Section: Ophthalmology

Original Research Article

PREVALENCE OF DIABETIC RETINOPATHY IN RECENTLY DIAGNOSED DIABETES PATIENTS

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Received *: 20/10/2025*
Received in revised form *: 05/12/2025*
Accepted *: 25/12/2025*

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DOI: 10.70034/ijmedph.2026.1.16

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (1); 79-85

ABSTRACT

Background: Diabetic retinopathy (DR) is one of the most common microvascular complications of type 2 diabetes mellitus (T2DM) and continues to be a leading cause of preventable visual impairment worldwide. As retinal damage may develop before clinical recognition of diabetes, early screening at the time of diagnosis is essential for timely intervention. The aim is to determine the prevalence and severity of diabetic retinopathy among newly diagnosed patients with T2DM and to identify clinical predictors associated with its presence.

Materials and Methods: A cross-sectional observational study was conducted among 120 newly diagnosed T2DM patients attending a tertiary care hospital. All participants underwent comprehensive ophthalmological examination including dilated fundus evaluation. Glycated haemoglobin (HbA1c) was recorded. DR was classified using the Early Treatment Diabetic Retinopathy Study (ETDRS) criteria. Statistical analysis included chi-square test, correlation analysis, and binary logistic regression.

Results: The prevalence of DR in the study population was 12%. Mild NPDR constituted the largest subgroup (42.9%), followed by moderate NPDR (35.7%), severe NPDR (14.3%), and proliferative DR (7.1%). Mean HbA1c was significantly higher among patients with DR (8.54 ± 2.21) compared with those without retinopathy (7.12 ± 1.31) ($p < 0.01$). Increasing HbA1c levels and older age were significantly associated with presence and severity of DR. Logistic regression confirmed HbA1c (OR 2.37) and age (OR 1.09) as independent predictors.

Conclusion: A notable proportion of individuals present with diabetic retinopathy at the time of first diagnosis of T2DM. Poor glycemic control and increasing age were major determinants. These findings highlight the importance of routine retinal screening at diagnosis and aggressive glycemic optimization to prevent early retinal microvascular complications.

Keywords: Diabetic retinopathy; Type 2 diabetes mellitus; HbA1c; Non-proliferative diabetic retinopathy; Proliferative diabetic retinopathy; ETDRS classification; Screening; Risk factors.

INTRODUCTION

Diabetes mellitus has emerged as one of the most significant non-communicable diseases worldwide, contributing substantially to morbidity, disability, and premature mortality. The most recent International Diabetes Federation (IDF) atlas estimates that approximately 537 million adults aged 20–79 years—equivalent to one in every ten individuals—are currently living with diabetes, and this number is expected to escalate to 643 million by 2030 and nearly 783 million by 2045 if current trends persist.[1]

India, often referred to as the "Diabetes Capital of the World," has witnessed an alarming surge in diabetes prevalence over the last two decades. In 2019, the estimated burden was 77 million adults, projected to exceed 134 million by 2045, positioning India among the top three countries globally with the highest diabetic population.[2] The rapidly increasing prevalence is attributed to rapid socio-economic transition, sedentary lifestyle patterns, dietary changes, ageing population, and genetic susceptibility.[3,4] Type 2 diabetes mellitus (T2DM) constitutes nearly 85–90% of all diagnosed cases, making it the predominant clinical form.[5]

As the burden of T2DM rises, associated microvascular and macrovascular complications have also increased significantly. Among these, diabetic retinopathy (DR) is considered one of the most preventable causes of visual impairment and blindness globally.[6,7] The pathogenic cascade of DR begins with chronic hyperglycemia-induced metabolic dysregulation, leading to oxidative stress, activation of the polyol pathway, capillary endothelial damage, basement membrane thickening, pericyte loss, and microaneurysm formation.[8-10] Over time, these microvascular changes progress to retinal ischemia, neovascularization, and macular edema, potentially resulting in irreversible vision loss if untreated.[11,12]

The prevalence, severity, and progression of DR vary across populations and are influenced by several demographic, systemic, and behavioral factors. Increasing age, male sex, longer duration of diabetes, poor glycemic control, hypertension, dyslipidemia, and smoking are well-recognized contributors to DR development.[13,14] In India, additional challenges such as inadequate awareness, late diagnosis, and limited routine ophthalmic screening contribute to delayed detection, particularly among newly diagnosed diabetics.[15,16]

Multiple clinical tools are used to evaluate DR severity. Dilated fundus examination (DFE) remains the first-line screening method, while fundus photography, optical coherence tomography (OCT), and fluorescein angiography provide valuable adjunctive diagnostic information.[17-19] The Early Treatment Diabetic Retinopathy Study (ETDRS) classification is widely utilized internationally to standardize disease staging and guide management strategies.[20]

Despite the high disease burden, there is limited literature from Maharashtra examining the prevalence and determinants of DR specifically among newly diagnosed diabetic patients. Understanding the magnitude and early clinical profile of DR in this subgroup is crucial for encouraging early screening, timely referral, and prevention of avoidable blindness.

Therefore, the present study was undertaken to determine the prevalence and severity of diabetic retinopathy, and to examine potential demographic and biochemical predictors—particularly age and glycemic control—among newly diagnosed T2DM patients attending a tertiary care centre.

Aim: To determine the prevalence, severity, and clinical predictors of diabetic retinopathy among newly diagnosed patients with type 2 diabetes mellitus attending a tertiary care centre in Maharashtra.

Objectives

1. To estimate the prevalence and grade the severity of diabetic retinopathy among newly diagnosed type 2 diabetic patients using the ETDRS classification system.
2. To assess the association of demographic and clinical variables—particularly age and glycated haemoglobin (HbA1c) levels—with the presence and severity of diabetic retinopathy in the study population.

MATERIALS AND METHODS

This was a cross-sectional, observational study conducted in the Department of Ophthalmology at RVM Institute of Medical Sciences & Research Centre, Siddipet, involving 120 recently diagnosed patients with type 2 diabetes mellitus. Ethical approval was obtained from the Institutional Ethics Committee prior to study initiation, and written informed consent was obtained from all participants.

Population and Sampling: Participants were recruited through purposive sampling from the Ophthalmology Outpatient Department within one month of their confirmed diabetes diagnosis. Individuals aged 18 years and above, who were willing to undergo a complete ophthalmic assessment, were considered eligible.

Inclusion Criteria

1. Patients newly diagnosed with T2DM (within the preceding 30 days).
2. Age ≥ 18 years.
3. Willingness to comply with ophthalmic evaluation and laboratory testing.

Exclusion Criteria

1. Previously diagnosed cases of diabetic retinopathy.
2. History of ocular pathology unrelated to diabetes (e.g., age-related macular degeneration).
3. Prior ocular surgery or trauma.
4. Systemic disorders affecting the retina (e.g., severe hypertension, vasculitis).
5. Pregnant women and individuals receiving long-term corticosteroid therapy.

Ophthalmic Evaluation

All subjects underwent a comprehensive ophthalmological evaluation including:

- Best-corrected visual acuity assessment
- Slit lamp biomicroscopy
- Refraction
- Dilated fundus examination using indirect ophthalmoscopy

Patients suspected of having DR were further evaluated by a vitreo-retinal specialist.

Adjunct Imaging

Where indicated, the following investigations were performed:

- Optical Coherence Tomography (OCT): to assess macular thickness and detect macular edema
- Fluorescein Fundus Angiography (FFA): selectively employed to assess retinal non-perfusion, vascular leakage, or neovascularization

Classification System

Disease grading was performed using the ETDRS classification, categorizing patients into:

- Mild, moderate, severe, and very severe Non-Proliferative Diabetic Retinopathy (NPDR)
- Early Proliferative and High-Risk Proliferative Diabetic Retinopathy (PDR)

Data Collection and Statistical Analysis: Demographic variables (age, gender, socioeconomic and educational status) and clinical data including HbA1c levels were recorded. Data entry was performed in Microsoft Excel, and statistical analysis was conducted using SPSS version 21.0.

Quantitative variables were expressed as mean ± standard deviation (SD). Group comparisons were performed using the independent t-test or Mann-Whitney U test, depending on data normality. Categorical variables were analyzed using the Chi-square test or Fisher's exact test. Pearson correlation and logistic regression analysis were performed to determine predictors of diabetic retinopathy. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 120 newly diagnosed Type 2 Diabetes Mellitus (T2DM) patients were evaluated in the study. The mean age of participants was 55.4 ± 10.8 years, with the highest representation in the 50–59-year age group (45%), followed by 60–69 years (24.2%). The detailed age distribution is shown in [Table 1].

Table 1: Age-wise Distribution of Participants (n = 120)

Age Group (years)	Frequency (n)	Percentage (%)
40–49	20	16.7%
50–59	54	45.0%
60–69	29	24.2%
≥70	17	14.1%
Total	120	100%

The majority of newly diagnosed diabetics belonged to the 50–59-year age group, reflecting the peak age for metabolic disease onset.

Gender Distribution: Among the study subjects, male participants constituted 57.5% (n = 69), while female participants accounted for 42.5% (n = 51) [Table 2].

Table 2: Gender Distribution (n = 120)

Gender	Frequency (n)	Percentage (%)
Male	69	57.5%
Female	51	42.5%
Total	120	100%

Prevalence and Severity of Diabetic Retinopathy: Out of 120 participants, 14 patients (12%) were found to have diabetic retinopathy (DR), while 106 (88%) had no detectable retinal involvement [Table 3].

Table 3: Prevalence of Diabetic Retinopathy (n = 120)

Diabetic Retinopathy Status	Frequency (n)	Percentage (%)
No DR	106	88.0%
DR Present	14	12.0%
Total	120	100%

DR was present at diagnosis in approximately one-in-eight patients, indicating early retinal involvement before clinical recognition of diabetes.

Among the DR-positive cases, mild NPDR was most common (42.9%), followed by moderate NPDR (35.7%), severe NPDR (14.3%), and proliferative DR (7.1%) [Table 4].

Table 4: Severity of Diabetic Retinopathy Among Affected Patients (n = 14)

DR Classification	Frequency (n)	Percentage (%)
Mild NPDR	6	42.9%
Moderate NPDR	5	35.7%
Severe NPDR	2	14.3%
Proliferative DR	1	7.1%
Total	14	100%

Early-stage (NPDR) disease predominated, although a small proportion already showed sight-threatening PDR.

Association Between Gender and Diabetic Retinopathy: There was no statistically significant association between gender and presence of DR (χ^2 = 0.26, p = 0.61), as shown in [Table 5].

Table 5: Association of Gender With Diabetic Retinopathy (n = 120)

Gender	No DR (n=106)	DR Present (n=14)	p-value
Male	60 (56.6%)	9 (64.3%)	
Female	46 (43.4%)	5 (35.7%)	0.61 (NS)
Total	106	14	

Gender did not significantly influence DR occurrence in newly diagnosed diabetic patients.

Glycemic Control and Diabetic Retinopathy: Patients with DR had significantly higher HbA1c levels compared to those without DR (8.54 ± 2.21 vs. 7.12 ± 1.31; p < 0.01) [Table 6].

Table 6: Mean HbA1c in DR vs. Non-DR Group (n = 120)

Group	n	Mean HbA1c (%)	SD
No DR	106	7.12	1.31
DR Present	14	8.54	2.21
Total	120	7.68	1.88

There was a progressive rise in HbA1c with increasing DR severity [Table 7].

Table 7: Mean HbA1c by Severity of Diabetic Retinopathy

Severity	n	Mean HbA1c (%)	SD
Mild NPDR	6	7.68	2.15
Moderate NPDR	5	8.14	2.34
Severe NPDR	2	8.92	2.10
PDR	1	10.50	—
Overall DR Cases	14	8.54	2.21

HbA1c demonstrated a dose-response relationship with disease severity.

Correlation Analysis: A moderate positive correlation was observed between age and DR severity (r = 0.41, p < 0.01), while HbA1c showed a stronger correlation with DR severity (r = 0.52, p < 0.01) [Table 8].

Table 8: Correlation Between Clinical Parameters and Retinopathy Severity

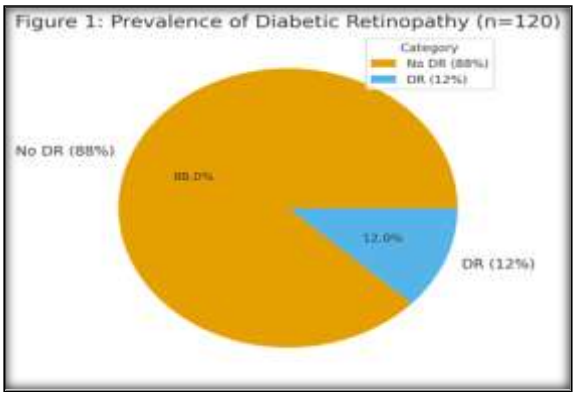
Variable	Correlation Coefficient (r)	p-value	Interpretation
Age vs DR Severity	+0.41	<0.01	Moderate correlation
HbA1c vs DR Severity	+0.52	<0.01	Strong correlation

Predictors of Diabetic Retinopathy: Binary logistic regression identified age and HbA1c as significant independent predictors of DR [Table 9].

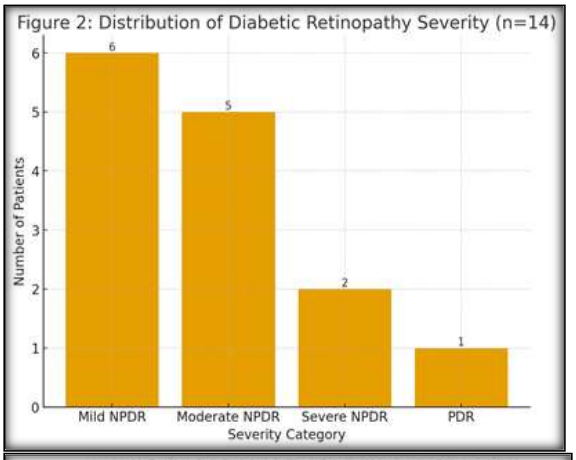
Table 9. Logistic Regression Model for Predictors of DR

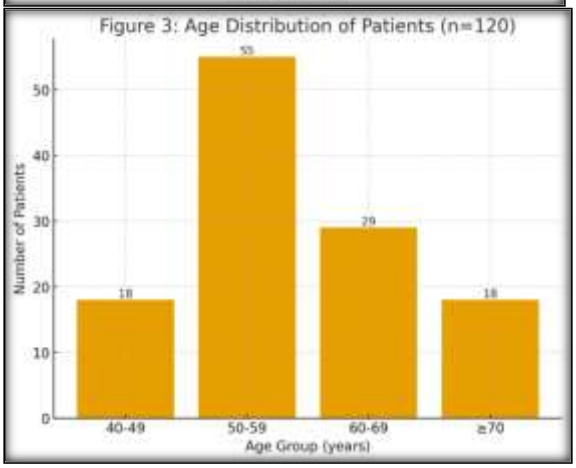
Variable	p-value	Odds Ratio (OR)	95% CI
Age	<0.01	1.09	1.06–1.11
HbA1c	<0.01	2.37	1.26–4.58
Gender	>0.05	NS	—

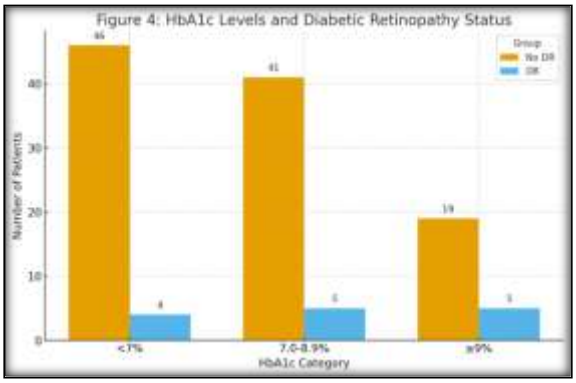
Age and poor glycemic control significantly increased DR risk, while gender was not predictive.



DR prevalence was 12%, even at the time of diabetes diagnosis. Higher HbA1c and increasing age were strongly associated with DR development and severity.Most DR cases were mild to moderate NPDR, but 7.1% already had PDR.Gender did not impact DR risk.







DISCUSSION

This study examined the burden and early clinical profile of diabetic retinopathy (DR) among newly diagnosed individuals with type 2 diabetes mellitus (T2DM). In the present cohort, 12% of newly diagnosed diabetics already demonstrated evidence of retinopathy, indicating that retinal microvascular changes may precede clinical detection of diabetes. The pattern of disease distribution in our study further showed that the majority had mild to moderate non-proliferative diabetic retinopathy (NPDR), while more advanced stages such as severe NPDR and proliferative DR (PDR) were less frequent. This distribution aligns with the expectation that early retinal injury is biologically present at the onset of overt diabetes and may progress silently before symptoms arise.

Prevalence Trends and Comparison With Global Evidence

The prevalence observed in our cohort is comparable with international reports. A large Swedish National Diabetes Registry analysis by Sofizadeh et al. found a 17.2% prevalence of DR at the time of T2DM diagnosis, supporting the premise that a considerable proportion of patients experience retinal damage before their condition is formally identified.[11] Similarly, long-term epidemiological modeling from the United States by VanderBeek et al. documented a rising prevalence of DR over two decades, despite improvements in the incidence of vision-threatening forms.[12] This suggests that while early detection and improved metabolic control may be reducing advanced DR, the overall number of individuals with early retinal disease continues to grow.

Studies from low- and middle-income regions tend to report higher frequencies. For example, Paudel and Dahal observed a 19.5% incidence of DR over a short follow-up period in Nepal, indicating a rapid onset of retinal pathology.[13] In Wales, Roy Chowdhury et al. reported that 23.2% of initially disease-free patients progressed to DR within five years, reinforcing that early metabolic and vascular abnormalities accelerate retinal damage.[14] In the United Kingdom primary care registry, Shah et al. documented an 18% prevalence at diagnosis, a reduction from earlier eras, reflecting improvements in early detection, screening participation, and public awareness.[15] In contrast, a hospital-based Indian study by Walia reported a notably higher prevalence of 43.5%, likely reflecting delayed diagnosis, limited screening access, and a tendency for patients to seek ophthalmic evaluation only when symptoms arise.[16-18]

Taken together, these findings indicate that the 12% prevalence in our study aligns more closely with structured healthcare settings, where diagnosis occurs earlier, rather than late-presentation populations.

Severity Patterns and Disease Stage Distribution

The dominance of early NPDR in the present study mirrors the distribution seen in most newly diagnosed cohorts. The Swedish registry reported a similar pattern, with mild retinopathy being the most observed stage at diagnosis.[11] Likewise, longitudinal monitoring in the Welsh cohort demonstrated that 93% of patients with incident DR remained in background stages after five years, with only a minority advancing to maculopathy.[14] The small proportion of severe NPDR and PDR noted in our findings is consistent with evidence from the United States and United Kingdom, where a continued decline in advanced DR has been observed over the last decade.[12,15] These trends may reflect improved glycemic monitoring, earlier detection, and greater availability of treatment options.

Influence of Glycemic Control and Systemic Factors: Among all variables assessed, glycemic control emerged as the most significant determinant

of DR in our cohort. Patients with retinopathy exhibited substantially higher mean HbA1c values than those without disease, and the risk increased markedly with each incremental rise in HbA1c. This association is well documented. Paudel and Dahal observed that HbA1c was one of the strongest predictors for DR onset.[13] Likewise, Shah et al. demonstrated that baseline HbA1c predicted both incident disease and progression over seven years.[15] Roy Chowdhury et al. also showed that individuals who developed DR during follow-up had higher fasting and postprandial glucose at diagnosis, along with impaired β-cell responsiveness.[14] Collectively, these findings confirm that hyperglycemia plays a central role in retinal microangiopathy even early in the disease course, underscoring the need for aggressive metabolic management from diagnosis onward.

Other systemic factors, including age, comorbid hypertension, chronic kidney disease, and previous cardiovascular events, have been identified as risk modifiers in large-scale analyses. In the Swedish cohort, lower socioeconomic status, older age, and renal disease were independently associated with DR.[11] In Nepal, coexisting hypertension and renal impairment doubled to quintupled the risk of retinal disease.[13] These associations reinforce the concept that DR reflects broader vascular vulnerability rather than an isolated ocular phenomenon.

Implications for Screening and Clinical Practice:

The presence of DR at diagnosis, even in a modest proportion such as in our study, carries meaningful clinical relevance. Evidence from multiple cohorts supports performing retinal evaluation immediately at the time of diagnosis, rather than deferring until later. Early identification enables risk stratification and tailored follow-up scheduling, which is particularly valuable in settings where resource allocation must be prioritized.

Given the cumulative evidence, patients with higher baseline HbA1c values, older age, hypertension, renal impairment, or low socioeconomic access require closer ophthalmic surveillance.

Table 10: Comparative Summary of DR Prevalence and Predictors in Newly Diagnosed Type 2 Diabetes

Study	Sample Size	DR at Diagnosis	Key Predictors Associated
Present Study	120	12%	Higher HbA1c, older age
Sofizadeh et al,[11] 2024	77,681	17.2%	Age, male sex, CKD, stroke, lower education
VanderBeek et al,[12] 2025	National database	Rising over time	Systemic comorbid conditions
Paudel & Dahal,[13] 2025	420	19.5% (incidence during follow-up)	High HbA1c, CKD, hypertension
Roy Chowdhury et al,[14] 2022	233	23.2% after 5 years	Higher baseline glucose and β-cell dysfunction
Shah et al,[15] 2021	11,399	18%	Initial HbA1c, socioeconomic factors
Walia,[18] 2024	200	43.5%	Hypertension, family history, duration

In summary, the findings of this study are consistent with global patterns and reinforce that a measurable proportion of individuals exhibit retinopathy at or soon after diagnosis of T2DM. Variation across regions highlights differences in access to screening, timing of diagnosis, and demographic or metabolic risk factors. The consistency of findings from multiple large-scale studies affirms that baseline ophthalmic evaluation and early glycemic optimization remain essential components of diabetes care.

CONCLUSION

In this study of newly diagnosed Type 2 diabetes mellitus patients, the prevalence of diabetic retinopathy (DR) was found to be 12%, indicating that a significant proportion of individuals present with retinal microvascular changes at the time of diabetes diagnosis. The majority of affected cases demonstrated non-proliferative forms of DR, although a small subset already exhibited sight-threatening proliferative changes, highlighting the silent and progressive nature of the disease.

Poor glycemic control, reflected by elevated HbA1c levels, demonstrated a strong positive association with both the presence and severity of retinopathy, confirming that hyperglycemia plays a critical role in the onset and progression of retinal damage. Additionally, increasing age independently predicted greater risk, suggesting cumulative metabolic burden as a contributing factor. In contrast, gender did not show a statistically significant association with DR, indicating equal susceptibility among males and females at disease onset.

These findings emphasize the importance of early ophthalmic screening at the time of diagnosis and underscore the need for aggressive glycemic control strategies from the earliest stages of diabetes management. Timely detection and intervention may substantially reduce long-term visual disability, prevent progression to advanced retinopathy, and improve overall quality of life for affected individuals.

Limitations

This study has some limitations that should be considered when interpreting the results:

1. Single-center study design: The findings may not fully represent broader regional or national populations with diverse demographic or socioeconomic characteristics.
2. Relatively small sample size: While adequate for preliminary assessment, a larger cohort would allow more robust subgroup analysis and predictive modeling.

3. Cross-sectional assessment: As the study design did not include follow-up evaluation, causal relationships or temporal progression of retinopathy could not be established.
4. Lack of assessment of additional risk factors: Important variables such as duration of undiagnosed hyperglycemia, lipid profile, blood pressure control, renal parameters, and lifestyle factors were not evaluated, and may influence retinopathy risk.
5. Ocular imaging limitations: The study did not include advanced diagnostic modalities such as OCT or fundus fluorescein angiography, which may detect early subclinical disease more accurately.

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