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STUDY OF PREVALENCE OF RETINOPATHY IN PREDIABETICS

General Medicine

Dr. Amrit Singh Parmar	Junior Resident, Dept. of Medicine, GMC Amritsar
Dr. Sat Pal Aloona	Professor, Dept. of Medicine, GMC Amritsar
Dr. Nehal Chandra	Resident Medical Officer, Life Care Hospital , Gurdaspur
Dr. Sapna*	Assistant Professor, Dept. of Medicine, GMC Amritsar *Corresponding Author

ABSTRACT

Background: Retinopathy is considered the complication most closely associated with diabetes mellitus. Hyperglycemia below the level of diabetes, so-called prediabetes refers to the intermediate metabolic state between normal and diabetic glucose homeostasis. It is becoming increasingly recognized that both microvascular and macrovascular complications can occur in patients with prediabetes. **Aim:** This cross-sectional study aims to estimate the prevalence of retinopathy in prediabetes **Material and methods:** This cross-sectional study aimed to determine the prevalence of retinopathy in prediabetics. A total of 75 patients were enrolled after meeting the inclusion criteria. The study was done on patients who attended the outdoor department or were admitted to the Medicine Department of Guru Nanak Dev Hospital Amritsar. **Result:** The majority of the patients in our study were in the age range of 50-59 years i.e. 31 (41.30%). Out of a total of 75 patients, 42 (56%) were male and 33 (44%) were females. Out of a total of 75 patients, diabetic retinopathy was observed in 5 (6.67%) patients. Out of a total of 5 diabetic retinopathy patients who were observed in this study, 4 (5.33%) had a mild grade of retinopathy and 1 (1.33%) had moderate retinopathy **Conclusion:** Retinal lesions characteristic of diabetes mellitus are present before the onset of the disease by current criteria of diagnosis. Therefore ill effects of hyperglycemia occur in a continuum without any definite cut-off points.

INTRODUCTION

Diabetes mellitus(DM) is a metabolic disorder characterized by chronic hyperglycemia, resulting from defects in insulin secretion and its action. In type I diabetes there is beta-cell destruction, usually leading to absolute insulin deficiency.

In type II diabetes there is a relative insulin deficiency and resistance to the action of insulin.[1] According to International Diabetes Federation, an estimated 381 million people had diabetes in 2013. Its prevalence is increasing rapidly and, by 2030 this number is estimated to double. The disease affects more than 62 million Indians. Indians develop diabetes 10 years earlier than other ethnic groups (mean age 42.5 years).[2]

Pre-diabetes is typically defined as blood glucose levels above normal, but below diabetes thresholds and is a risk state that increases the chance of developing diabetes. The American Diabetes Association (ADA) applies the threshold of a 2-hour plasma glucose value after 75 gm glucose intake of between 7.8–11.1 mmol/L (140–199 mg/dL) for Impaired Glucose Tolerance(IGT).

Impaired Fasting Glucose(IFG) is fasting plasma glucose of 5.6–6.9 mmol/L (100–125 mg/dL). The ADA has also introduced the use of HbA1c levels of 5.7–6.4% for prediabetes.[3],[4]

DM goes through several subclinical stages of abnormalities before its clinical manifestations occur. Diabetes induce changes in the microvasculature, causing extracellular matrix protein synthesis, and capillary basement membrane thickening which are the pathogonomic features of diabetic microangiopathy.

These changes in conjunction with advanced glycation end products, oxidative stress, low-grade inflammation, and neovascularization of vasa vasorum can lead to macrovascular complications.[5]

Diabetic retinopathy (DR) is a microvascular complication seen in both type I and type II diabetes. The earliest signs are micro-aneurysms (10-100)μm sized saccular capillary extensions due to pericyte loss in the retinal capillaries and retinal hemorrhages. Diabetic retinopathy is primarily classified into non-proliferative diabetic retinopathy (NPDR) and proliferative diabetic retinopathy (PDR).[6]

The present study was aimed to determine the prevalence of retinopathy in prediabetics.

Figure 1: Mild non-proliferative diabetic retinopathy (NDPR) with microaneurysms and retinal hemorrhage.

Figure 2 - Severe non-proliferative diabetic retinopathy (NPDR) and maculopathy.

MATERIAL AND METHODS

After obtaining the ethical clearance from the Institutional Ethical Committee the present study was conducted in the Department of Medicine, Government Medical College, Amritsar over a period of 2 years. A total of 75 patients were enrolled after fulfilling the inclusion criteria.

Inclusion Criteria

Patients diagnosed as prediabetics either with impaired fasting glucose or impaired glucose tolerance after screening by fasting blood glucose and 2 hour Oral Glucose Tolerance Test(OGTT) according to ADA criteria. Fasting plasma glucose l00mg/dl (5.6mmol/l) to 125mg/dl (6.9mmol/l) or 2 hour plasma glucose in the 75g OGTT 140mg/dl (7.8mmol/l) to 199mg/dl (11.0mmol/l) and Hb1Ac of 5.7-6.4%.

Exclusion Criteria
• Pregnant females
• Patients with established hypertensive retinopathy
• Patients with other diagnosed retinopathy disorders

Each patient was subjected to detailed history and relevant clinical examination with emphasis on direct and indirect ophthalmoscopy. Informed consent regarding participation into the study was taken from the patient.

All the information regarding history and examination was recorded in case record form. All baseline investigations viz. Complete Blood Count(CBC), Liver Function Tests (LFT), Kidney Function Tests(KFT), Sodium, Potassium, Fasting Blood Glucose, OGTT, HbA1c(Glycosylated Hemoglobin).

RESULTS & OBSERVATIONS
Majority of the patients in our study were in the age range of 50-59 years i.e. 31 (41.30%) followed by 19 (25.30%) patients belonging to 60-69 years. There were 17 (22.70%) patients belonged to age group 40-49 and 8 were in the age range of 30-39 years. The mean age of patients included in study was 52.07±9.31 years.

Out of total 75 patients, 42 (56%) were male and 33 (44%) were females. Among the study patients 20 (26.6%) were hypertensives, 6 (8%) had thyroid disorder, 3 (4%) had chronic kidney disease and 7 (9.34%) had heart failure. While 39 (52%) patients had no co-morbidity.

Out of total 75 patients, 45 (62.67%) were having fasting blood glucose levels of 118-125, followed by 24 (32%) with fasting blood glucose levels of 109-117 and remaining 4 (5.34%) patients were having 100-108 fasting blood glucose levels. The mean fasting blood glucose levels were 118±5.44. In our study, majority of patients i.e. 30 (40%) had HbA1c of 6.1-6.2 followed by 22 (29.33%) with HbA1c levels of 5.9-6.0 19 (25.33%) patients had HbA1c levels of 6.3-6.4 while only 4 (5.33%) had HbA1c levels of 5.7-5.8. Mean HbA1c level in our study patients was 6.12±8.17.

Out of a total of 75 patients, diabetic, retinopathy was observed in 5 (6.67%) patients only. Out of a total of 5 diabetic retinopathy patients whom were observed in our study 4 (5.33%) had mild grade of retinopathy and 1 (1.33%) had moderate retinopathy. Severe diabetic retinopathy was not found in any of our patients. All the patients with diabetic retinopathy were found to have non-proliferative type of retinopathy. Proliferative retinopathy was not observed in any of our study.

When diabetic retinopathy was correlated with age it was seen that diabetic retinopathy was present in 2 (2.66%) patients of age group 50-59 years, 2 (2.66%) of age group 60-69 years and 1 (1.34%) was of age group 40-49 years.

Out of 70 (93.33%) patients with no diabetic retinopathy 8 (10.67%) were aged 30-39, 16 (21.33%) were aged 40-49 years, 29 (38.67%) were of 50-59 and 17 (22.67%) were belonging to 60-69 years age group. Out of a total of 5 (6.67%) diabetic retinopathy patients, 3 were males and 2 were females. Amongst 70 (93.33%) patients with no diabetic retinopathy, there were 39 (52%) males and 31 (41.33%) females.
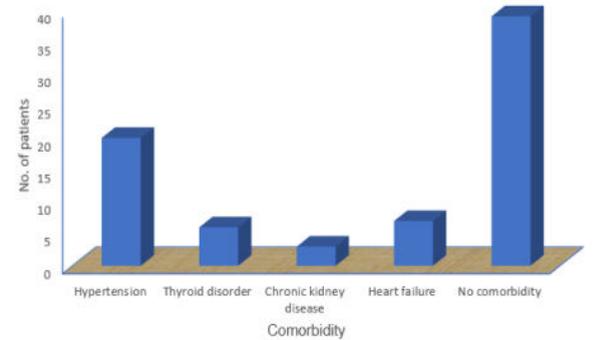
Table 1 Age Distribution Of Study Patients

Age years	Frequency	Percentage
30-39	8	10.70
40-49	17	22.70
50-59	31	41.30
60-69	19	25.30
Total	75	100.00

Table 2 Various Comorbidities In Study Patients

| Comorbidity	Frequency	Percentage
Hypertension	20	26.66
Thyroid disorder	6	8.00
Chronic kidney disease	3	4.00
Heart failure	7	9.34
No comorbidity	39	52.00
Total	75	100.00
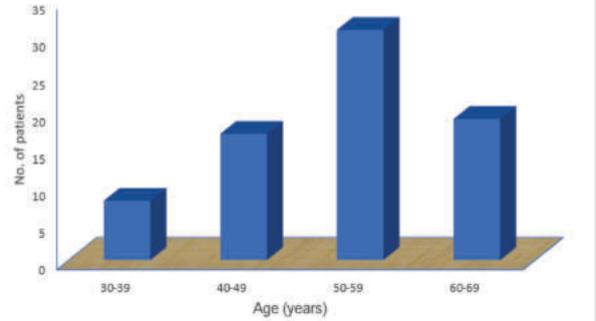
Majority of the patients in our study were in the age range of 50-59 years i.e. 31 (41.30%) followed by 19 (25.30%) patients belonging to 60-69 years.

Among the study patients 20 (26.6%) were hypertensives, 6 (8%) had thyroid disorder, 3 (4%) had chronic kidney disease and 7 (9.34%) had heart failure. While 39 (52%) patients had no co-morbidity.

Table 3 Distribution Of Study Patients As Per Hba1c

| HbA1c	Frequency	Percentage
5.7-5.8	4	5.33
5.9-6.0	22	29.33
6.1-6.2	30	40.00
6.3-6.4	19	25.33
Total	75	100.0
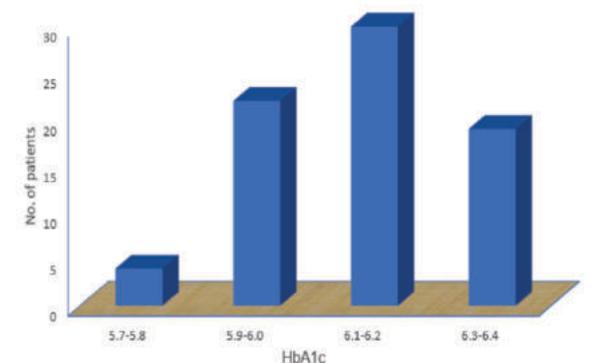
In our study, majority of patients i.e. 30 (40%) had HbA1c of 6.1-6.2 followed by 22 (29.33%) with HbA1c levels of 5.9-6.0. Mean HbA1c level in our study patients was 6.12±8.17.

Table 4 Prevalence Of Retinopathy In Various Age Groups

Age (years)	Retinopathy present		Retinopathy absent	
	No.	%age	No.	%age
30-39	0	0.00	8	10.67
40-49	1	1.34	16	21.33
50-59	2	2.66	29	38.67
60-69	2	2.66	17	22.67

When diabetic retinopathy was correlated with age it was seen that diabetic retinopathy was present in 2 (2.66%) patients of age group 50-59 years, 2 (2.66%) of age group 60-69 years and 1 (1.34%) was of age group 40-49 years.
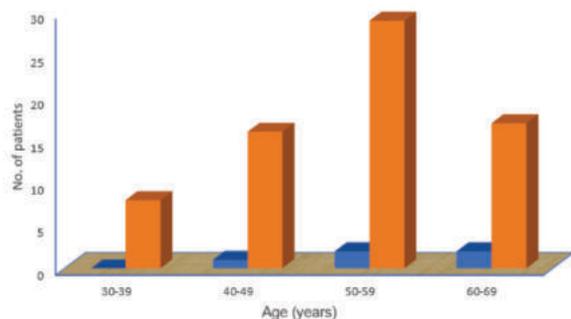
DISCUSSION

Majority of patients with diabetes mellitus go through one necessary phase called 'pre-diabetes before the onset of overt diabetes. Individuals with impaired glucose tolerance and/or impaired fasting glucose are currently considered to have 'pre-diabetes'. Prediabetes not only has the potential risk of developing to diabetes but also can lead to the onset of DR. [7]

Most of the subjects in our study were in the age range of 50-59 years i.e. 31 (41.30%) followed by 19 (25.3%) patients belonging 60-69 years. The mean age was 52.07 years. **Sokotowska-Oracz A et al (2017)**[8] conducted a study on prediabetic patients with ocular changes aged 37-78 years with a mean age of 58.4 years. **Neil H et al (2022)**[9] conducted a study to estimate prevalence of retinopathy in prediabetics in which mean age of males was 53.02 years and 52.42 of females.

Out of total 75 subjects, 42 (56.00%) were males and 33 (44%) were females which is similar with the findings of **Chen X et al (2012)**[10] wherein there were 45/65 males and females. In a study done by **Kirthi V et al (2022)**[11] men had slightly higher prevalence of retinopathy than women.

In our study, among the study patients, 20 (26.66%) were hypertensives, 6 (8%) had thyroid disorder, 3 (4%) had chronic kidney disease and 7 (9.34%) had heart failure while 39 (52%) had no co-morbidity. In a study conducted by **Lamparter J et al**[12] no independent association was found between any of the analysed co-morbidities (congestive heart failure, myocardial infarction, stroke, chronic obstructive pulmonary disease, peripheral artery disease and chronic kidney disease).

Out of total 75 subjects, 45 (62.67%) were having fasting blood glucose levels of 118-125, followed by 24 (32%) with fasting blood glucose levels of 109-117 and only 4 (5.34%) patients had 100-108 fasting blood glucose. The mean fasting blood glucose levels were 118 mg/dl. This is comparable with study done by **Neil H et al (2022)**[9] in which mean fasting blood glucose levels were 118 mg/dl.

In our study, most of patients i.e. 30 (40%) had HbA1c of 6.1-6.2 followed by 22 (29.33%) with HbA1c levels of 5.8-5.9. 19 (25.33%) patients had HbA1c levels were 6.2-6.3 while as only 4 (5.33%) were having HbA1c levels of 5.7-5.8. Mean HbA1c level in our study patients was 6.12. The findings of our study is comparable with study of **Lamparter J et al. (2014)**[12] who had 5.91 mean HbA1c levels.

Out of a total of 75 patients, diabetic retinopathy was seen in 5 (6.67%) patients only. The findings of our study is consistent with the result of study done by **Lamparter J et al. (2014)**[12] in which prevalence of diabetic retinopathy in prediabetics was found to be 8.1%. **Kirthi V et al (2022)**[11] also conducted a systematic review to find prevalence of retinopathy in prediabetics and median was found to be 7.1% after observing 24 studies.

When diabetic retinopathy was correlated with age it was seen that diabetic retinopathy was present in 1 patient with age group 40-49 years. 2 (2.66%) patients were of 50-59 years and 60-69 years age group. Out of 70 (93.33%) patients with no diabetic retinopathy, 29 (38.67%) were from 50-59 years age group, 17 (22.67%) were from 60-69 years age group and 16 (21.33%) were belonging to 40-49 years age group. **Rao BP et al (2015)**[13] conducted a study on 100 patients and found 70% with retinopathy amongst prediabetes within age group of 50-70 years.

Out of a total of 5 diabetic retinopathy patients, there were 3 (4%)

males and 2 (2.67%) females. Among 70 (93.33%) patients with no diabetic retinopathy, there were 39 (52%) males and 31 (41.33%) females out of total 75 study patients. **Lamparter J et al. (2014)**[12] in their study had 8.2% male diabetic retinopathy patients and 8.1% female diabetic retinopathy patients which is consistent with the findings of the present study.

CONCLUSION

The present study was aimed to determine the prevalence of diabetic retinopathy in pre-diabetic individuals. The current guidelines for diabetes mellitus diagnosis fails to capture the burden of subclinical spectrum of disease causing end organ damage which affects the significant population of pre-diabetics.

Retinal lesions characteristic of diabetes mellitus are present before the onset of disease by current criteria of diagnosis. Therefore ill effects of hyperglycemia occurs in continuum without any definite cut-off points.

The finding of the study suggest that current diagnostic criteria for screening of diabetes mellitus associated chronic complications may need reconsideration.

Declaration of Conflicting Interests:
The author(s) declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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