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Original Research Article

Correlative study of diabetic retinopathy in type 2 diabetes mellitus with haemoglobin A1c, duration of diabetes and modifiable risk factors: smoking, alcohol and BMI in adult population attending a tertiary care hospital

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ABSTRACT

Background: Diabetes is a disease, which if not controlled, affects every cell of the body from head to toe. No wonder it is often referred to as the "SILENT KILLER". So through our study, we aim to study the correlation between (haemoglobin A1c) HbA1c levels, duration of diabetes and modifiable risk factors with diabetic retinopathy (DR) in patients of type 2 diabetes mellitus.
Methods: This study was conducted in 100 patients (200 eyes) who were diagnosed cases of type 2 diabetes mellitus. A detailed history of the duration of diabetes, alcohol intake and smoking and HbA1c levels was taken. Complete ocular examination was done. BMI was also calculated.
Results: 2/3rd of the eyes with grade 3 DR were of>10 years duration while 2/3rd of the eyes with grade 2 DR were of 5-10 years duration. Of the eyes with grade 3 DR, all the patients had HbA1c of more than 8. Significant p value shows strong correlation between DR and obesity. No significant correlation of DR was found with alcohol and smoking.
Conclusions: The findings in our study endorse the view that duration and HbA1c are important risk factors for occurrence and severity of DR and therefore a regular follow up and good glycemic control is highly essential for the prevention of occurrence and progression of DR. Strong correlation between BMI and DR suggest that lifestyle changes play a pivotal role.

Keywords: Diabetes, HbA1c, Diabetic retinopathy, Alcohol, Smoking, BMI

INTRODUCTION

DR is the leading cause of blindness among individuals between 25 and 74 years of age in the industrialized world.[1]

It is an emerging global epidemic expected to affect 642 million individuals by the year 2040. Almost two-third of all type 2 and almost all type 1 diabetics are expected to develop DR over a period of time.

The importance of long term glycemic control has been conclusively established in the landmark clinical trials including the diabetes control and complications trial (DCCT) and The UK prospective diabetes study (UKPDS).[1]

Chronic hyperglycemia is the primary factor leading to the development of diabetic retinopathy and other complications of the disease. It results in biochemical and molecular pathway changes that increase the oxidative stress, the advanced glycation end products and protein

kinase C pathways that ultimately lead to endothelial cell damage and pericyte loss of retinal capillaries. Numerous hematological abnormalities also occur.

Based on the clinical features, DR can be classified into non proliferative DR where there are intra retinal vascular changes but no extra retinal fibrovascular tissue formation. Based on its severity, it can be further classified into mild, moderate and severe. The other is the proliferative DR, wherein there is neovascularization, due to diabetes induced ischaemia and its associated complications like vitreous hemorrhage and eventual retinal detachment may occur. Diabetic maculopathy and macular oedema due to increased vascular permeability may arise. It is the most common cause of visual loss in a case of diabetic retinopathy.[2]

The risk of developing DR or other microvascular complications of diabetes depends on both the duration and severity of hyperglycemia. In patients diagnosed with diabetes before the age of 30 years, the incidence of DR after 10 years is 50% and after 30 years 90%. DR rarely develops within 5 years of the onset of the disease, but about 5% of type 2 diabetics have DR at the time of presentation. Raised HbA1c is associated with an increased risk or proliferative disease. By reducing the HbA1c by 1%, the microvascular complications can be reduced by one third.[3]

In a study conducted by Young et al alcohol consumption was found to be an important risk factor for DR.[9]

Although prolonged diabetes duration and raised HbA1c were well established risk factors for diabetic retinopathy, role of BMI, alcohol and smoking as a risk factor were slightly controversial. Therefore, this study had been conducted to investigate these risk factors and find their correlation with DR.

METHODS

This cross-sectional study was conducted in 100 patients (200 eyes) who were diagnosed cases of type 2 diabetes mellitus and presented to the outpatient ophthalmology department of Geetanjali medical college and hospital in Southern Rajasthan from December 2019 to February 2021. Study was conducted at 95% confidence interval at 5% of maximum allowable error. Patients who were diagnosed clinically were enrolled by simple random sampling. Written informed consent was taken from each study participant.

After taking a detailed history, including the duration of diabetes and HbA1c levels, complete ocular examination, starting from visual acuity, IOP measurement and anterior and posterior segment evaluation was done. After the instillation of the appropriate mydriatic drug, the fundus was examined using a 20D lens and the indirect ophthalmoscope. This was followed by fundus photography (if required). Based on the ophthalmoscopic features, the severity of the diabetic retinopathy of the 200 eyes was graded based on the early treatment diabetic retinopathy study (ETDRS) classification.

Body weight and height were measured in kilograms and in meter respectively. BMI was calculated as weight (kg)/height (m^2). Based on BMI, individuals were classified as: underweight<18.5; normal weight 18.5-24.9; overweight 25-29.9 and obesity 30 or greater.

The results were evaluated by ANOVA and Chi square tests.

RESULTS

Of the eyes diagnosed with grade 3 DR, 66.7% eyes were of the patients whose diabetes was of more than 10 years duration, 33.3% eyes were of the patients with 5-10 years duration of diabetes while no patient of duration of less than 5 years had grade 3 DR Table 1.

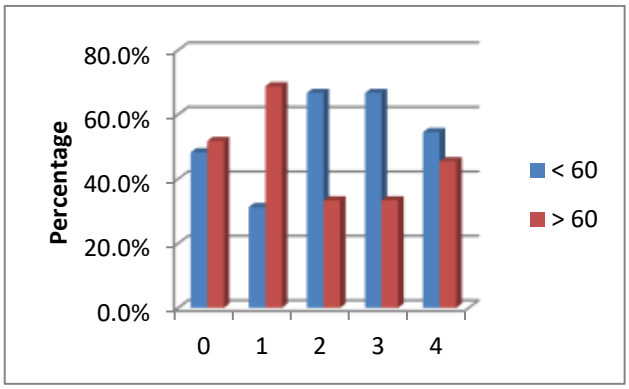

Figure 1: Number of eyes in each grade versus the age group of more than 60 and less than 60 years.

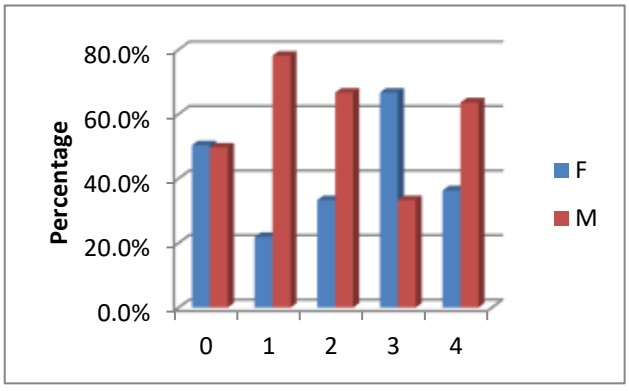

Figure 2: Number of eyes in each grade versus gender.

In eyes with grade 2 DR, majority of the eyes (66.7%) were of patients with 5-10 years duration of diabetes table 1.

However, in grade 1 DR, the percentage of eyes which were involved was equal in patients with diabetes of less than 5 years and more than 10 years table 1.

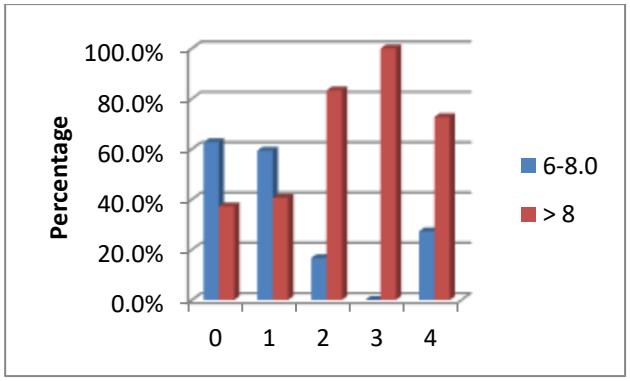

Figure 3: Number of eyes in each grade versus the HbA1c levels (6-8 and more than 8).

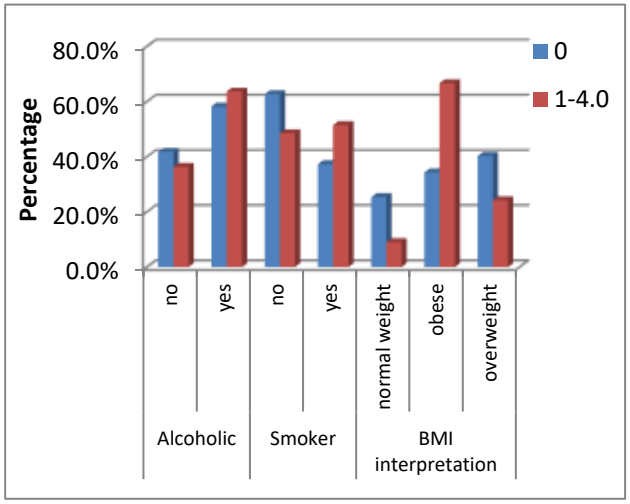

Figure 4: Modifiable risk factors versus diabetic retinopathy.

Figure 5: Fundus photo of a patient with HbA1c levels between 6-8 and duration between 5-10 years.

Figure 6: Fundus photo of a patient with HbA1c level >8 and duration of 5 years.

Figure 7: Fundus photo of a patient with HbA1c level of >8 and duration of >10 years.

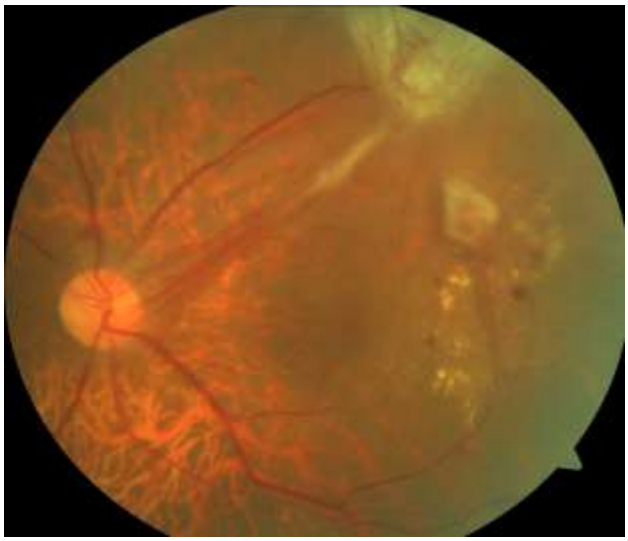

Figure 8: Fundus photo of a patient with HbA1c level of >8 and duration of >10 years.

Table 1: Number of eyes in each grade versus the duration of diabetes (less than 5 years, 5-10 years and more than 10 years).

Grade		Duration (in years), N (%)						Total	P value
		<5		5-10		>10			
Diabetic retinopathy grading (ETDRS)	0	94	64.8	28	19.3	23	15.9	145	0.001
	1	12	37.5	8	25.0	12	37.5	32	0.017
	2	1	16.7	4	66.7	1	16.7	6	0.040
	3	0	0.0	2	33.3	4	66.7	6	0.005
	4	5	45.5	6	54.5	0	0.0	11	0.029
Total		112	56.0	48	24.0	40	20.0	200	

Table 2: Association of occurrence of DR in relation to intake of alcohol, smoking and the patient's BMI.

Characteristics		Diabetic retinopathy grading (ETDRS) outcome N (%)				Total	P value
		0		1-4.0			
Alcoholic	No	28	41.8	12	36.4	40	0.602
	Yes	39	58.2	21	63.6	60	
Smoker	No	42	62.7	16	48.5	58	0.176
	Yes	25	37.3	17	51.5	42	
BMI interpretation	Normal	17	25.4	3	9.1	20	0.008
	Obese	23	34.3	22	66.7	45	
	Overweight	27	40.3	8	24.2	35	
Total		67	100.0	33	100.0	100	

Of the eyes with grade 3 DR, all the patients had HbA1c of more than 8 Figure 3.

Of the eyes with HbA1c between 6-8, 62.8% eyes had no DR Figure 3.

Out of the 100 patients, 45 were found obese. 66.7% of these obese patients showed changes of DR Table 2, Figure 4.

Out of the 60 patients who were alcoholic, 63.6% showed changes of DR Table 2, Figure 4.

Out of the 42 patients who were smokers, 51.5% showed changes of DR Table 2, Figure 4.

DISCUSSION

This study was conducted in 200 eyes of patients suffering from type 2 diabetes mellitus.

2/3rd of the eyes with grade 3 DR were of >10 years duration while 2/3rd of the eyes with grade 2 DR were of 5-10 years duration.

More incidence of grade 3 DR was noted in these patients, thus stressing on the fact that HbA1c adversely affects the occurrence and progression of diabetic retinopathy. Good glycemic control is therefore of utmost significance in diabetic patients.

Our study provided an insight into the correlation between duration and levels of HbA1c with grade of DR. HbA1c has a significant predictive role in indicating the severity of DR.

Correlation of DR with three modifiable risk factors like alcohol, smoking and obesity were also studied. However significant p value was obtained only in overweight and obese patients. This strongly suggested a significant correlation between DR and obesity. No significant correlation between DR and alcohol and smoking was found. This signified the pivotal need of an active lifestyle with healthy eating habits and exercise to remarkably reduce the occurrence of DR which creates a significant morbidity in diabetic patients affecting their quality of life.

In the study done in 1991 by Singh et al the mean value for HbA1c was found to be higher in patients suffering from proliferative DR.[3] The study of Apoorva et al done in 2017 also concluded that poor metabolic control caused high HbA1c which was significantly associated with severe DR and presence of clinically significant macular oedema (CSME).[5] Study of Garg et al points that duration of diabetes and poor glycemic control causes microalbuminuria which poses a risk for DR.[6] In the study conducted by Shrote et al significant p value was obtained showing significant correlation between BMI and severity of DR.[8]

Limitations

This study included all patients of type 2 diabetes mellitus whether on medications or not. Thus, HbA1c levels would have been affected by the anti-diabetic treatment thus limiting the results of the study.

CONCLUSION

The findings in our study endorse the view that duration and HbA1c are important risk factors for occurrence and severity of DR and therefore a regular follow up and good glycemic control is highly essential for the prevention of occurrence and progression of diabetic retinopathy. Strong correlation between BMI and DR suggests that lifestyle changes are a strategic fulcrum to control the development and progression of DR.

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