International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Available online on: https://ijmpr.in/

Original Article

Association Between Diabetes Mellitus Duration and Diabetic Retinopathy Severity Among Patients Attending a Tertiary Care Hospital: A Cross-Sectional Study

Dr. Yasam Sowmya[1], Dr. Pogula Nagarjuna Reddy[2], Dr. M. V. Narayana Reddy[3]

[1]Assistant Professor, Department of Ophthalmology, Santhiram Medical College and General Hospital, Nandyal, Andhra Pradesh, India.
[2]Associate Professor, Department of General Medicine, Santhiram Medical College and General Hospital, Nandyal, Andhra Pradesh, India.
[3]Assistant Professor, Department of General Medicine, Santhiram Medical College and General Hospital, Nandyal, Andhra Pradesh, India.

OPEN ACCESS

Corresponding Author:

Dr. Yasam Sowmya
Assistant Professor, Department of Ophthalmology, Santhiram Medical College and General Hospital, Nandyal, Andhra Pradesh, India.

Received: 05-12-2025
Accepted: 11-01-2026
Available online: 28-02-2026

ABSTRACT

Background: Diabetic retinopathy is a common microvascular complication of diabetes mellitus and remains an important cause of preventable visual impairment. Disease duration is a major non-modifiable determinant, while glycaemic control and hypertension influence progression. Local hospital-based data help identify patients requiring closer ophthalmic surveillance.
Objectives: To assess the association between duration of diabetes mellitus and severity of diabetic retinopathy among patients attending a tertiary care hospital.
Methods: This cross-sectional study included 100 patients with diabetes mellitus attending the ophthalmology outpatient department of Santhiram Medical College, Nandyal, Andhra Pradesh, India, from April 2025 to September 2025. Demographic details, duration of diabetes, hypertension status, and HbA1c category were recorded. Dilated fundus examination was performed, and diabetic retinopathy was graded as no diabetic retinopathy, mild non-proliferative diabetic retinopathy, moderate non-proliferative diabetic retinopathy, severe non-proliferative diabetic retinopathy, or proliferative diabetic retinopathy. Associations were tested using chi-square test, ANOVA, and ordinal regression.
Results: The mean age was 56.8 ± 9.7 years, and the mean diabetes duration was 10.4 ± 5.8 years. Diabetic retinopathy was present in 66.0% of patients. Mild, moderate, and severe non-proliferative diabetic retinopathy were observed in 24.0%, 20.0%, and 12.0%, respectively, while proliferative diabetic retinopathy was present in 10.0%. Retinopathy severity increased significantly with longer diabetes duration. Patients with diabetes duration greater than 15 years had the highest proportion of severe non-proliferative diabetic retinopathy and proliferative diabetic retinopathy. Duration greater than 15 years, HbA1c ≥8.0%, and systemic hypertension were significantly associated with increased retinopathy severity.
Conclusion: Longer duration of diabetes mellitus was strongly associated with increasing diabetic retinopathy severity. Early retinal screening, strict glycaemic control, and regular follow-up are essential to reduce vision-threatening disease in long-standing diabetes.

Keywords*: Diabetes mellitus; Diabetic retinopathy; Disease duration; Non-proliferative diabetic retinopathy; Proliferative diabetic retinopathy; HbA1c.*

INTRODUCTION

Diabetic retinopathy is a highly specific neurovascular complication of diabetes mellitus and represents one of the leading causes of preventable visual impairment among adults. Chronic hyperglycaemia damages retinal

microvasculature through endothelial dysfunction, capillary basement membrane thickening, pericyte loss, inflammatory activation, and breakdown of the blood-retinal barrier. The clinical spectrum ranges from microaneurysms and intraretinal haemorrhages in early non-proliferative diabetic retinopathy to retinal ischaemia, neovascularisation, vitreous haemorrhage, and tractional retinal detachment in advanced proliferative disease [1]. Because diabetes prevalence is rising globally, the absolute burden of diabetic retinopathy has also increased and continues to place pressure on ophthalmic services [2,3].

The duration of diabetes mellitus is one of the most consistent predictors of diabetic retinopathy. Population-based studies have shown a progressive rise in retinopathy prevalence as the duration of diabetes increases, with marked differences between newly diagnosed diabetes and long-standing disease [4,5]. The Wisconsin Epidemiologic Study of Diabetic Retinopathy demonstrated that both prevalence and severity are strongly related to disease duration, while later longitudinal evidence confirmed that progression risk is shaped by baseline retinopathy grade and systemic metabolic exposure [4,5]. Therefore, a patient with long-standing diabetes represents a biologically high-risk group even when symptoms are absent.

Several modifiable systemic factors interact with diabetes duration in determining retinal outcome. The UK Prospective Diabetes Study identified glycaemia, blood pressure, and duration of diabetes as important determinants of retinopathy incidence and progression in type 2 diabetes [6]. The Diabetes Control and Complications Trial showed that intensive glycaemic control delayed the onset and slowed the progression of retinopathy in insulin-dependent diabetes [7]. Hypertension further aggravates retinal microvascular injury, and tight blood pressure control reduces diabetes-related microvascular complications [8]. These findings support integrated diabetes care, where ophthalmic surveillance is combined with sustained metabolic and cardiovascular risk control.

In India, diabetic retinopathy contributes substantially to avoidable visual loss because many patients reach ophthalmology services after prolonged disease duration or poor metabolic control. Community-based Indian studies such as the Chennai Urban Rural Epidemiology Study and the Sankara Nethralaya-Diabetic Retinopathy Epidemiology and Molecular Genetics Study reported diabetic retinopathy prevalence around 17.6% to 18.0% in urban diabetic populations [9,10]. The All India Ophthalmological Society screening study reported a prevalence of 21.7% among screened individuals with known diabetes [11]. Studies in Asian Indians with young-onset diabetes also highlight the role of longer duration and metabolic risk factors in sight-threatening retinopathy [12]. Hospital-based tertiary care settings often show higher retinopathy frequency because patients are referred with longer disease duration, ocular symptoms, and associated systemic disease.

The present study was conducted to evaluate the association between duration of diabetes mellitus and diabetic retinopathy severity among patients attending the ophthalmology outpatient department of a tertiary care hospital. The primary objective was to determine whether longer duration of diabetes was associated with higher retinopathy severity. The secondary objectives were to describe the distribution of diabetic retinopathy grades and to assess the association of poor glycaemic control and systemic hypertension with retinopathy severity.

METHODOLOGY

Study design and setting

This hospital-based cross-sectional study was conducted in the Department of Ophthalmology, Santhiram Medical College, Nandyal, Andhra Pradesh, India. The study period extended from April 2025 to September 2026. The hospital provides tertiary ophthalmic and medical services to patients from Nandyal and surrounding districts, including individuals referred for diabetic eye evaluation. A cross-sectional design was selected because the exposure variable, duration of diabetes mellitus, and the outcome variable, diabetic retinopathy severity, were measured at a single clinical encounter.

Study population and eligibility criteria

The study population included adults with previously diagnosed diabetes mellitus attending the ophthalmology outpatient department during the study period. Patients aged 18 years and above with available clinical history regarding duration of diabetes and willingness to undergo ocular examination were eligible. Patients with media opacity preventing adequate fundus evaluation, previous retinal laser or intravitreal therapy, retinal vascular occlusion, hypertensive retinopathy mimicking diabetic retinal changes, advanced glaucoma, uveitis, pregnancy-related retinal disease, incomplete clinical records, or refusal to provide consent were excluded.

Sample size and sampling technique

The minimum sample size was estimated using the single proportion formula $n = Z^2p(1-p)/d^2$. Assuming 50% expected prevalence due to variability in hospital-based retinopathy rates, 95% confidence level, and 10% absolute precision, the calculated sample size was 96. The sample was rounded to 100 patients. Eligible patients were enrolled by consecutive sampling until the required sample size was reached.

Study variables and data collection
The independent variable was duration of diabetes mellitus, categorized as less than 5 years, 5-10 years, 11-15 years, and more than 15 years. The dependent variable was diabetic retinopathy severity. Additional covariates included age, sex, systemic hypertension, and HbA1c category. Poor glycaemic control was defined as HbA1c ≥8.0%. Data were collected using a structured case record form. Duration of diabetes was obtained from patient history and available medical records. Blood pressure and HbA1c values were recorded from recent clinical documentation when available.

Ophthalmic assessment and grading
All patients underwent visual assessment, anterior segment examination, intraocular pressure measurement when clinically indicated, and dilated fundus examination using indirect ophthalmoscopy and slit-lamp biomicroscopy with a fundus lens. Diabetic retinopathy was graded according to internationally accepted clinical severity categories as no diabetic retinopathy, mild non-proliferative diabetic retinopathy, moderate non-proliferative diabetic retinopathy, severe non-proliferative diabetic retinopathy, or proliferative diabetic retinopathy [13,14]. When both eyes had different grades, the more severe eye was used for patient-level classification.

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 expressed as frequency and percentage. The chi-square test was used to assess the association between duration of diabetes and retinopathy severity. One-way ANOVA was used to compare mean diabetes duration across retinopathy grades. Ordinal regression analysis was performed to identify factors associated with increasing retinopathy severity. A p-value less than 0.05 was considered statistically significant.

Ethical considerations
Institutional Ethics Committee approval was obtained from Santhiram Medical College, Nandyal, Andhra Pradesh, India, before initiation of the study. Written informed consent was obtained from all participants. Patient confidentiality was maintained by anonymizing clinical data during analysis and reporting.

RESULTS
A total of 100 patients with diabetes mellitus attending the ophthalmology outpatient department of a tertiary care hospital were included in the final analysis. The mean age of the study participants was 56.8 ± 9.7 years. Males constituted 56 patients (56.0%), while females accounted for 44 patients (44.0%). The mean duration of diabetes mellitus was 10.4 ± 5.8 years. Systemic hypertension was present in 46 patients (46.0%), and 38 patients (38.0%) had poor glycaemic control based on HbA1c levels ≥8.0% (Table 1).

Table 1. Baseline characteristics of study participants (n=100)

Variable	Frequency	Percentage
Age group		
<50 years	22	22.0
50-59 years	38	38.0
60-69 years	30	30.0
≥70 years	10	10.0
Sex		
Male	56	56.0
Female	44	44.0
Duration of diabetes mellitus		
<5 years	22	22.0
5-10 years	32	32.0
11-15 years	26	26.0
>15 years	20	20.0
Systemic hypertension		
Present	46	46.0
Absent	54	54.0
HbA1c level		
<7.0%	28	28.0
7.0-7.9%	34	34.0
≥8.0%	38	38.0

Diabetic retinopathy was observed in 66 patients (66.0%), while 34 patients (34.0%) had no evidence of diabetic retinopathy. Among patients with diabetic retinopathy, mild non-proliferative diabetic retinopathy was the most common

pattern, observed in 24 patients (24.0%), followed by moderate non-proliferative diabetic retinopathy in 20 patients (20.0%), severe non-proliferative diabetic retinopathy in 12 patients (12.0%), and proliferative diabetic retinopathy in 10 patients (10.0%) (Table 2).

Table 2. Distribution of diabetic retinopathy severity among study participants (n=100)

Diabetic retinopathy status	Frequency	Percentage
No diabetic retinopathy	34	34.0
Mild NPDR	24	24.0
Moderate NPDR	20	20.0
Severe NPDR	12	12.0
Proliferative diabetic retinopathy	10	10.0

The severity of diabetic retinopathy increased progressively with longer duration of diabetes mellitus. Among patients with diabetes duration of less than 5 years, 15 patients (68.2%) had no diabetic retinopathy, and none had severe non-proliferative diabetic retinopathy or proliferative diabetic retinopathy. In contrast, among patients with diabetes duration of more than 15 years, only one patient (5.0%) had no diabetic retinopathy, while 6 patients (30.0%) had severe non-proliferative diabetic retinopathy and 7 patients (35.0%) had proliferative diabetic retinopathy. The association between diabetes duration and diabetic retinopathy severity was statistically significant ($\chi^2 = 44.99$, $p<0.001$) (Table 3).

Table 3. Association between duration of diabetes mellitus and diabetic retinopathy severity (n=100)

Duration of diabetes	No DR	Mild NPDR	Moderate NPDR	Severe NPDR	PDR	Total
<5 years	15	5	2	0	0	22
5-10 years	12	11	6	2	1	32
11-15 years	6	6	8	4	2	26
>15 years	1	2	4	6	7	20
Total	34	24	20	12	10	100

The mean duration of diabetes mellitus also showed a graded rise across retinopathy categories. Patients without diabetic retinopathy had a mean diabetes duration of 5.9 ± 3.4 years, whereas those with proliferative diabetic retinopathy had a mean duration of 17.8 ± 4.6 years. This difference was statistically significant (ANOVA $F = 31.42$, $p<0.001$) (Table 4).

Table 4. Mean duration of diabetes mellitus according to diabetic retinopathy severity

Retinopathy severity	Mean duration of diabetes, years	Standard deviation
No diabetic retinopathy	5.9	3.4
Mild NPDR	8.7	4.1
Moderate NPDR	11.8	4.8
Severe NPDR	14.9	5.2
Proliferative diabetic retinopathy	17.8	4.6

On ordinal regression analysis, longer duration of diabetes mellitus was significantly associated with increasing severity of diabetic retinopathy. Compared with patients having diabetes for less than 5 years, those with duration of 11-15 years had higher odds of more severe retinopathy (OR: 4.62, 95% CI: 1.58-13.47, p=0.005), while those with duration of more than 15 years had markedly higher odds (OR: 9.84, 95% CI: 2.94-32.91, p<0.001). Poor glycaemic control and systemic hypertension were also significantly associated with higher retinopathy severity (Table 5).

Table 5. Factors associated with increased diabetic retinopathy severity

Variable	Odds ratio	95% CI	p-value
Diabetes duration 5-10 years	2.18	0.78-6.12	0.137
Diabetes duration 11-15 years	4.62	1.58-13.47	0.005
Diabetes duration >15 years	9.84	2.94-32.91	<0.001
HbA1c ≥8.0%	3.36	1.31-8.61	0.012
Systemic hypertension	2.47	1.04-5.87	0.041

Overall, the findings demonstrated a strong positive association between duration of diabetes mellitus and diabetic retinopathy severity. Patients with longer disease duration showed a higher frequency of vision-threatening stages, especially severe non-proliferative diabetic retinopathy and proliferative diabetic retinopathy.

DISCUSSION

The present cross-sectional study demonstrated a clear positive association between diabetes mellitus duration and diabetic retinopathy severity among patients attending a tertiary care hospital. Diabetic retinopathy was present in 66.0% of participants, and severity increased progressively across duration categories. Patients with diabetes duration greater than 15 years had the highest proportion of severe non-proliferative diabetic retinopathy and proliferative diabetic retinopathy. These findings reinforce the clinical principle that longer cumulative exposure to hyperglycaemia produces greater retinal microvascular injury and increases the probability of vision-threatening disease.

The observed prevalence of diabetic retinopathy was higher than the estimates reported in several population-based studies. Global pooled analysis by Yau et al. estimated that approximately one-third of individuals with diabetes had some form of retinopathy, and prevalence increased with diabetes duration, HbA1c, and blood pressure [2]. More recent global projections have also confirmed diabetic retinopathy as a growing public health burden [3]. Indian population-based studies reported lower prevalence than the present hospital-based study. The CURES Eye Study reported 17.6% prevalence in urban India, while the SN-DREAMS report documented 18.0% among people with diabetes [9,10]. The All India Ophthalmological Society screening study reported 21.7% prevalence [11]. The higher proportion in this study is clinically plausible because tertiary care outpatient departments receive symptomatic patients and referrals with longer disease duration.

The duration-severity gradient in this study agrees with classical epidemiological evidence. The Wisconsin Epidemiologic Study of Diabetic Retinopathy showed that retinopathy prevalence rose sharply with longer duration of diabetes in both younger-onset and older-onset diabetes groups [4,5]. The UKPDS also identified diabetes duration and glycaemic exposure as key determinants of retinopathy incidence and progression in type 2 diabetes [6]. In the present study, patients without retinopathy had a mean duration of 5.9 years, while those with proliferative disease had a mean duration of 17.8 years. This graded pattern supports the cumulative injury model of diabetic retinal disease.

Poor glycaemic control and systemic hypertension were significantly associated with increased retinopathy severity. This finding is consistent with evidence from the Diabetes Control and Complications Trial, which established that intensive glycaemic control delays onset and slows progression of retinopathy [7]. The UKPDS blood pressure trial further demonstrated that tight blood pressure control reduces microvascular complications in type 2 diabetes [8]. These observations indicate that duration of diabetes should not be interpreted in isolation. A patient with long-standing diabetes, elevated HbA1c, and hypertension needs more frequent retinal evaluation and closer coordination between physicians and ophthalmologists.

The use of established clinical grading categories improves comparability with other studies and strengthens routine applicability. The International Clinical Diabetic Retinopathy severity scale and ETDRS-derived grading approaches provide practical categories for identifying eyes at risk of progression and visual loss [13,14]. Current clinical recommendations support retinal evaluation at diagnosis for type 2 diabetes and periodic follow-up depending on retinopathy grade and systemic risk profile [1,14]. In resource-limited settings, duration-based risk stratification helps prioritize screening for patients with long-standing diabetes, particularly those with poor glycaemic control or hypertension.

Overall, the study emphasizes that diabetes duration remains a simple but powerful clinical marker for retinopathy severity. Tertiary hospitals should integrate diabetes duration, HbA1c status, and hypertension history into diabetic eye clinic workflows. This approach supports early identification of severe non-proliferative and proliferative diabetic retinopathy, timely referral for retinal treatment, and counselling on sustained systemic control.

Limitations

The study was hospital based and included 100 patients, limiting wider generalizability. Cross-sectional assessment prevents temporal inference between diabetes duration and retinopathy progression. Glycaemic control was categorized using a single HbA1c value, which does not capture long-term variability. Other relevant determinants, including lipid profile, renal status, treatment adherence, smoking intensity, and diabetic macular edema grading, were not fully analysed.

CONCLUSION

This cross-sectional study demonstrated a significant positive association between duration of diabetes mellitus and diabetic retinopathy severity among patients attending a tertiary care hospital. Retinopathy was more frequent and more severe in patients with longer disease duration, especially beyond 15 years. Poor glycaemic control and systemic hypertension were additional factors associated with greater retinopathy severity. These findings support routine retinal screening from the time of diabetes diagnosis, stricter follow-up for long-standing diabetes, and integrated management of glycaemia and blood pressure. Duration of diabetes should be used as a simple clinical marker to identify patients requiring closer ophthalmic surveillance and early retinal intervention.

REFERENCES

1. Cheung N, Mitchell P, Wong TY. Diabetic retinopathy. Lancet. 2010;376(9735):124-136. doi:10.1016/S0140-6736(09)62124-3.
2. Yau JWY, Rogers SL, Kawasaki R, Lamoureux EL, Kowalski JW, Bek T, et al. Global prevalence and major risk factors of diabetic retinopathy. Diabetes Care. 2012;35(3):556-564. doi:10.2337/dc11-1909.
3. Teo ZL, Tham YC, Yu M, Chee ML, Rim TH, Cheung N, et al. Global prevalence of diabetic retinopathy and projection of burden through 2045: systematic review and meta-analysis. Ophthalmology. 2021;128(11):1580-1591. doi:10.1016/j.ophtha.2021.04.027.
4. Klein R, Klein BEK, Moss SE, Davis MD, DeMets DL. The Wisconsin Epidemiologic Study of Diabetic Retinopathy. III. Prevalence and risk of diabetic retinopathy when age at diagnosis is 30 or more years. Arch Ophthalmol. 1984;102(4):527-532.
5. Stratton IM, Kohner EM, Aldington SJ, Turner RC, Holman RR, Manley SE, et al. UKPDS 50: risk factors for incidence and progression of retinopathy in type II diabetes over 6 years from diagnosis. Diabetologia. 2001;44(2):156-163. doi:10.1007/s001250051594.
6. Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. N Engl J Med. 1993;329(14):977-986. doi:10.1056/NEJM199309303291401.
7. UK Prospective Diabetes Study Group. Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 38. BMJ. 1998;317(7160):703-713. doi:10.1136/bmj.317.7160.703.
8. Rema M, Premkumar S, Anitha B, Deepa R, Pradeepa R, Mohan V. Prevalence of diabetic retinopathy in urban India: the Chennai Urban Rural Epidemiology Study (CURES) Eye Study, I. Invest Ophthalmol Vis Sci. 2005;46(7):2328-2333. doi:10.1167/iovs.05-0019.
9. Raman R, Rani PK, Reddi Rachepalle S, Gnanamoorthy P, Uthra S, Kumaramanickavel G, et al. Prevalence of diabetic retinopathy in India: Sankara Nethralaya Diabetic Retinopathy Epidemiology and Molecular Genetics Study report 2. Ophthalmology. 2009;116(2):311-318. doi:10.1016/j.ophtha.2008.09.010.
10. Gadkari SS, Maskati QB, Nayak BK. Prevalence of diabetic retinopathy in India: the All India Ophthalmological Society Diabetic Retinopathy Eye Screening Study 2014. Indian J Ophthalmol. 2016;64(1):38-44. doi:10.4103/0301-4738.178144.
11. Rajalakshmi R, Amutha A, Ranjani H, Ali MK, Unnikrishnan R, Anjana RM, et al. Prevalence and risk factors for diabetic retinopathy in Asian Indians with young onset type 1 and type 2 diabetes. J Diabetes Complications. 2014;28(3):291-297. doi:10.1016/j.jdiacomp.2013.12.008.
12. Early Treatment Diabetic Retinopathy Study Research Group. Grading diabetic retinopathy from stereoscopic color fundus photographs: an extension of the modified Airlie House classification. ETDRS report number 10. Ophthalmology. 1991;98(5 Suppl):786-806.
13. American Diabetes Association Professional Practice Committee. 12. Retinopathy, Neuropathy, and Foot Care: Standards of Care in Diabetes-2025. Diabetes Care. 2025;48(Suppl 1):S252-S265. doi:10.2337/dc25-S012.