sugar (mg/dl)			
<126	52 (71.2)	21 (28.8)	<0.001
≥126	210 (46.6)	241 (53.4)	
HbA1c (%)			
≤7	120 (87.0)	18 (13.0)	<0.001
>7	142 (36.8)	244 (63.2)	
Serum cholesterol (mg/dl)			
<200	198 (53.8)	170 (46.2)	0.005
≥200	64 (41.0)	92 (59.0)	
Serum triglyceride (mg/dl)			
<150	160 (54.6)	133 (45.4)	0.111
≥150	102 (44.2)	129 (55.8)	
BMI			
Normal	47 (54.7)	39 (45.3)	0.573
Over weight	108 (50.2)	107 (49.8)	
Obese	107 (48.0)	116 (52.0)	

BMI: Body mass index, DR: Diabetic retinopathy, HbA1c: Glycated hemoglobin

In patients with DR, regarding the risk factor (duration of DM, history of hypertension, poor systolic and diastolic blood pressure control, poor glycemic control, and elevated serum cholesterol) which are associated with high risk of DR, it was observed that the percentage of NPDR was higher than PDR with no any statistical significance.

DISCUSSION

The present study showed that the prevalence of DR among 3026 type 2 diabetes was 8.6% (5.9% NPDR and 2.7% PDR).

Several studies were done to show the prevalence of DR; a clinical-based study in Oman showed that the prevalence of DR was 42%.^[8] Studies in Pakistan and India stated that the prevalence was 17.5% and 26.2%, respectively,^[15,16] these differences may be due to variation in sample size. Descriptive analysis of demographic characteristics of age and gender in both groups showed the mean age of patients with DR was slightly higher than the control (59.6 ± 7.55 vs. 57.81 ± 7.26) with predominance in females (31.1%), but there was no statistical significance regarding the risk of DR with any age groups and gender. Similarly, in a study done in

China^[17] and in Korea,^[18] no association was found between DR regarding age. While male preponderance had been reported in the study done in China,^[17] a study done in Japan had shown female preponderance.^[19] In a study done in Hoorn, the Netherlands,^[20] it showed that those with age groups of 50–59 years and ≥60 years have a greater risk of DR. This difference may be due to variation of population and their ages.

Regarding the risk of DR and in agreement with a study in United States,^[21] it was found that longer duration of diabetes, history of hypertension, poor control of blood pressure (systolic and diastolic), poor glycemic control, high fasting blood sugar, and HbA1c were associated with increasing risk of DR. Regarding the duration of diabetes, in a study done in Hyderabad and adjoining areas,^[22] the highest prevalence of DR was in patients with duration of diabetes >10 years.

Recent study conducted in United States of America^[21] show that risk of DR increases 6% with each year of DM.

Regarding the history of hypertension, one study done to estimate the risk for developing DR observed that after 10 years duration of diabetes, DR in patients with hypertension was more than 2 time higher than patients without hypertension.^[23] Further, a study which was done in 23 hospital based clinics in England, Scotland, and Northern Ireland^[24] observed that the diabetic complications can be prevented or delayed by controlling hypertension.

Chronic hyperglycemia leads to chain of events that lead to DR^[25] in a study in pima Indians, they showed that poor glycemic control which indicated by high HbA1c has been found as a risk factor.^[26] There was a strong evidence proved that adequate glycemic control reduce the risk for developing DR.^[27]

Regarding the BMI, it was found no statistical significant association between BMI and the risk for DR. Several studies show inconsistent relationship with positive association and other negative association.^[28] In a study which was done in Japan, the authors showed that patients with BMI >30 kg/m² and after 7 years of follow-up have statistical significance in DR frequencies.^[29] Hence, this variation in the result need more research to study the association of BMI and the risk for development of DR.

Regarding the dyslipidemia, the risk of DR increase in patients with dyslipidemia, but it was found no statistical significance with triglyceride. A study which was done in university of Wisconsin and Madison^[30] showed that the hard exudates of DR in particular is associated with elevated cholesterol level, while Beijing Eye Study^[31] reported no association between increased cholesterol levels and DR.

CONCLUSIONS

The prevalence of DR in Sulaimani Diabetic and Endocrine Center was less than tenth among 3026 diabetic patients. Diabetic patients with poor glycemic control, history of hypertension, elevated systolic and diastolic hypertension,

Table 3: The distribution of study groups according to type of diabetic retinopathy and some clinical and laboratory finding

Risk factors	NPDR, n (%)	PDR, n (%)	P
Duration of diabetes (years)			
≤10	9 (64.3)	5 (35.7)	0.248
>10	172 (69.4)	76 (30.6)	
History of hypertension			
Yes	121 (68.0)	57 (32.0)	0.339
No	60 (71.4)	24 (28.6)	
Systolic blood pressure (mmHg)			
<140	84 (73.0)	31 (27.0)	0.137
≥140	97 (66.0)	50 (34.0)	
Diastolic blood pressure (mmHg)			
<90	135 (70.7)	56 (29.3)	0.221
≥90	46 (64.8)	25 (35.2)	
Fasting blood sugar (mg/dl)			
<126	13 (61.9)	8 (38.1)	0.303
≥126	168 (69.7)	73 (30.3)	
HbA1c (%)			
≤7	11 (61.1)	7 (38.9)	0.303
>7	170 (69.7)	74 (30.3)	
Serum cholesterol (mg/dl)			
<200	115 (67.6)	55 (32.4)	0.295
≥200	66 (71.7)	26 (28.3)	
Serum triglyceride (mg/dl)			
<150	90 (67.7)	43 (32.3)	0.356
≥150	91 (70.5)	38 (29.5)	
BMI			
Normal	28 (71.8)	11 (28.2)	0.831
Over weight	75 (70.1)	32 (29.9)	
Obese	78 (67.2)	38 (32.8)	

BMI: Body mass index, PDR: Proliferative diabetic retinopathy, NPDR: Non-PDR, HbA1c: Glycated hemoglobin

duration of diabetes longer than 10 years, and high serum cholesterol have a greater risk for developing DR. Age, gender, BMI, and serum triglyceride were not associated with increasing chance for DR.

Recommendation

The results of this study suggest that in addition to serum glucose control in diabetic patients, screening for hypertension and dyslipidemia, and adequate treatment for these risk factors. In addition, early screening for DR might be prevented or delayed the progression of DR.

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Conflicts of interest

There are no conflicts of interest.

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