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Glycaemic status is an important risk factor for the occurrence of diabetic retinopathy in newly diagnosed type 2 diabetic patients

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ABSTRACT

Objective: To assess the frequency of diabetic retinopathy (DR) and correlation with HbA1c in newly diagnosed type 2 diabetic patients. **Materials and Methods:** The study was conducted at a tertiary care medical centre in north India. All patients of >30 to <60 years of age, who were newly (within a month) diagnosed type 2 diabetes mellitus, according to World Health Organization (WHO) criteria and American Diabetes Association (ADA) recommendations, were included in the study. HbA1c was estimated from venous blood collected in ethylene diamine tetra acetic acid (EDTA) test tube, using boronate affinity chromatography (HPLC). Diabetic retinopathy was assessed by fundus examination using direct ophthalmoscope after dilatation of pupils. Early treatment diabetic retinopathy study (ETDRS) scale was used to assess the severity of diabetic retinopathy. **Results:** Twenty-eight percent of the newly diagnosed cases were found to have diabetic retinopathy, of which 73.52% were of mild NPDR (non-proliferative diabetic retinopathy) and 26.47% were of moderate NPDR. Mean FPG of population with retinopathy was 194.05 ±29.82 mg/dl and that of population without retinopathy was 175.67 ± 27.71mg/dl. Mean HbA1c of population with retinopathy was 7.71±1.01%and that of population without retinopathy was 7.22 ± 0.74. **Conclusions:** Mild NPDR is the most common form of diabetic retinopathy in newly diagnosed type 2 DM patients. Study demonstrated a very significant positive correlation between level of glycosylated hemoglobin (HbA1c) and frequency of diabetic retinopathy in these cases. So, glycaemic status is an important risk factor for the occurrence of diabetic retinopathy.

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INTRODUCTION

Diabetic retinopathy (DR) is the most frequent cause of blindness among adult age 20 to75 years.[1,2] It is an important health problem worldwide. Chennai Urban Rural Epidemiology (CURES) Eye Study reported the prevalence of DR to be 17.6% in India, which is less in comparison to the western world.[3] However, globally, due to a large population of diabetes patients, it has been estimated that about 30% of people with DM have DR.[4] It is not surprising that glycemic index (GI), which is a physiological measure for classifying carbohydrate-containing foods according to postprandial glycemic potential, has been related to many disorders, such as diabetes and cardiovascular disease and diabetic retinopathy[5,6] and hence a risk factor. Many patho-physiological effects follow postprandial hyperglycemia after eating a high-GI meal may leads to diabetes or diabetic complications including DR.[7]

Several studies reported that the reduction of HbA1c to 7% can cause a decrease in the prevalence of DR as well as

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in the rate of progression.[8-10] The purpose of the present study was to study the prevalence of diabetic retinopathy in newly diagnosed type 2 DM patients and it's correlation with HbA1c levels, in a tertiary medical care centre in north India, thus to see, whether the results obtained in other studies replicate here or the epidemiological factors play a role and bring out results, different from other studies.

MATERIALS AND METHODS

The present study was a cross-sectional study conducted at KG Medical University Lucknow, All patients with type 2 diabetes mellitus who attended Medicine OPD and Endocrinology OPD, were included in the study who fulfilled the following inclusion criteria: age <30 to >60 years, written informed consent and diagnosed as type 2 DM within last 1 month, at the time of enrollment. Cases were defined according to the following WHO diagnostic criteria and ADA recommendations.[11]

- FPG ≥126 mg/dl (7.0 mmol/l). (Fasting defined as no caloric intake for at least 8 h.), or
- 2-h plasma glucose ≥ 200 mg/dl (11.1 mmol/l) during an OGTT. The test was performed as described by the World Health Organization, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water, or
- In a patient with classic symptoms of hyperglycemia or hyperglycaemic crisis, a random plasma glucose ≥200 mg/dl (11.1 mmol/l), or A1C ≥ 6.5%.

Patient of known hypertension with or without treatment, ischemic heart disease, cardiomyopathy, valvular heart disease, heart failure, chronic pulmonary illness, severe anaemia, hemoglobinopathies and those who were already on antidiabetic medications were excluded from the study. Diabetic retinopathy was assessed by doing fundus examination by using direct ophthalmoscope after pupillary dilatation. Venous blood was collected after 8 hours fasting into a test tube coated with Ethylene Diamine Tetra Acetic Acid (EDTA) for HbA1c. HbA1c was estimated by using Nycocard immunoassay kit (USA). Fasting and post-prandial plasma glucose was measured using chem-7 auto analyzer (Erba Mannheim) of transasia bio-medicals Ltd.

Severity of diabetic retinopathy was classified using early treatment diabetic retinopathy study (EDRTS) scale. Data were analyzed for mean, percentage, standard deviation, Student 't' test, Fisher's exact test, by using SPSS 16(Statistical Package for the Social Sciences) for Windows (SPSS, Chicago, IL). The 't'-test and Fisher's exact tests were applied to study quantitative and qualitative data, respectively with 'p' value < 0.05 was considered statistically significant.

RESULTS

A total of 121 patients of newly diagnosed type 2 diabetes mellitus were selected for this cross sectional study. Out of which 79 (65%) were males and 42 (35%) females. Mean age of the population was 51.08 ± 5.30 years. Mean age of male population was 51.70 ± 5.83 years and that of female population was 49.41 ± 6.90 years. The incidence of diabetic retinopathy in population and sex-wise distribution is shown in table 1.

Out of 100 patients of newly diagnosed type 2 DM; 29% patients were found to have diabetic retinopathy. Out of this 28 % cases, 25 cases (75.86%) were of mild NPDR and 09 cases (24.14%) were of moderate NPDR. No patients of severe NPDR and PDR were detected. 34 cases of DR had 22 males and 12 females. However, when male and female populations were compared for incidence of retinopathy applying Fisher's exact test, no significant difference was found (p>1.0000) regarding the incidence of diabetic retinopathy between the two populations. The incidence of DR, when compared with fasting plasma glucose (FPG) and HbA1c (%), yielded the results depicted in table 2.

Mean FPG of population with retinopathy was 206.69 ± 25.20 mg/dl and that of population without retinopathy was 170.18 ± 26.80 mg/dl. This shows that FPG is positively associated with the incidence of diabetic retinopathy and correlation was found extremely significant (p<0.0001). Mean HbA1c of population with

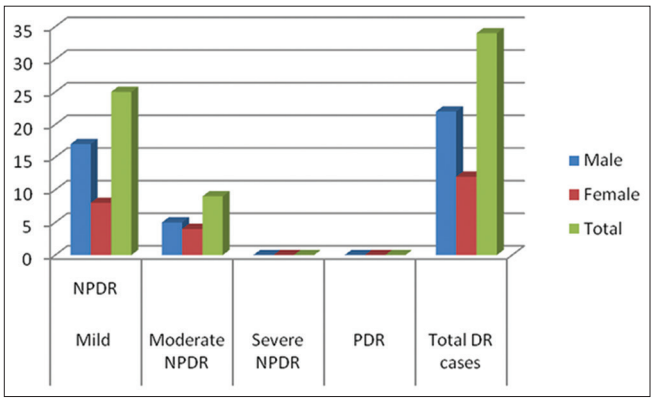

Figure 1: Comparison of Incidence of diabetic retinopathy in population and gender wise distribution

Table 1: Incidence of diabetic retinopathy in population & gender wise distribution

	Mild NPDR	Moderate NPDR	Severe NPDR	PDR	Total DR cases
Male	17	05	0	0	22
Female	08	04	0	0	12
Total	25	09	0	0	34

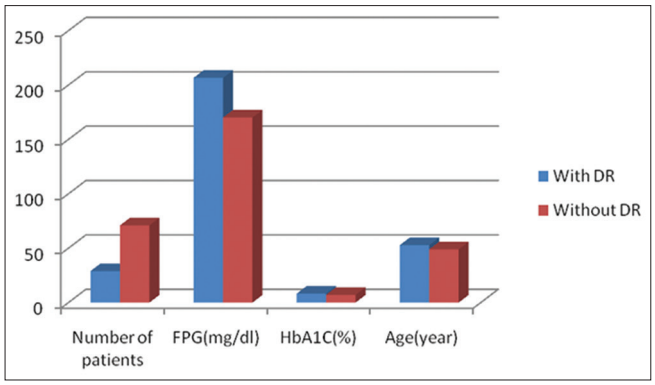

Figure 2: Comparative parameters of the patients with Ddiabetic Retinopathy

Table 2: Comparative parameters of the patients with Diabetic Retinopathy

Parameters	With DR	Without DR	*P* value
Number of patients	34	87	-
Fasting plasma glucose (mg/dl)	194.05±29.82	175.67±27.71	0.0020
HbA1c (%)	7.71±1.01	7.22±0.74	0.0157
Age (year)	54.57±6.49	46.48±7.15	0.0012

retinopathy was 8.23 + 0.85 % and that of population without retinopathy was 7.08 + 0.44 %. Thus, HbA1c is positively associated with the incidence of diabetic retinopathy and correlation was found extremely significant ($p<0.0001$).

Mean age of population with retinopathy was 52.82 + 5.27 yrs and that of population without retinopathy was 48.95 + 6.27 yrs. So, age is positively associated with the incidence of diabetic retinopathy in population and correlation was found very significant ($p<0.0043$).

DISCUSSION

Diabetic retinopathy remains a major complication of type 2 diabetes and requires early detection for best treatment.[12] The prevalence of any diabetic retinopathy among people with newly diagnosed type-2 diabetes was 28%, which is less than the prevalence of diabetic retinopathy, 35-39%,[13]. With best of my knowledge this is the only study to screen diabetic retinopathy at tertiary health care in north India in newly diagnosed diabetes mellitus. Our findings are in line with reports from recent population studies in which the prevalence of diabetic retinopathy ranged from 6% to 23%.[14,15] The lowest estimates (6.2% in Australia[16] and 10.2% in the USA[17] come from studies that undertook simultaneous diabetes diagnosis and retinal screening. These differences in prevalence of retinopathy in newly diagnosed type 2 diabetics might be due to variable time interval between onset and detection of the disease. It can be a result of socio-economical factors which mainly determine the access to and availability of medical care and variation in defining the presence of diabetes mellitus. Our data showed that newly diagnosed type 2 diabetics with retinopathy had higher HbA1c and higher fasting plasma glucose levels. USA has now started diagnosing diabetes based on the presence of an elevated HbA1c.[18] Some study claimed that requirement for fasting or glucose challenge), may be replaced by HbA1c.[19]

CONCLUSION

On the basis of our data we concluded that there was statistically significant positive correlation between level of glycosylated hemoglobin (HbA1c) and frequency of diabetic retinopathy in the newly diagnosed cases of type 2 diabetes mellitus and Mild NPDR is most common form of diabetic retinopathy in all retinopathy subjects.

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Authors Contribution:
SK – Contributed to the original idea, designed the study, enrolled the patients, collected the data and analysed, prepared the manuscript and reviewed the manuscript; **AP –** Conceived hypothesis, designed study, patient enrolment, data collection, data analysis, preparing of manuscript and reviewing the manuscript; **PK-1** – Contributed to the study design, data analysis, preparing of manuscript and reviewing the manuscript; **VA –** Contributed to patient enrolment and data collection; **NV and PK and SP–** Contributed to data analysis, preparing of manuscript and reviewing the manuscript.

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