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Clinical Profile and Risk Factors of Diabetic Retinopathy among Patients with Type 2 Diabetes Mellitus Attending a Tertiary Care Hospital: An Observational Study.

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Abstract

Background: Diabetic retinopathy is a common microvascular complication of type 2 diabetes mellitus and remains an important cause of preventable visual impairment. Early identification of ocular involvement and associated systemic risk factors supports timely referral and vision-preserving management. ***Objectives:*** To evaluate the clinical profile, prevalence, severity pattern, and associated risk factors of diabetic retinopathy among patients with type 2 diabetes mellitus attending a tertiary care hospital. ***Methods:*** This observational study was conducted at Prathima Institute of Medical Sciences, Karimnagar, Telangana, India, from August 2025 to January 2026. A total of 100 patients with type 2 diabetes mellitus were included. Demographic details, duration of diabetes, comorbidities, body mass index, smoking history, family history, and glycaemic control were recorded. Ophthalmic assessment included visual acuity testing, anterior segment examination, and fundus evaluation. Diabetic retinopathy was graded according to standard clinical severity categories. Data were analysed using descriptive statistics and association testing, with statistical significance set at $p<0.05$. ***Results:*** The mean age was 56.8 ± 10.4 years, and males constituted 56.0% of the study population. The mean duration of diabetes was 8.7 ± 5.1 years. Diabetic retinopathy was identified in 39.0% of patients. Mild non-proliferative diabetic retinopathy was the most frequent grade. Longer diabetes duration, HbA1c ≥8%, and hypertension showed significant associations with diabetic retinopathy. Nearly half of the patients were asymptomatic during screening. ***Conclusion:*** Diabetic retinopathy was frequent among patients with type 2 diabetes mellitus in this tertiary care setting. Duration of diabetes, poor glycaemic control, and hypertension were important associated factors. Regular retinal screening remains essential, even among asymptomatic patients.

Keywords: Diabetic retinopathy; Type 2 diabetes mellitus; Non-proliferative diabetic retinopathy; Glycaemic control; Hypertension; Retinal screening.

INTRODUCTION

Diabetic retinopathy is one of the most clinically important microvascular complications of diabetes mellitus and continues to contribute substantially to preventable visual impairment across the world. It develops through chronic hyperglycaemia-mediated vascular injury, endothelial dysfunction, capillary leakage, retinal ischaemia, and pathological neovascularisation. The disease often remains silent during its early stages, while irreversible retinal damage continues to progress. This asymptomatic phase gives retinal screening a distinct public health value because timely detection and treatment reduce the risk of advanced ocular morbidity [1,2].

The burden of diabetic retinopathy has increased with the growing prevalence of type 2 diabetes mellitus. Large pooled analyses have shown that diabetic retinopathy affects a sizeable proportion of individuals with diabetes, with vision-threatening forms including proliferative diabetic retinopathy and diabetic macular oedema contributing to avoidable blindness [2-4]. Contemporary reviews also indicate that the burden is expected to expand in low- and middle-income countries where diabetes is frequently diagnosed late and retinal screening coverage remains incomplete [3,5]. India carries a substantial diabetes burden, and population-based Indian studies have documented notable variation in diabetic retinopathy prevalence across urban and rural communities, reflecting differences in disease duration, health-seeking behaviour, metabolic control, and access to ophthalmic services [12-14].

The principal risk factors for diabetic retinopathy include longer duration of diabetes, poor glycaemic control, hypertension, dyslipidaemia, nephropathy, and insulin use in selected clinical settings. Among these, duration of diabetes and glycaemic exposure are among the most consistent determinants. Landmark studies have established that intensive glycaemic control reduces microvascular complications, while blood pressure control lowers diabetes-related vascular risk [8-10]. These

observations support an integrated care model in which ophthalmic evaluation is linked with systemic risk-factor assessment. In routine hospital practice, however, patients commonly present for eye evaluation only after visual symptoms develop, resulting in missed opportunities for early intervention.

Clinical grading of diabetic retinopathy provides a practical framework for risk stratification and referral. The International Clinical Diabetic Retinopathy Disease Severity Scale classifies disease into mild, moderate, and severe non-proliferative diabetic retinopathy and proliferative diabetic retinopathy, with separate evaluation for diabetic macular oedema [11]. These categories are useful in tertiary care settings because they guide the urgency of ophthalmic follow-up and treatment planning.

The present study was undertaken to assess the clinical profile and risk factors of diabetic retinopathy among patients with type 2 diabetes mellitus attending a tertiary care hospital. The objectives of this study were to determine the prevalence and severity distribution of diabetic retinopathy, describe ocular symptoms and clinical findings, and evaluate associations between diabetic retinopathy and selected systemic risk factors, including duration of diabetes, glycaemic control, hypertension, dyslipidaemia, and obesity.

MATERIALS AND METHODS

Study design and setting: This hospital-based observational study was conducted at Prathima Institute of Medical Sciences, Karimnagar, Telangana, India. The study period extended from August 2025 to January 2026. The institution provides tertiary-level medical and ophthalmic care and receives patients from surrounding urban, semi-urban, and rural areas. The study was designed to evaluate the clinical profile and associated risk factors of diabetic retinopathy among patients with established type 2 diabetes mellitus.

Study population: Patients with type 2 diabetes mellitus attending the outpatient or inpatient services during the study period were considered for enrolment. Adults with a confirmed diagnosis of type 2 diabetes mellitus who consented to participate and underwent complete ophthalmic evaluation were included. Patients with media opacity preventing adequate fundus assessment, history of retinal vascular occlusion, non-diabetic retinal disease affecting grading, previous vitreoretinal surgery, or incomplete clinical records were excluded to maintain uniformity of assessment.

Sample size and sampling: A total of 100 patients were included. The sample size was considered adequate for a descriptive observational study within the defined study duration and available clinical flow. Eligible patients were enrolled using a consecutive sampling method until the required sample size was reached. Consecutive recruitment reduced investigator-driven selection and improved representation of routine patients attending the tertiary care setting.

Data collection: Demographic variables, duration of diabetes, treatment history, family history of diabetes, smoking history, hypertension, dyslipidaemia, and body mass index category were recorded using a structured data collection form. Glycaemic control was assessed using HbA1c, and poor glycaemic control was defined as HbA1c ≥8%. Hypertension and dyslipidaemia were documented based on clinical history, treatment records, or available investigations. Obesity was classified according to body mass index status recorded during clinical evaluation.

Ophthalmic evaluation and grading: All participants underwent visual acuity assessment, anterior segment examination, and dilated fundus evaluation. Fundus findings were assessed for microaneurysms, retinal haemorrhages, hard exudates, cotton wool spots, venous beading, intraretinal microvascular abnormalities, neovascularisation, vitreous haemorrhage, and macular oedema. Diabetic retinopathy was graded as no diabetic retinopathy, mild non-proliferative diabetic retinopathy, moderate non-proliferative diabetic retinopathy, severe non-proliferative diabetic retinopathy, and proliferative diabetic retinopathy using standard clinical severity categories [7,11]. Clinically significant macular oedema was recorded separately.

Statistical analysis: Data were entered into a spreadsheet and analysed using standard statistical methods. Continuous variables were expressed as mean and standard deviation, while categorical variables were presented as frequency and percentage. Associations between diabetic retinopathy and selected risk factors were examined using the chi-square test or an appropriate categorical test. A p-value below 0.05 was considered statistically significant.

Ethical considerations: The study was conducted in accordance with ethical principles for biomedical research involving human participants. Institutional ethics committee approval was obtained before commencement of data collection. Written informed consent was obtained from all participants. Confidentiality of patient identity and clinical information was maintained throughout the study, and participation did not interfere with routine care.

RESULTS

A total of 100 patients with type 2 diabetes mellitus were included in the study. The mean age of the study population was 56.8 ± 10.4 years, with most patients belonging to the 51-60 years age group. Males constituted 56.0% of participants, while females accounted for 44.0%. The mean duration of diabetes was 8.7 ± 5.1 years. Hypertension was present in 42.0% of patients, dyslipidaemia in 38.0%, and obesity in 31.0%. Poor glycaemic control, defined by HbA1c ≥8%, was observed in 46.0% of patients (Table 1).

Table 1. Baseline demographic and clinical characteristics of the study population

Variable	Category / Value	Frequency / Mean	Percentage / SD
Total sample size	-	100	100.0
Age, years	Mean ± SD	56.8	±10.4
Age group	30-40 years	10	10.0
	41-50 years	22	22.0
	51-60 years	38	38.0
	>60 years	30	30.0
Sex	Male	56	56.0
	Female	44	44.0
Duration of diabetes, years	Mean ± SD	8.7	±5.1
BMI status	Normal	29	29.0
	Overweight	40	40.0
	Obese	31	31.0
Hypertension	Present	42	42.0
Dyslipidaemia	Present	38	38.0
Smoking history	Present	26	26.0
Family history of diabetes	Present	48	48.0

Diabetic retinopathy was identified in 39 patients, giving an overall prevalence of 39.0%. Among patients with diabetic retinopathy, mild non-proliferative diabetic retinopathy was the most common grade, observed in 17.0% of the total study population. Moderate non-proliferative diabetic retinopathy was noted in 12.0%, severe non-proliferative diabetic retinopathy in 6.0%, and proliferative diabetic retinopathy in 4.0%. Clinically significant macular oedema was observed in 9.0% of patients (Table 2).

Table 2. Distribution of diabetic retinopathy among the study population

Retinopathy status / Grade	Frequency (n=100)	Percentage (%)
No diabetic retinopathy	61	61.0
Any diabetic retinopathy	39	39.0
Mild NPDR	17	17.0
Moderate NPDR	12	12.0
Severe NPDR	6	6.0
Proliferative diabetic retinopathy	4	4.0
Clinically significant macular oedema	9	9.0

The proportion of diabetic retinopathy increased with longer duration of diabetes. Retinopathy was present in 16.0% of patients with diabetes duration below 5 years, compared with 35.3% among those with 5-10 years duration and 56.1% among those with diabetes for more than 10 years. This association was statistically significant. Poor glycaemic control was also strongly associated with diabetic retinopathy, as 58.7% of patients with HbA1c ≥8% had retinopathy compared with 22.2% of patients with HbA1c <8%. Hypertension was also significantly associated with diabetic retinopathy (Table 3).

Table 3. Association of diabetic retinopathy with clinical and metabolic risk factors

Risk factor	Category	Diabetic retinopathy present n (%)	Diabetic retinopathy absent n (%)	p-value
Duration of diabetes	<5 years (n=25)	4 (16.0)	21 (84.0)	0.005
	5-10 years (n=34)	12 (35.3)	22 (64.7)	
	>10 years (n=41)	23 (56.1)	18 (43.9)	
HbA1c	<8% (n=54)	12 (22.2)	42 (77.8)	<0.001
	≥8% (n=46)	27 (58.7)	19 (41.3)	
Hypertension	Present (n=42)	23 (54.8)	19 (45.2)	0.012
	Absent (n=58)	16 (27.6)	42 (72.4)	
Dyslipidaemia	Present (n=38)	19 (50.0)	19 (50.0)	0.078
	Absent (n=62)	20 (32.3)	42 (67.7)	
Obesity	Present (n=31)	15 (48.4)	16 (51.6)	0.205
	Absent (n=69)	24 (34.8)	45 (65.2)	

On clinical evaluation, blurred vision was the most common ocular symptom, reported by 32.0% of patients, followed by floaters in 11.0% and difficulty in night vision in 9.0%. However, 48.0% of patients were asymptomatic at the time of ophthalmic screening. Visual acuity impairment was more frequent among patients with moderate to severe retinopathy and proliferative diabetic retinopathy. Cataract changes were noted in 24.0% of patients, and macular oedema was recorded in 9.0% (Table 4).

Table 4. Ocular symptoms and clinical findings among the study population

Clinical feature	Frequency (n=100)	Percentage (%)
Asymptomatic	48	48.0
Blurred vision	32	32.0
Floaters	11	11.0
Difficulty in night vision	9	9.0
Visual acuity 6/6-6/12	66	66.0
Visual acuity <6/12-6/60	27	27.0
Visual acuity <6/60	7	7.0
Cataract changes	24	24.0
Macular oedema	9	9.0

Overall, diabetic retinopathy was significantly associated with longer duration of diabetes, poor glycaemic control, and hypertension. Dyslipidaemia and obesity showed higher proportions among patients with diabetic retinopathy, although the associations were not statistically significant. These findings indicate that systematic retinal screening is essential, particularly in patients with long-standing diabetes, uncontrolled blood glucose levels, and coexisting hypertension.

DISCUSSION

This observational study demonstrated that diabetic retinopathy was present in 39.0% of patients with type 2 diabetes mellitus attending a tertiary care hospital. The observed burden reflects a clinically meaningful proportion of patients requiring continued ophthalmic surveillance. Mild non-proliferative diabetic retinopathy was the most common grade, followed by moderate and severe non-proliferative disease. This pattern indicates that many patients were detected before proliferative changes became dominant, which is favourable from a prevention perspective because early-stage disease offers a wider window for risk-factor correction and follow-up [5,7].

The prevalence observed in this hospital-based study was higher than estimates from several Indian population-based studies. CURES reported a lower prevalence in urban South Indians, and the SN-DREAMS reports documented variable prevalence across urban and rural Indian populations [12-14]. This difference is expected because tertiary care hospitals often receive patients with longer diabetes duration, comorbid hypertension, poorer metabolic control, or visual complaints. Hospital-based prevalence therefore represents a service-level burden rather than a community estimate. However, it remains useful for planning screening clinics, referral pathways, and counselling strategies within tertiary-care practice.

Longer duration of diabetes showed a significant association with diabetic retinopathy in this study. Retinopathy was more frequent in patients with diabetes duration exceeding 10 years than in those with shorter duration. This finding is consistent with global epidemiological analyses and Indian studies, where duration of diabetes repeatedly emerges as one of the strongest predictors of retinopathy [2,5,13,14]. The biological explanation is straightforward: cumulative exposure to hyperglycaemia promotes endothelial injury, pericyte loss, capillary basement membrane thickening, and retinal microvascular compromise.

Poor glycaemic control was another important factor. Patients with HbA1c ≥8% had a higher proportion of retinopathy compared with those with better control. The UKPDS and subsequent analyses demonstrated that higher glycaemic exposure is closely related to microvascular complications, while improved glycaemic control reduces long-term microvascular risk [8,10]. Hypertension also showed a significant association in the present study. This agrees with evidence that blood pressure control contributes to reduction of diabetes-related microvascular complications [9]. Dyslipidaemia and obesity showed higher retinopathy proportions but did not reach statistical significance, likely reflecting the limited sample size and multifactorial nature of retinal vascular damage.

A notable clinical observation was that 48.0% of patients were asymptomatic at screening. This finding has direct practice relevance. Reliance on visual symptoms alone misses a substantial proportion of early diabetic retinopathy. Current standards recommend regular retinal assessment for patients with diabetes, and the present study reinforces the need for routine ophthalmic screening integrated with diabetic care [6,7].

Limitations

The study had a single-centre observational design and a modest sample size, limiting wider generalisation. Consecutive sampling reduced selection bias but did not eliminate referral bias in a tertiary care setting. Fundus grading was based on clinical assessment rather than central photographic grading. Longitudinal progression, treatment response, renal parameters, and medication adherence were not evaluated, restricting causal interpretation.

CONCLUSION

Diabetic retinopathy was observed in a considerable proportion of patients with type 2 diabetes mellitus attending this tertiary care hospital. Mild non-proliferative diabetic retinopathy was the most frequent grade, while clinically significant macular oedema and proliferative disease were present in smaller but clinically important proportions. Longer duration of diabetes, poor glycaemic control, and hypertension were significantly associated with retinopathy. Nearly half of the patients were asymptomatic, highlighting the need for proactive retinal evaluation rather than symptom-driven referral. Integrated diabetic care with periodic ophthalmic screening, strict glycaemic control, and blood pressure optimisation is essential to reduce preventable visual morbidity in this population.

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