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Original Research Article

A Clinical Study on Prevalence of Diabetic Retinopathy Changes in Patients with Non-Insulin-Dependent Diabetes Mellitus at REH, Kurnool Medical College, Kurnool

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Conflict of interest: Nil

Abstract:

Background Diabetic retinopathy is one of the most common microvascular complications of diabetes mellitus and a leading cause of preventable blindness among working-age adults. The increasing prevalence of T2DM (Type 2 Diabetes Mellitus) in India has resulted in a growing burden of diabetic retinopathy. Early detection and timely intervention are essential to prevent vision-threatening complications and blindness.

Methods A cross-sectional study was conducted in the Department of Ophthalmology, Regional Eye Hospital, Kurnool, from August 2022 to July 2024. A total of 200 patients with type 2 diabetes mellitus were screened for diabetic retinopathy. Detailed ocular examination, including visual acuity assessment, slit-lamp biomicroscopy, fundus examination, fundus photography, and optical coherence tomography when required, was performed. Systemic evaluation included FBS (Fasting Blood Sugar), PPBS (Postprandial Blood Sugar), and glycated hemoglobin (HbA1c) estimation. Data were analyzed using descriptive statistics and chi-square test.

Results Among 200 patients studied, diabetic retinopathy was present in 60 of them, giving a prevalence of **30%**. The prevalence of DR increased significantly with advancing age and duration of diabetes ($p<0.001$). Patients aged ≥71 years showed the highest prevalence (63%). DR was observed in 70.8% of patients whose diabetes duration was greater than 15 years. Glycemic control demonstrated a strong association with DR; 93% of patients with HbA1c ≥8.1% had retinopathy ($p<0.0001$). Gender was not significantly associated with the occurrence of DR ($p=0.686$).

Conclusion: The prevalence of diabetic retinopathy among patients with type 2 diabetes mellitus in this study was 30%. Increasing age, longer duration of diabetes, and poor glycemic control were significant risk factors for the development of diabetic retinopathy. Regular retinal screening and optimal glycemic control are essential for early detection and prevention of vision-threatening diabetic retinopathy.

Keywords: Type 2 Diabetes Mellitus, Diabetic Retinopathy, Prevalence, HbA1c, Glycemic Control, Retinal Screening, Visual Impairment, Non-Insulin-Dependent Diabetes Mellitus.

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Introduction

India is often referred to as the "Diabetes Capital of the World" due to its large diabetic population, accounting for a significant proportion of global diabetes cases.[1] Diabetes mellitus has emerged as a major public health challenge worldwide, with its prevalence increasing rapidly over recent decades.[2] India has the second-highest number of individuals with diabetes globally, and the burden is expected to rise substantially in the coming years according to the International Diabetes Federation (IDF) Diabetes Atlas 2021.[3,4]

Diabetic retinopathy is the most common microvascular complication of diabetes mellitus and represents a major cause of visual impairment and blindness among working-age adults. [5,6] The increasing prevalence of T2DM (Type 2 Diabetes Mellitus) has contributed to a corresponding rise in cases of diabetic retinopathy, making it an important public health concern in India. [7-9]

If left undetected and untreated, diabetic retinopathy may progress to STDR (Sight-Threatening Diabetic Retinopathy), including PDR (Proliferative Diabetic

Retinopathy) and diabetic macular edema (DME), which are major causes of vision loss in diabetic patients. [6-8] Early diagnosis and timely treatment are crucial in preventing diabetes-related visual disability, particularly among individuals with long-standing diabetes and poor glycemic control. [8,9]

Regular retinal screening programs facilitate early detection of diabetic retinopathy and allow prompt intervention before irreversible visual loss occurs.[8] Accurate data regarding the prevalence of diabetic retinopathy are essential for planning effective screening strategies, allocating healthcare resources, identifying high-risk groups, and implementing preventive measures aimed at reducing the burden of blindness due to diabetes.[10]

Aims and Objectives: The study aimed to determine the prevalence of diabetic retinopathy among patients with NIDDM (Non-Insulin-Dependent Diabetes Mellitus) attending Regional Eye Hospital, Kurnool Medical College, Kurnool, and to identify individuals with STDR (Sight-Threatening Diabetic Retinopathy) at an early stage so that timely intervention and appropriate treatment can be instituted to prevent visual impairment and blindness.

Materials and Methods

Study Design: This was a hospital-based cross-sectional observational study conducted in the Department of Ophthalmology, Regional Eye Hospital, Kurnool, Andhra Pradesh, over a period of two years from August 2022 to July 2024. The study population comprised patients with NIDDM/type 2 diabetes mellitus attending the outpatient department of the Regional Eye Hospital as well as patients referred from various departments of Government General Hospital, Kurnool. During the study period, a total of 200 subjects with type 2 diabetes mellitus were screened and evaluated for the presence of diabetic retinopathy.

Inclusion and Exclusion Criteria: The study included patients with a history of type 2 diabetes mellitus, including those with associated systemic comorbidities such as hypertension, coronary artery disease, and cerebrovascular accidents, who were willing to participate in the study. Patients with type 1 diabetes mellitus, gestational diabetes mellitus, opaque ocular media (such as mature cataract or corneal opacity) that precluded adequate fundus examination, poor pupillary dilatation, those undergoing hemodialysis, and individuals who were unwilling to participate were excluded from the study.

Data Collection Procedure: After obtaining informed consent, detailed demographic information and a comprehensive history regarding the duration of diabetes, presenting complaints, associated systemic illnesses, and personal history were recorded for all participants. A complete ophthalmic evaluation was performed, including assessment of BCVA (Best-Corrected Visual Acuity), intraocular pressure measurement using GAT (Goldmann Applanation Tonometry), and slit-lamp biomicroscopic examination to identify anterior segment abnormalities and cataracts. Following adequate pupillary dilatation with 1% tropicamide eye drops, fundus examination was carried out using direct and indirect ophthalmoscopy and slit-lamp biomicroscopy with a 90D lens to assess diabetic retinopathy changes. Fundus photographs were obtained for documentation, and OCT (Optical Coherence Tomography) was performed when indicated to evaluate macular involvement. Systemic evaluation included measurement of FBS, PPBS, and HbA1c levels, and all findings were recorded in a structured proforma for analysis.

Statistical Analysis: The collected data were entered into Microsoft Excel and analyzed using appropriate statistical methods. Descriptive statistics were used to summarize the data, and the results were expressed as frequencies, percentages, and proportions. Categorical variables were presented in the form of tables and figures for better interpretation. The chi-square test was employed to assess the statistical significance of associations between categorical variables, and a p-value of less than 0.05 was considered statistically significant.

Results

Table 1: Baseline Characteristics of the Study Population (N=200)

Variable	Category	n	%
Age (in years)	≤40	8	4.0
	41–50	51	25.5
	51–60	70	35.0
	61–70	52	26.0
	≥71	19	9.5
Gender	Male	91	45.5
	Female	109	54.5

Table 1 illustrates the demographic characteristics of the study population. Most patients belonged to the 51–60 years age group (35%), followed by the 61–70 years group (26%). Females constituted a slightly higher proportion (54.5%) than males (45.5%).

Table 2: Prevalence and Severity of Diabetic Retinopathy		
Retinopathy Grade	**n**	**%**
No DR	140	70.0
Very Mild NPDR	9	4.5
Mild NPDR	14	7.0
Moderate NPDR	12	6.0
Severe NPDR	5	2.5
Very Severe NPDR	2	1.0
Mild–Moderate PDR	4	2.0
High-Risk PDR	1	0.5
Advanced Diabetic Eye Disease	2	1.0
CSME	11	5.5

Table 2 shows the prevalence and grading of diabetic retinopathy. Overall prevalence of DR was 30%, while 70% of patients showed no retinopathy. NPDR constituted the majority of cases, whereas PDR and advanced diabetic eye disease were relatively uncommon. CSME was present in 5.5% of patients.

Table 3: Association between Age and Diabetic Retinopathy			
Age Group (in years)	**Total Patients**	**DR Present**	**DR Prevalence (%)**
≤40	8	3	37.5
41–50	51	6	11.7
51–60	70	11	15.7
61–70	52	28	53.8
≥71	19	12	63.0
Chi-square = 27.40; p <0.001			

Table 3 demonstrates a significant association between age and diabetic retinopathy. The prevalence of DR increased markedly with advancing age, reaching 63% among patients aged ≥71 years. The association was statistically significant.

Table 4: Association between Gender and Diabetic Retinopathy			
Gender	**Total Patients**	**DR Present**	**DR Prevalence (%)**
Male	91	26	28.5
Female	109	34	31.1
Chi-square = 0.163; p = 0.686			

Table 4 depicts the relationship between gender and diabetic retinopathy. Although females showed a slightly higher prevalence of DR than males, the difference was not statistically significant.

Table 5: Duration of Diabetes and Presence of Diabetic Retinopathy			
Duration of Diabetes (in years)	**Total Patients**	**DR Present**	**DR Prevalence (%)**
<1	26	3	11.6
1–5	49	3	6.1
6–10	62	14	22.5
11–15	39	23	58.9
>15	24	17	70.8
Chi-square = 37.67; p <0.001			

Table 5 highlights a strong relationship between diabetes duration and diabetic retinopathy. The prevalence of DR increased progressively with longer duration of diabetes, reaching 70.8% among patients with diabetes for more than 15 years. This association was highly significant.

Table 6: Treatment History and Systemic Associations			
Variable	**Category**	**n**	**%**
Treatment	OHA only	180	90.0
	OHA + Insulin	16	8.0
	No treatment	4	2.0
Systemic Associations	None	141	70.5
	Hypertension	38	19.0
	Hypertension + CAD	3	1.5
	Hypertension + CVA	2	1.0
	CAD	9	4.5
	CVA	7	3.5

Table 6 summarizes treatment patterns and associated systemic illnesses. Most patients were managed with oral hypoglycemic agents alone (90%). Hypertension was the most common systemic comorbidity, while over two-thirds of participants had no documented systemic association.

Table 7: Glycemic Status of Study Participants			
Parameter	**Category**	**n**	**%**
FBS (mg/dL)	≤140	129	64.5
	141–180	49	24.5
	≥181	22	11.0
PPBS (mg/dL)	≤180	46	23.0
	181–250	112	56.0
	≥251	42	21.0
HbA1c (%)	≤6.5	81	40.5
	6.6–8.0	76	38.0
	≥8.1	43	21.5

Table 7 presents the glycemic profile of the study population**.** Most patients had FBS ≤140 mg/dL and PPBS values between 181 and 250 mg/dL. Approximately one-fifth of patients had poor glycemic control with HbA1c ≥8.1%.

Table 8. Association between HbA1c and Diabetic Retinopathy			
HbA1c (%)	**Total Patients**	**DR Present**	**DR Prevalence (%)**
≤6.5	81	3	3.7
6.6–8.0	76	17	22.3
≥8.1	43	40	93.0
Chi-square = 103.45; p <0.0001			

Table 8 demonstrates the impact of glycemic control on diabetic retinopathy. The prevalence of DR increased dramatically with rising HbA1c levels, reaching 93% among patients with HbA1c ≥8.1%. This was the strongest statistically significant association observed in the study.

Discussion

Diabetic retinopathy is the leading cause of preventable blindness among working-age adults and accounts for 5% of global blindness. With India ranking second worldwide in diabetic burden, [3,4] accurate prevalence data are critical for effective public health planning. The present cross-sectional study screened 200 type 2 diabetic (NIDDM) patients at Regional Eye Hospital, Kurnool, and found an overall DR prevalence of 30%.

Prevalence of Diabetic Retinopathy: The 30% prevalence observed in this study is consistent with several Indian and global reports. Surya Chandra Mallireddy and Rajkumar Patra et al.,[11] (30.6%) and Devatha S and Preethi [12] (30.84%) reported nearly identical rates, while RP Agrawal et al.,[13] (28.9%) and Yang et al.,[5] (global: 28%; India subgroup: 42%) bracket our findings. Our prevalence exceeds that of Gadkari et al.,[1] (21.7%), Rema et al., (CURES Eye Study I)[14] (17.6%), Narendran et al.,[15] (26.8%), and the global meta-analysis by Teo et al.,[16] (22.27%), but is lower than Ramavat et al.,[17] (33.9%), UKPDS (35–39%), and the clinic-based series by Megha Luthra et al.,[18] (67.1%). The heterogeneity across studies reflects differences in study design, population, and diagnostic criteria rather than true disparities in disease burden.

Age and DR: DR prevalence increased steeply with age ($p < 0.001$): from 11.7% in the 41–50 year group to 63% in patients aged ≥71 years. This mirrors data from RP Agrawal et al.,[13] (57.8% at 61–70 years; 59.3% at >70 years) and Surya Chandra Mallireddy and Rajkumar Patra et al.,[11] who found 64.7% of DR patients were above 60 years. Gadkari et al.,[1] and SN-DREAMS III [7] reported lower absolute rates but demonstrated the same age-related gradient, underscoring advancing age as a consistent predictor of DR.

Gender and DR: DR was marginally more prevalent in females (31.1%) than males (28.5%), though the difference was not statistically significant ($p > 0.05$). This contrasts with Rema et al.,[14] and SN-DREAMS III [7], both of which reported significantly higher DR in men. However, Megha Luthra et al.,[18] and Shrestha et al.,[19] similarly found higher rates in females, consistent with the trend in the present study. The lack of a statistically significant sex difference in our cohort aligns with the general epidemiological view that gender is not an independent risk factor for DR.

Duration of Diabetes and DR: Duration of diabetes emerged as the strongest independent predictor of DR in this study ($p < 0.001$), with prevalence rising from 6.1% (1–5 years) to 70.8% (>15 years). This progressive increase is corroborated by Gadkari et al.,[1] Rema et al.,[12] (1.89-fold increase per 5-year period), SN-DREAMS III[7], RP Agarwal et al.,[13]

(52.2% at >15 years), and Shrestha et al.,[19] (90.3% at ≥20 years). Chronic hyperglycemia over time drives retinal microvascular changes - pericyte loss, basement membrane thickening, and endothelial dysfunction - that underlie the lesions of DR.

Glycemic Control and DR: There was a strong, statistically significant association between HbA1c and DR prevalence ($p < 0.0001$): only 3.7% with HbA1c ≤6.5% had DR, compared with 93% with HbA1c ≥8.1%. This dose-response relationship is consistent with the landmark DCCT and UKPDS findings and is further supported by RP Agarwal et al.,[13] SN-DREAMS III[7], and Megha Luthra et al.,[18] all of whom demonstrated rising DR rates with worsening glycemic control. These findings reinforce tight glycemic management (HbA1c < 7%) as the cornerstone of DR prevention.

Types of Retinopathies: NPDR was the predominant form (70%; 42/60), followed by CSME (18.4%; 11/60), PDR (8.3%; 5/60), and advanced diabetic eye disease (3.3%; 2/60). Sight-threatening DR was present in 41.7% of DR patients. The predominance of NPDR is consistent with RP Agrawal et al.,[13] (79.8% NPDR), Purushotham et al.,[20] (71.79% NPDR), and Shrestha et al[19] (85.5% NPDR; CSME 19.2%). The high STDR burden (41.7%) underscores the importance of timely referral and treatment to prevent irreversible vision loss.

In summary, the 30% DR prevalence in this hospital-based cohort aligns with contemporary Indian data and confirms that diabetes duration, age, and poor glycemic control are the primary drivers of retinopathy. Systematic screening and strict metabolic control remain the most effective strategies to reduce the burden of DR-related blindness in India.

Limitations

This study has certain limitations. Being a cross-sectional hospital-based study, it was not possible to establish causal relationships between the identified risk factors and diabetic retinopathy. In addition, variations in study design, population characteristics, and diagnostic criteria across different studies may limit direct comparisons of findings. Furthermore, patients were not followed up after the initial assessment, preventing evaluation of disease progression and long-term outcomes. Future longitudinal studies with larger populations and regular follow-up are needed to assess the effectiveness of diabetes management strategies in reducing the prevalence and progression of diabetic retinopathy.

Conclusion

The present study found that the prevalence of diabetic retinopathy among patients with type 2 diabetes mellitus was 30%. Increasing age, longer duration of diabetes, poor glycemic control reflected by higher HbA1c levels, and elevated FBS and PPBS values were significantly associated with the development and severity of diabetic retinopathy. These findings highlight the importance of comprehensive diabetes management, including regular retinal screening and optimal metabolic control, for early detection and prevention of vision-threatening complications. Enhancing patient awareness regarding periodic eye examinations and integrating diabetic eye care into primary healthcare services can play a vital role in reducing visual impairment, preserving quality of life, and minimizing the socioeconomic burden associated with diabetic retinopathy.

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