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The Prevalence of Diabetic Retinopathy and Related Risk Factors in Diabetic Type I, in Tehran, Iran

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Abstract: One of the most important complications of diabetes is retinopathy. It is in turn one of the causes to visual impairment and even blindness. Researches show that more than 60% of type II diabetic patients and nearly all of type I being retinopathy after 20 years. 3.6% of type I and 1.6% of type II retinopathy diabetic patients will finally become blind so finding out the effective factors causing and developing retinopathy can help us to solve some of the sight problems of diabetic patients. So we study a sample of 591 diabetic patients that had gone to ophthalmology clinic in Farabi hospital. Sampling method was randomly and our study is cross-sectional. In this study independent variables and the severity of retinopathy in two eyes has been visited and examined by standard methods, so based on the severity of retinopathy, they were classified into four classes: Normal, Mild, Moderate-Severe and Proliferate. (We studied a sample of 591 diabetic patients referring to Farabi hospital in Tehran. The data were collected randomly and our study is cross-sectional). In this study 245 (41.5%) patients were type I diabetics and 346 (58.5%) of them were type II. The prevalence of retinopathy in type I diabetics in right eye was 51.4% whereas in the left eye, it was 48.98%. The prevalence of retinopathy in type 2 diabetics, in right and left eyes were 28.3 and 27.2%, respectively. To analyze the effective factors on the severity of retinopathy in type I, we used bivariate Bayesian cumulative regression analysis model. It was found the duration of diabetes, diastolic hypertension, BMI, sex, dose of insulin, proteinuria and macular edema have significant effect on the severity of retinopathy ($p<0.05$). The prevalence of retinopathy in this study do not have a great difference with other studies, furthermore, the effective factors were comparable to the mentioned ones in the field. Controlling the mentioned systemic factors and effective causes, regular examinations by ophthalmologists and internal medicines have been recommended to predict retinopathy incidence and its recurrence.

Key words: Diabetes, diabetic retinopathy, prevalence, effective factors, Bayesian analysis, ordinal bivariate response

INTRODUCTION

One of the most chronic and no communicable diseases in the world is diabetes that its prevalence is increasing. WHO estimates diabetes to increase to about 300 millions cases by 2025. More than 75% of diabetes is in developing countries (Oussamma, 2006).

Diabetes is classified into two classes: type I depend to insulin that appear in younger cases usually and type II independent to insulin that appear in fat persons. One of important complications of diabetic patients is retinopathy. During the first two decades of disease, nearly all patients with type I diabetes and >60% of patients with type II diabetes have retinopathy. In the Wisconsin Epidemiologic Study of Diabetic Retinopathy (WESDR), 3.6% of younger- onset patients (type I diabetes) and 1.6% of older-onset patients (type II diabetes) were legally blind. In the younger-onset group, 86% of blindness was attributable to diabetic retinopathy (Klein *et al*., 1984).

The prevalence of retinopathy type I and type II depends on the country and sampling method estimated difference (Marshall *et al*., 1993; Segato *et al*., 1991; Agardh *et al*., 1989; Collins *et al*., 1995; Gonzalez *et al*., 1994; Sparrow *et al*., 1993; Fernandez-Vigo *et al*., 1993; Fernando *et al*., 1993). One of effective factors to

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retinopathy is during of the disease. Among younger-onset patients with diabetes in the WESDR, the prevalence of any retinopathy was 8% at 3 years, 25% at 5 years, 60% at 10 years and 80% at 15 years. The prevalence of PDR was 0% at 3 years and increased to 25% at 15 years (Klein *et al*., 1984).

Unfortunately, 82% of patients refer to the medicine when impairments appear which takes 8-14 years. In meta analysis (multi central) researches show that following up and correct treatment are effective to decrease the visual impairments in diabetic patients to 50%, this number is almost 90% in developed retinopathy (Oussamma, 2006).

Ophthalmologists classified retinopathy into four classes based on the severity: Normal, Mild, Moderate-Severe, Proliferate.

The percent of patients (retinopathy) is estimated differently in different societies. In Oman, in a study which was carry out among 500 diabetic patients, the prevalence was estimated 42.4%, in which 25.6% were Mild, 4% Moderate-Severe and 12.8% Proliferate (Haddad and Saad, 1998).

In the study of Wisconsin (WESDR) among 720 diabetic patients type I, suffering retinopathy under 30 year (younger onset), 32.9% of them have two healthy eyes. It means that the prevalence of retinopathy estimated 67.1%. In the left eyes, the prevalence of mild, moderate-severe and proliferative diabetic retinopathy was 38.5, 17.6 and 6.6%, respectively. These percents were, respectively, 37.5, 17.8 and 6.5% for the right eyes. In other words, 37.2% of the patients had normal left eyes and 38.2% of them had normal right eyes (Klein *et al*., 1984; Kim, 1995).

In a different study, some factors such as duration of diabetes, sex, diastolic hypertension, BMI, high creatinine, high Triglycerides, macular edema, proteinuria and dose of insulin are effective factors on retinopathy (Agardh *et al*., 1989; Haddad and Saad, 1998; Bustami *et al*., 2001).

Because of knowing the prevalence rate and associated risk factors that are effective on retinopathy and their controlling so they can help to decrease the prevalence of retinopathy or provide from it's recurrence, So we study the prevalence of retinopathy and effective factors to be retinopathy and provider of the disease.

MATERIALS AND METHODS

This study has been done based on cross-sectional method. Considering other studies that estimated the prevalence of retinopathy on 0.4-0.5 and assuming retinopathy prevalence of 50% among diabetic patients and error of 0.04 and by the confidence interval of 95%, this calculations resulted in a sample size of 600 diabetic patients, to achieve this sample size we selected randomly from the diabetic type I and II who had referred to ophthalmologic clinic in the Farabi hospital. This hospital is one the most famous university referral centers in our country which many patients with various ophthalmic problems refer to it from different parts of Iran.

Dependent variable was the severity of retinopathy. Diabetic patients (type I and II) were examined by the fellowship of retina in Farabi hospital. They measured pupil full dilatation by indirect ophthalmo-scope for complete retinal exam and they used +90 D lens and slit lamp and they classified it on four classes (Wilkinson *et al*., 2003). The other independent variables such as: during of diabetes, systolic blood pressure, diastolic blood pressure, BMI, pulse rate, sex, proteinuria (base on laboratory data), dose of using insulin(in type I), residence, macular edema, refractive errors and intraocular pressure were measured by examination or questions which were registered from patients.

Statistical analysis: For the descriptive purposes, we reported the qualitative factors in terms of rates and percentages and the quantitative variables in terms of mean±SD. For the analytic purposes, since the response data (severity of diabetic retinopathy for the right and left eyes of each patient) is a bivariate ordinal variable, we used the bivariate ordinal regression model proposed by Kim (1995). Data management and descriptive analysis was performed using SPSS version 13 and regression modeling process was performed using R2.5 software.

RESULTS

In this study, a total number of 600 diabetic patients were recruited. Of these, the data from 9 patients were excluded because of incomplete or suspicious information. In the remaining 591 patients, 245 persons (41.5%) had type I and the others (346 persons, 58.5%) had type II diabetes. Table 1 shows the general characteristics of the selected sample.

Among the type I diabetic patients, the prevalence of diabetic retinopathy was 51.4 and 49.0%, respectively, for the right and the left eyes. This prevalence was, respectively, 28.3 and 27.2% for the right and the left eyes of the type II diabetic patients. Table 2 and 3 show more detailed information about the severity of the diabetic retinopathy for the type I and II patients.

In the next step, we used a bivariate ordinal regression model in order to determine the effective factors on severity of diabetic retinopathy in type I patients. Table 4 shows the obtained results. According

Table 1: General characteristics of the sample

Characteristic		Type of diabetes	
		Type I	Type II
Sex	Male	131 (53.5%)	189 (54.6%)
	Female	114 (46.5%)	157 (45.4%)
Residency place	Urban	157 (64.1%)	218 (63.0%)
	Rural	88 (35.9%)	128 (37.0%)
Proteinuria	Presence	126(51.4%)	92(26.7%)
Duration of diabetes		15.32±5.13	11.82±6.25
Age at diagnosis		28.76±7.31	42.38±8.35
Systolic BP		134.61±8.58	130.19±9.12
Diastolic BP		89.98±9.26	86.11±8.81
BMI		24.6±4.1	30.48±3.8
Pulse rate		82.1±8.18	79.14±6.81
Insulin dose (per day)		21.05±8.68	----------
Refractive error (od)		-0.889±1.19	-0.66±1.75
Refractive error (os)		-0.888±1.2	-0.76±1.86
Ocular pressure (od)		16.93±6.02	15.89±3.72
Ocular pressure (os)		18.02±7.18	16.25±3.78
Macular edema (od)	Presence	126(51.4%)	98(28.3%)
Macular edema (os)	Presence	118(48.2%)	92(26.6%)

Table 2: Severity of diabetic retinopathy for type I diabetic patients

		Left eye				
		Normal	Mild	Mod-Sev	Proliferative	Total
Right eye	Normal	89	28	2	0	119(48.6%)
	Mild	31	30	4	0	65(26.5%)
	Mod-Sev	5	8	25	2	40(16.3%)
	Proliferative	0	0	4	17	21(8.6%)
	Total	125(51%)	66(26.9%)	35(14.3%)	19(7.7%)	245

Table 3: Severity of diabetic retinopathy for type II diabetic patients

		Left eye				
		Normal	Mild	Mod-Sev	Proliferative	Total
Right eye	Normal	216	32	0	0	248(71.7%)
	Mild	34	21	2	0	57(16.5%)
	Mod-Sev	2	5	20	5	32(9.2%)
	Proliferative	0	0	7	2	9(2.6%)
	Total	252(72.8%)	58(16.7%)	29(8.4%)	7(2%)	346

Table 4: Bivariate ordinal regression results for determining effective factors on diabetic retinopathy

Factor		Estimate	SE	95%CI	p-value
Sex	Female	-0.29	0.138	(-0.56, -0.0239)	0.0127
	Male	Reference category			
Residency	Rural	-0.035	0.165	(-0.35, 0.287)	0.368
	Urban	Reference category			
Proteinuria	Presence	0.778	0.159	(0.46, 1.08)	<0.001
	Absence	Reference category			
Macular edema	Presence	1.74	0.157	(1.44, 2.05)	<0.001
	Absence	Reference category			
Duration of diabetes		0.109	0.01	(0.088, 0.129)	<0.001
Age at diagnosis		-0.02	0.013	(-0.044, 0.0049)	0.073
Systolic BP		-0.0094	0.009	(-0.028, 0.009)	0.317
Diastolic BP		0.028	0.011	(0.0057, 0.049)	0.009
BMI		0.043	0.0088	(0.026, 0.06)	<0.001
Pulse rate		0.015	0.0104	(-0.005, 0.035)	0.145
Insulin dose		0.027	0.01	(0.008, 0.047)	<0.001
Refractive error		-0.056	0.056	(-0.169, 0.052)	0.113
Ocular pressure		0.017	0.017	(-0.0165, 0.053)	0.126

to these results, it can be concluded that duration of diabetes, diastolic blood pressure, BMI, sex, proteinuria, dose of insulin per day and macular edema were statistically significant effective factors on severity of diabetic retinopathy. We found no significant relationship between age at diagnosis of diabetes, systolic blood pressure, pulse rate, refractive error, ocular pressure and place of residence on severity of diabetic retinopathy.

DISCUSSION

In the present study, the prevalence of diabetic retinopathy was 63.6% for type I diabetic patients. A study in Oman showed that 37.5% of type I diabetic patients in this country had diabetic retinopathy (Haddad and Saad, 1998). Gonzalez *et al.* (1994) in Mexico, Fernandez *et al.* (1993) in Spain and Sparrow *et al.* (1993) in England reported a prevalence of 50% in the same patients, but study of Agardh *et al.* (1989) resulted in a prevalence of 60.5% in Sweden.

In addition, our study showed a prevalence of 37.5% for type II diabetic patients. This prevalence was reported about 43.6% in Oman (Haddad and Saad, 1998), 22.0% in Taiwan (Tung *et al.*, 2006), 26.2% in India (Narendran *et al.*, 2002) and 12.0% in Kuwait (Shammar *et al.*, 2005).

As another result, our study revealed a prevalence of 51.4 and 49.0% in the right and left eyes of type I diabetic patients. In the study of Wisconsin, the prevalence of diabetic retinopathy was reported about 61.8 and 62.8% for the right and left eyes of the younger onset diabetic patients (Klein *et al.*, 1984; Kim, 1995). Furthermore, the prevalence of mild, moderate-severe and proliferative diabetic retinopathy in our study were 26.5, 16.3 and 8.6%, respectively, in the right eyes of the type I diabetic patients. These percentages were 26.9, 14.3 and 7.7% in the left eyes of these patients. In the Wisconsin study, these percents were 37.5, 17.8 and 6.5% in the right eyes and 38.5, 17.6 and 6.6% for the left eyes (Klein *et al.*, 1984; Kim, 1995). Haddad and Saad (1998) reported mild, moderate to severe and proliferative diabetic retinopathy in 12.5, 4.6 and 20.8% of the selected patients in their survey (Haddad and Saad, 1998).

Except for Haddad's study, the results of the other above mentioned studies shows that the prevalence of the diabetic retinopathy in type I diabetics is higher than type II patients. This is an expectable result according to our medical experience. In addition, our findings showed no remarkable difference with the described studies. However, some differences might be due to ethnic variability in these studies (Emanuele *et al.*, 2005; Simmons *et al.*, 2007).

The results of regression analysis in our study showed that patients sex, duration of diabetes, proteinuria, macular edema, diastolic blood pressure, BMI and insulin dose were significantly associated with the severity of diabetic retinopathy. For Wisconsin study, Kim concluded that duration of diabetes, glycosylated hemoglobin, diastolic blood pressure, proteinuria, patient's sex, macular edema and presence of refractive errors were significant effective factors on severity of diabetic retinopathy (Kim, 1995). Bustami *et al.* (2001) reported the same effective factors on severity of diabetic retinopathy, except refractive error and insulin dose (Bustami *et al.*, 2001). Also, other studies reported duration of diabetes, sex, diastolic hypertension, BMI, high creatinine, high Triglycerides, macular edema, proteinuria and dose of insulin as the effective factors on diabetic retinopathy (Agardh *et al.*, 1989; Haddad and Saad, 1998; Biswas and Das, 2002; Shammar *et al.*, 2005).

CONCLUSION

In general, our study showed a high prevalence of diabetic retinopathy among diabetic patients in Iran. According to these results, promoting the knowledge level of the diabetic patients about the dangerous consequents of diabetic retinopathy as well as regular screening of the diabetic patients in order to detection of this ophthalmic problem in the early stages is highly recommended in our country.

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