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Retinopathy and its associated factors in Type 2 Diabetes Mellitus in rural population of central India

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Abstract
Introduction: *Diabetes is traditionally known as a "silent disease," exhibiting no symptoms until it progresses to severe target organ damage. Duration of diabetes is closely associated with onset and severity of diabetic retinopathy. Lack of glycaemic control, hypertension, renal disease manifested in form of microalbuminuria and proteinuria, elevated level of serum lipid are associated with extravasated lipid in retina (hard exudates) and visual loss., pregnancy and tobacco use.*
Aim: *To study retinopathy and its associated factors in type 2 Diabetes Mellitus in the rural population of central India.*
Material & Methods: *315 diagnosed Type 2 diabetes mellitus patients who fulfilled the inclusion and exclusion criteria were selected from health camp from rural areas around the U.P.U.M.S in the neighbouring districts of Etawah and Mainpuri. The patients were recruited after written consent. The information was collected using structured questionnaire and physical examination. HbA1c was measured using immune turbiditric method. All participants underwent a comprehensive dilated fundus examination to detect diabetic retionopathy by indirect ophthalmoscopy. Diabetic Retinopathy was clinically graded in accordance with the International Clinical Diabetic Retinopathy guidelines.*
Results: *A sample of 315 patients revealed that 39% were below 50years. Mean age of study population was 51.72 yrs. Average duration of diabetes was 3.97 years. Mean BMI was 25.23 kg/m^2. Mean FBS was 193.74 mg/dl. Average PPBS was 322.85 mg/dl. Average HBA1c was 9.07%. Mean total cholesterol was 182.78 mg/dl, HDL was 43.37 mg/dl, LDL was 105.30 mg/dl, and Triglyceride was 170.50 mg/dl. Socio economic status revealed 76% belonged to Lower and Lower middle class. The prevalence of NPDR was seen to be 19% and PDR 1.9%. Age and increased BP showed significant association with retinopathy with p value of <0.001 and 0.003 respectively.*
Conclusion: *Duration of Diabetes and Blood pressure were strongly associated with Diabetic retinopathy*
Keywords: *Diabetes Mellitus, Retinopathy, Glycemic Control, Hypertension.*

Introduction

Diabetes mellitus (DM) refers to a group of common metabolic disorders that share the phenotype of hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both.[1]DM is classified on the basis of the

pathogenic process that leads to hyperglycaemia, as opposed to earlier criteria such as age of onset or type of therapy. The two broad categories of DM are designated as type 1 and type 2. Both types of diabetes are preceded by a phase of abnormal glucose homeostasis as the pathogenic processes progress. Type 1 DM is the result of complete or near-total insulin deficiency. Type 2 DM is a heterogeneous group of disorders characterized by variable degrees of insulin resistance, impaired insulin secretion, and increased glucose production4. Diabetic Retinopathy (DR) is one of the common complication of diabetes mellitus and the leading cause of blindness worldwide.[2] It is characterized by signs of retinal ischemia and/or increased retinal vascular permeability, with loss of vision due to neo-vascularization, haemorrhage, retinal detachment, macular oedema and/or retinal capillary non-perfusion.[3] Patients with DR are 25 times more likely to become blind than those without diabetes.

In patients with type 2 diabetes, approximately 20% have retinopathy at the time of diabetes diagnosis &approximately 25% of patients with type 1 diabetes have retinopathy after 5 years, with this figure increasing to 60% and 80% after 10 and 15 years, respectively.[4] This condition is of vascular origin, and is characterized by signs of retinal ischemia as well as signs of increased vascular permeability.[5] It is a well-known fact that retinopathy often goes unnoticed until vision loss occurs, hence early detection, timely treatment and appropriate care can protect or delay the vision loss.[6] This study was conducted to investigate the associations between the diabetic retinopathy and a variety of risk factors, including duration of diabetes, HbA1c levels, hypertension, age, gender and dyslipidaemia.

Material and Method

315 patients of age more than 25 years with type 2 DM out of which 158 were male and 157 were female participated in the study. All secondary causes of hyperglycemia and type 1 DM were excluded from the study. All consecutive patients were recruited (during their routine follow-up) in the Department of Internal Medicine U.P.U.M.S Saifai Etawah during the time period Jan 2017 to June 2018. Diabetes was defined on fulfillment of criteria laid down by the WHO Consultation Group Report and International diabetes federation IDF, i.e., plasma fasting blood glucose ≥126 mg/dl or 2 h plasma post-glucose value ≥200 mg/dl OR HbA1c > 6.5 % and known cases of type 2 diabetes mellitus. HbA1c has now been recommended by an International Committee and by the ADA as a means to diagnose diabetes. The participants diagnosed as Diabetics were then asked to follow up in our institute for further evaluation. History regarding drug usage and family history of diabetes were taken. Blood samples were drawn for measurement of HbA1c, lipid profile, complete blood count and kidney function tests. All biochemical test were done using an autoanalyser. HbA1c was measured using immune turbiditric method. All participants underwent a comprehensive dilated fundus examination to detect DR by indirect ophthalmoscopy. DR was clinically graded in accordance with the International Clinical Diabetic Retinopathy guidelines.

Disease Severity Level	**Findings Observable upon Dilated Ophthalmoscopy**
No apparent retinopathy	No abnormalities
Mild NPDR	Micro aneurysms only
Moderate NPDR	More than just micro aneurysms but less than severe NPDR
Severe NPDR	
International Definition	Any of the following and no signs of proliferative retinopathy: • More than 20 intraretinal hemorrhages in each of **four** quadrants • Definite venous beading in **two** or more quadrants • Prominent IRMA in **one** or more quadrants
PDR	One or both of the following: • Neovascularization • Vitreous/preretinal hemorrhage

IRMA = intraretinal microvascular abnormalities; NPDR = nonproliferative diabetic retinopathy; PDR = proliferative diabetic retinopathy

Note: Any patient with two or more of the characteristics of severe NPDR is considered to have very severe NPDR

Statistical Analysis

The data was coded and analysed using Microsoft Excel and SPSS 23. The results are presented in frequencies, percentages and mean±SD. The Chi-square test was used to compare categorical variables. The one way analysis of variance (ANOVA) and Unpaired t-test was used to compare continuous variables. The p-value<0.05 was considered significant.

Results

The present study is cross sectional observational study, conducted in the Department of General Medicine of UPUMS Saifai, Etawah from January 2017 to June 2018 with the objective to determine the retinopathy and its associated factors in Type 2 DM in rural population of central India.

A total of 315 Type 2 Diabetic cases were included in this study. Out of which 158 were male and 157 were female and we studied retinopathic changes in them.

In this study patients who were having Type 2 Diabetes mellitus and of more than 25 years age were included, out of which 123 (39%) were below 50years and 123 (39%) were between 51-60 years and 55 (17.5%) were between 61-70 years and 14 (4.4%) were in >70 years of age group.

Mean age of study population was 51.72 yrs. Average duration of diabetes was 3.97 years.

Mean BMI was 25.23 kg/m^2. Mean FBS was 193.74 mg/dl. Average PPBS was 322.85 mg/dl. Average HBA1c was 9.07%.

Mean total cholesterol was 182.78 mg/dl, HDL was 43.37 mg/dl, LDL was 105.30 mg/dl, and Triglyceride was 170.50 mg/dl. The prevalence of diabetic retinopathy was observed to be 21%, which constituted 19% of Non-proliferative diabetic retinopathy.

Table 1 Mean Age, duration, anthropomorphic, blood sugar, lipid profile

Characteristics	Sex		Total
	Males	Females	
Age	51.62 ± 12.3	51.83 ± 11.74	51.72 ± 12.36
Duration of diabetes (in years)	4.59 ± 2.3	3.33 ± 1.69	3.97 ± 2.5
BMI	25.27 ± 4.08	25.19 ± 4.40	25.23 ± 4.2
FBS	196.63 ± 77.79	190.84 ± 61.321	193.74 ± 70.02
PPBS	323.70 ± 97.06	322.01 ± 98.90	322.85 ± 97.86
HBA1C	9.16 ± 2.1	8.98 ± 2.2	9.07 ± 2.15
Total Cholesterol	182.08 ± 47.42	183.49 ± 41.07	182.78 ± 44.3
HDL	42.23 ± 7.48	44.53 ± 7.88	43.37 ± 7.75
LDL	104.98 ± 33.49	105.63 ± 32.08	105.30 ± 32.74
TG	174.33 ± 94.22	166.64 ± 70.05	170.50 ± 83.01

Table 1 reveals the gender wise distribution of demographic and clinical profile of study subjects. Average age of duration of diabetes was more among males diabetic patients. Females study subjects showed increased average levels of lipid profile, except triglyceride.

Table 2 Socio Economic Status of Diabetics

Socio economic Class	NO. of diabetic	Percent
Lower	167	53.0
Lower Middle	75	23.8
Middle	34	10.8
Upper Middle	24	7.6
Upper	15	4.8

Table 2- Most of the study subjects belonged to lower and lower middle class of economic status.

Table 3: Association of retinopathy with duration of diabetes

Duration of diabetes	**No. of patients**		**NPDR**		**PDR**		**No**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
<5 years	101	32.1	10	9.9	0	0.0	91	90.1
5-10 years	70	22.2	16	22.9	4	5.7	50	71.4
>10 years	31	9.8	22	71.0	0	0.0	9	29.0
New cases	113	35.9	12	10.6	2	1.8	99	87.6

Table 3 The duration of diabetes was <5 years among 32.1% patients. The prevalence of NPDR was higher among patients whom duration of diabetes was >10 years (71%) as compared to other duration of diabetes. The prevalence of PDR was higher among patients who whom duration of diabetes was 5-10 years (5.7%).

Table 4: Association of retinopathy with age and sex

Age in years	No.	%	NPDR		PDR		No		
<50	123	39.0	4	3.3	2	1.6	117	95.1	0.0001*
51-60	123	39.0	34	27.6	2	1.6	87	70.7	
61-70	55	17.5	10	18.2	2	3.6	43	78.2	
>70	14	4.4	12	85.7	0	0.0	2	14.3	
Sex									
Male	158	50.2	28	17.7	4	2.5	126	79.7	0.61
Female	157	49.8	32	20.4	2	1.3	123	78.3	

Table 4 shows the increased proportion of diabetic retinopathy with increase in age of the study subjects among both proliferative and non-proliferative diabetic retinopathy and this association was found to be statistically significant (p value - 0.0001). The prevalence of diabetic retinopathy was nearly same among both the genders.

Table 5: Association of retinopathy with hypertension

Hypertension	No. of patients		NPDR		PDR		No		p-value[1]
	No.	%	No.	%	No.	%	No.	%	
Present	86	27.3	24	27.9	4	4.7	58	67.4	0.003*
Absent	229	72.7	36	15.7	2	0.9	191	83.4	

Table 5 shows the association of retinopathy with hypertension. Hypertension was seen among majority (27.3) patients. The prevalence of NPDR was higher among patients of hypertensive (27.9%) than non-hypertensive (15.7%). The prevalence of PDR was 4.7% who were hypertensive. There was significant (p=0.003) association of retinopathy with hypertension.

Table 6: Comparison of anthropometric parameters with retinopathy

Anthropometric parameters	NPDR	PDR	No	p-value[1]
BMI	25.71±3.64	27.96±3.59	25.10±4.38	0.17
Waist circumference	85.93±9.92	91.33±10.82	81.25±15.41	0.06
Hip circumference	93.80±8.90	98.33±13.18	89.45±15.64	0.06
WHR	0.91±0.03	0.92±0.01	0.90±0.04	0.22

Table-6 shows the comparison of anthropometric parameters with retinopathy. There was no significant (p>0.05) difference in anthropometric parameters with retinopathy.

Table 7: Comparison of lipid profile and retinopathy

	NPDR (Mean±SD)	PDR (Mean±SD)	No DR (Mean±SD)	P value
FBS	198.40±64.45	246.00±143.64	191.36±68.74	0.14
HbA1c	8.55±1.81	10.23±3.95	9.17±2.15	0.06
HDL	43.47±8.07	45.07±7.30	43.31±7.71	0.85
TG	191.35±91.38	211.33±7.23	164.49±80.97	0.06

Table-7 shows the comparison of blood glucose and lipid profile with retinopathy. All the parameters were observed to be increased among proliferative diabetic retinopathy patients compared to other study subjects. But the difference was not sufficient to be proven a statistically significant difference.(p value >0.05)

Discussion

Retinopathy was detected in 22.86 % diabetics in our study. Non proliferative retinopathy was most common variety of retinopathy (20.95 %). Most common abnormality was micro-aneurysm. These findings are similar to study by Ramachandran A et al[7] who found retinopathy in 23.7% (background retinopathy in 20.0% and proliferative in 3.7%).in study by Rema M et al[8] (2006) 34.1% had evidence of retinopathy. This included 30.8% with non-proliferative diabetic retinopathy including 6.4% with maculopathy and 3.4% with proliferative diabetic retinopathy. In a study conducted by Dandona L et al.[9] diabetic retinopathy was present in 22.3 %. Most of the diabetic retinopathy was of the mild (50%) or moderate (39.3%) non-proliferative type. In a study by V Narenderan et

al[10], 26.2% self-reported history diabetics had retinopathy. Non-proliferative diabetic retinopathy (94.1%) was the most common form of retinopathy seen. Higher prevalence of Retinopathy was seen in study by Mohan V et al[11] in which Retinopathy was detected in 52.0% of patients which included 41.7% with non-proliferative and 10.3% with proliferative diabetic retinopathy but it was a institute based study in a urban area . Lower prevalence was seen in Chennai Urban Rural Epidemiology Study (CURES)[12] in which the overall prevalence of diabetic retinopathy was 17.6 %. Raman R et al[13]in a study found the prevalence of diabetic retinopathy as 10.3% in the rural Indian population. A study conducted by Vaz NC et al.[14] found the prevalence of diabetic retinopathy to be 15.4 %. In a study conducted by Jonas JB et al[15] diabetic retinopathy prevalence was 9.6%.

Conclusion

Retinopathy was detected in 20.95 % Diabetics. Non proliferative retinopathy was most common variety of retinopathy (19.04 %). There was positive correlation between duration of diabetes, age and hypertension with diabetic retinopathy while no significant association was found between gender, anthroprometric measurements and de-arranged fasting lipid profile.

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