



CLINICAL PROFILE OF DIABETIC RETINOPATHY AMONG TYPE II DIABETES MELLITUS PATIENTS IN A TERTIARY CARE HOSPITAL: A CROSS-SECTIONAL STUDY

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Abstract

Introduction: Diabetic retinopathy (DR) represents a major microvascular complication of diabetes mellitus and a leading cause of preventable blindness globally. Understanding the clinical profile of DR in tertiary care settings is crucial for developing effective management strategies, particularly in resource-limited healthcare systems.

Methods: A hospital-based cross-sectional study was conducted at Vyas Medical College and Hospital, Jodhpur, over six months (March-August 2025). Using systematic random sampling, 350 Type II diabetes mellitus patients aged ≥ 18 years were enrolled. Comprehensive ophthalmologic examination including dilated funduscopy and digital fundus photography was performed. DR grading followed International Clinical Diabetic Retinopathy severity scale. Data collection included demographic information, diabetes history, clinical parameters, and laboratory investigations. Statistical analysis employed chi-square tests, t-tests, and multivariate logistic regression.

Results: Overall DR prevalence was 31.1% (95% CI: 26.3-36.3%). Severity distribution included mild NPDR (16.0%), moderate NPDR (8.3%), severe NPDR (3.4%), and PDR (3.4%). Vision-threatening DR affected 6.9% of patients. Diabetes duration >15 years showed 7.42-fold increased risk (95% CI: 3.45-15.95), while poor glycemic control ($HbA1c \geq 9\%$) demonstrated 4.23-fold increased risk (95% CI: 2.27-7.87). Hypertension was associated with 1.74-fold increased risk (95% CI: 1.09-2.78). Progressive visual impairment correlated significantly with increasing DR severity.

Conclusion: The study reveals significant DR burden in tertiary care settings with strong associations between modifiable risk factors and disease development. Duration of diabetes, glycemic control, and hypertension emerged as key determinants requiring targeted interventions for effective DR prevention and management.

Keywords: Diabetic retinopathy, Type II diabetes mellitus, tertiary care, glycemic control, risk factors

Introduction

Diabetic retinopathy (DR) represents one of the most significant microvascular complications of diabetes mellitus and stands as a leading cause of preventable blindness among the working-age population globally (Teo et al., 2021). As a progressive retinal disorder characterized by damage to the blood vessels of the light-sensitive tissue at the back of the eye, diabetic retinopathy has

emerged as a critical public health concern that demands urgent attention from healthcare systems worldwide.

The global burden of diabetic retinopathy continues to escalate in parallel with the increasing prevalence of diabetes mellitus. Recent meta-analysis estimates suggest that approximately 22.27% of individuals with diabetes develop some form of diabetic retinopathy, with 6.17% progressing to vision-threatening diabetic retinopathy (VTDR) (Teo et al., 2021). The International Diabetes Federation projects that the global diabetes population will rise from 463 million in 2019 to 700 million by 2045, indicating that the burden of diabetic retinopathy is expected to remain substantially high, with an estimated 160.50 million people affected by 2045 (Teo et al., 2021).

In the Indian context, diabetic retinopathy presents a particularly complex challenge. The Sankara Nethralaya-Diabetic Retinopathy Epidemiology and Molecular Genetic Study (SN-DREAMS) III revealed significant variations in prevalence across different regions of the country (Gurudas et al., 2022). The national prevalence of diabetic retinopathy among people with diabetes aged 40 years and older is estimated at 12.5%, with vision-threatening diabetic retinopathy affecting 4.0% of this population (Gurudas et al., 2022). However, these figures mask substantial regional disparities, with prevalence rates varying considerably between urban and rural areas, as well as across different socioeconomic strata.

The clinical profile of diabetic retinopathy in Type II diabetes mellitus patients presents distinct characteristics that warrant detailed investigation. Unlike Type I diabetes, where the onset and duration can be more precisely tracked, Type II diabetes often remains undiagnosed for extended periods, potentially allowing diabetic retinopathy to develop insidiously (Ramavat et al., 2013). Studies from tertiary care centers in India have reported prevalence rates ranging from 16.9% to 33.9% among Type II diabetes patients, with significant variations based on diabetes duration, glycemic control, and associated comorbidities (Rani et al., 2021; Devatha & Preethi, 2024).

The pathophysiology of diabetic retinopathy involves a complex interplay of metabolic, hemodynamic, and inflammatory factors. Chronic hyperglycemia leads to the formation of advanced glycation end products, activation of protein kinase C pathway, increased oxidative stress, and upregulation of vascular endothelial growth factor (VEGF). These biochemical changes result in increased vascular permeability, capillary closure, and retinal ischemia, ultimately leading to the characteristic features of diabetic retinopathy including microaneurysms, hemorrhages, exudates, and neovascularization (Wong et al., 2016).

Risk factor identification remains crucial for effective management and prevention strategies. Duration of diabetes emerges as the single most important predictor, with studies demonstrating that patients with diabetes duration exceeding 10 years have 4.8 times higher odds of developing diabetic retinopathy compared to those with shorter duration (Rani et al., 2021). Poor glycemic control, defined as blood glucose levels ≥ 200 mg/dL, increases the risk by 1.5 times, while insulin treatment is associated with 2.6 times higher odds of diabetic retinopathy development (Rani et al., 2021). Hypertension represents another significant modifiable risk factor, with studies from western India demonstrating statistically significant associations between elevated blood pressure and diabetic retinopathy prevalence (Ramavat et al., 2013).

The clinical staging of diabetic retinopathy follows the International Clinical Diabetic Retinopathy (ICDR) severity scale, which classifies the condition into five distinct stages: no apparent retinopathy, mild non-proliferative diabetic retinopathy (NPDR), moderate NPDR, severe NPDR, and proliferative diabetic retinopathy (PDR). Recent studies from Indian tertiary care centers have reported that among patients with diabetic retinopathy, approximately 15.14% present with mild NPDR, 8.16% with moderate NPDR, 2.83% with severe NPDR, and 4.69% with proliferative diabetic retinopathy (Devatha & Preethi, 2024).

Gender differences in diabetic retinopathy prevalence have been consistently observed across multiple studies. Data from Indian tertiary care hospitals indicate higher prevalence rates among males (34.82%) compared to females (25.01%), although the underlying mechanisms for this disparity remain under investigation (Devatha & Preethi, 2024). Age-related patterns also

demonstrate increasing severity with advancing age, reinforcing the importance of duration of diabetes exposure as a critical determinant.

The burden of diabetic macular edema (DME) as a sight-threatening complication requires special attention in clinical profiling. Studies report DME prevalence rates of 4.07% globally among individuals with diabetes, with clinically significant macular edema affecting approximately 6.5% of patients with established diabetic retinopathy (Ramavat et al., 2013; Teo et al., 2021). The presence of macular edema significantly impacts visual outcomes and requires prompt intervention to prevent irreversible vision loss.

Advances in diagnostic technology have revolutionized the approach to diabetic retinopathy screening and management in tertiary care settings. Non-mydriatic fundus photography has emerged as the gold standard for systematic screening, offering high sensitivity and specificity for detecting sight-threatening diabetic retinopathy (Rajalakshmi et al., 2018). Recent developments in artificial intelligence-based automated screening systems have demonstrated comparable performance to human graders, with potential applications in resource-limited settings (Bhaskaranand et al., 2016).

The socioeconomic impact of diabetic retinopathy extends beyond individual health outcomes to encompass healthcare system burden and societal costs. Late diagnosis and delayed treatment contribute significantly to preventable blindness, with studies indicating that 89.9% of patients with known diabetes had never undergone fundus examination for diabetic retinopathy evaluation (Rani et al., 2021). This gap in screening coverage highlights the critical need for systematic approaches to diabetic retinopathy management in tertiary care facilities.

Treatment modalities for diabetic retinopathy have evolved significantly with the introduction of anti-vascular endothelial growth factor (anti-VEGF) therapy and improved laser photocoagulation techniques. Early detection through comprehensive clinical profiling enables timely intervention, which can significantly slow disease progression and preserve visual function. The emphasis on integrated diabetes care, combining optimal glycemic control with regular ophthalmologic surveillance, represents the current standard of care.

Contemporary research in diabetic retinopathy focuses increasingly on personalized medicine approaches, incorporating genetic factors, biomarkers, and advanced imaging techniques to refine risk stratification and treatment selection. The development of telemedicine platforms and portable screening devices holds promise for expanding access to diabetic retinopathy care, particularly in underserved populations served by tertiary care centers.

The aim of the study is to assess the clinical profile of diabetic retinopathy among patients with Type II diabetes mellitus attending a tertiary care hospital, including the prevalence, severity distribution, and associated risk factors.

Methodology

Study Design

A hospital-based cross-sectional descriptive study.

Study Site

The study was conducted at **Vyas Medical College & Hospital, Jodhpur**, a tertiary care institution providing specialized healthcare services to patients from Rajasthan and neighboring states.

Study Duration

The study was conducted over a period of 06 months from March 2025 to August 2025.

Sampling and Sample Size

The study employed systematic random sampling technique to ensure representative selection of Type II diabetes mellitus patients attending the ophthalmology and diabetic outpatient departments. Sample size calculation was performed using the formula $n = Z^2pq/d^2$, where $Z = 1.96$ (95%

confidence level), p = expected prevalence of diabetic retinopathy (30.84% based on previous Indian studies), $q = 1-p$, and d = margin of error (5%). Considering a 10% non-response rate, the calculated sample size was 350 patients. Every third eligible patient was selected from the daily patient list to minimize selection bias. The sampling process was continued until the desired sample size was achieved, ensuring adequate representation across different age groups, diabetes duration categories, and glycemic control status.

Inclusion and Exclusion Criteria

Inclusion criteria comprised patients diagnosed with Type II diabetes mellitus aged 18 years and above, diabetes duration of at least one year, ability to provide informed consent, and willingness to undergo complete ophthalmologic examination including dilated fundoscopy. Patients with both newly diagnosed and established diabetes were included to capture the full spectrum of diabetic retinopathy presentation. Exclusion criteria included patients with Type I diabetes mellitus, gestational diabetes, secondary diabetes due to other medical conditions, presence of media opacities preventing adequate fundus visualization (dense cataracts, vitreous hemorrhage), previous history of retinal surgery or laser photocoagulation, other retinal pathologies unrelated to diabetes (age-related macular degeneration, retinal vein occlusion), inability to provide informed consent, and pregnant or lactating women.

Data Collection Tools and Techniques

Data collection was performed using a standardized, pre-tested questionnaire administered through face-to-face interviews conducted by trained research personnel. The questionnaire captured demographic information (age, gender, occupation, residence), detailed diabetes history (duration since diagnosis, family history, treatment modalities), associated comorbidities (hypertension, dyslipidemia, chronic kidney disease), lifestyle factors (smoking, alcohol consumption, dietary habits), and current medications. Clinical examination included comprehensive ophthalmologic assessment performed by qualified ophthalmologists using standardized protocols. Best-corrected visual acuity was measured using Snellen's chart, followed by anterior segment examination using slit-lamp biomicroscopy. Fundus examination was conducted after pharmacological mydriasis using tropicamide 1% drops, employing both direct and indirect ophthalmoscopy. Digital fundus photography was performed using non-mydriatic fundus cameras following standardized protocols, with images captured in multiple fields including disc-centered and macula-centered views. Diabetic retinopathy grading was performed according to the International Clinical Diabetic Retinopathy (ICDR) severity scale by experienced ophthalmologists, with inter-observer reliability assessed through duplicate grading of 10% of cases. Laboratory investigations included glycated hemoglobin (HbA1c), fasting and postprandial blood glucose, lipid profile, and renal function tests performed using standardized laboratory protocols.

Data Management and Statistical Analysis

All collected data were entered into a purpose-designed electronic database using REDCap (Research Electronic Data Capture) platform, ensuring data security and integrity through role-based access controls and audit trails. Data validation included range checks, consistency verification, and duplicate entry detection to minimize errors. Statistical analysis was performed using SPSS version 26.0 (IBM Corporation, Armonk, NY). Descriptive statistics included frequencies and percentages for categorical variables, mean $\pm$ standard deviation for normally distributed continuous variables, and median with interquartile range for non-normally distributed data. Prevalence rates were calculated with 95% confidence intervals using binomial distribution. Chi-square tests were employed to assess associations between categorical variables, while Student's t-test and Mann-Whitney U tests were used for continuous variables as appropriate. Multivariate logistic regression analysis was conducted to identify independent risk factors for diabetic retinopathy, with results presented as odds ratios with 95% confidence intervals. Statistical

significance was defined as p-value <0.05. Sub-group analyses were performed based on diabetes duration categories, glycemic control status, and presence of associated comorbidities to identify differential risk patterns.

Ethical Considerations

The study protocol received approval from the Institutional Ethics Committee of Vyas Medical College and Hospital, Jodhpur, prior to commencement of data collection activities. All procedures were conducted in accordance with the principles of the Declaration of Helsinki and Good Clinical Practice guidelines. Written informed consent was obtained from all participants after providing detailed information about the study objectives, procedures, potential risks and benefits, and voluntary nature of participation.

Results

Table 1: Demographic and Clinical Characteristics of Study Participants (N=350)

Characteristics		Total Sample	DR Present	DR Absent	p-value
Age (years)	Mean $\pm$ SD	58.3 $\pm$ 12.4	62.1 $\pm$ 11.8	56.2 $\pm$ 12.6	0.001
	40-50 years, n (%)	89 (25.4)	18 (16.5)	71 (29.3)	
	51-60 years, n (%)	134 (38.3)	38 (34.9)	96 (39.7)	
	>60 years, n (%)	127 (36.3)	53 (48.6)	74 (30.6)	
Gender	Male, n (%)	198 (56.6)	69 (63.3)	129 (53.3)	0.085
	Female, n (%)	152 (43.4)	40 (36.7)	112 (46.3)	
BMI (kg/m ²)	Mean $\pm$ SD	26.8 $\pm$ 4.2	27.4 $\pm$ 4.1	26.5 $\pm$ 4.2	0.061
Residence	Urban, n (%)	221 (63.1)	71 (65.1)	150 (62.0)	0.577
	Rural, n (%)	129 (36.9)	38 (34.9)	91 (37.6)	
Education	Primary/Below, n (%)	142 (40.6)	52 (47.7)	90 (37.2)	0.091
	Secondary, n (%)	135 (38.6)	38 (34.9)	97 (40.1)	
	Higher, n (%)	73 (20.9)	19 (17.4)	54 (22.3)	

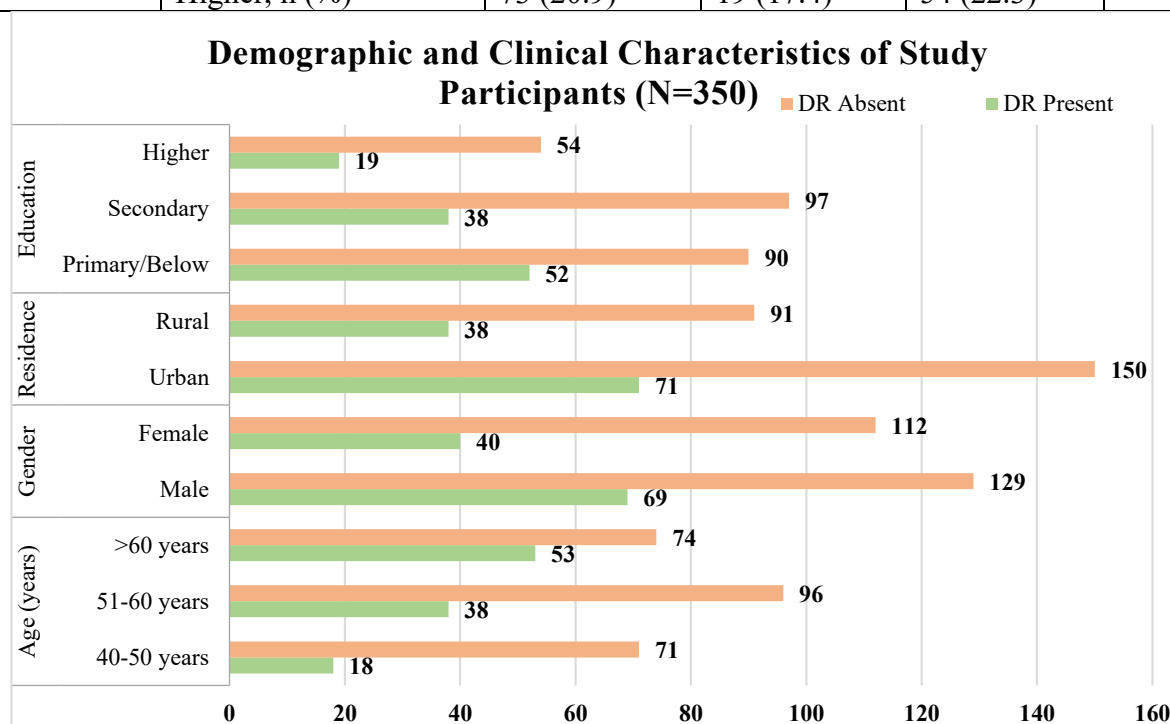


Fig: 1(i)

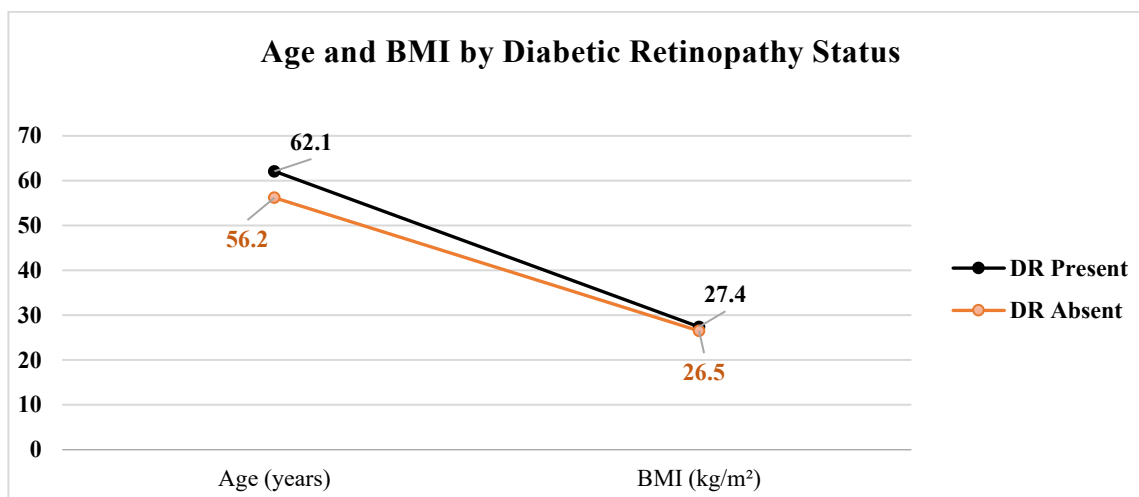


Fig: 1(ii)

Table 2: Prevalence and Severity Distribution of Diabetic Retinopathy (N=350)

Diabetic Retinopathy Status	Frequency (n)	Percentage (%)	95% CI
Overall DR Prevalence	109	31.1	26.3 - 36.3
No DR	241	68.9	63.7 - 73.7
DR Severity			
Mild NPDR	56	16.0	12.4 - 20.2
Moderate NPDR	29	8.3	5.7 - 11.6
Severe NPDR	12	3.4	1.8 - 5.9
PDR	12	3.4	1.8 - 5.9
Vision-Threatening DR	24	6.9	4.5 - 10.0
DME Present	18	5.1	3.1 - 8.0
Gender-wise Distribution			
Male with DR	69	34.8	28.2 - 42.0
Female with DR	40	26.3	19.4 - 34.2

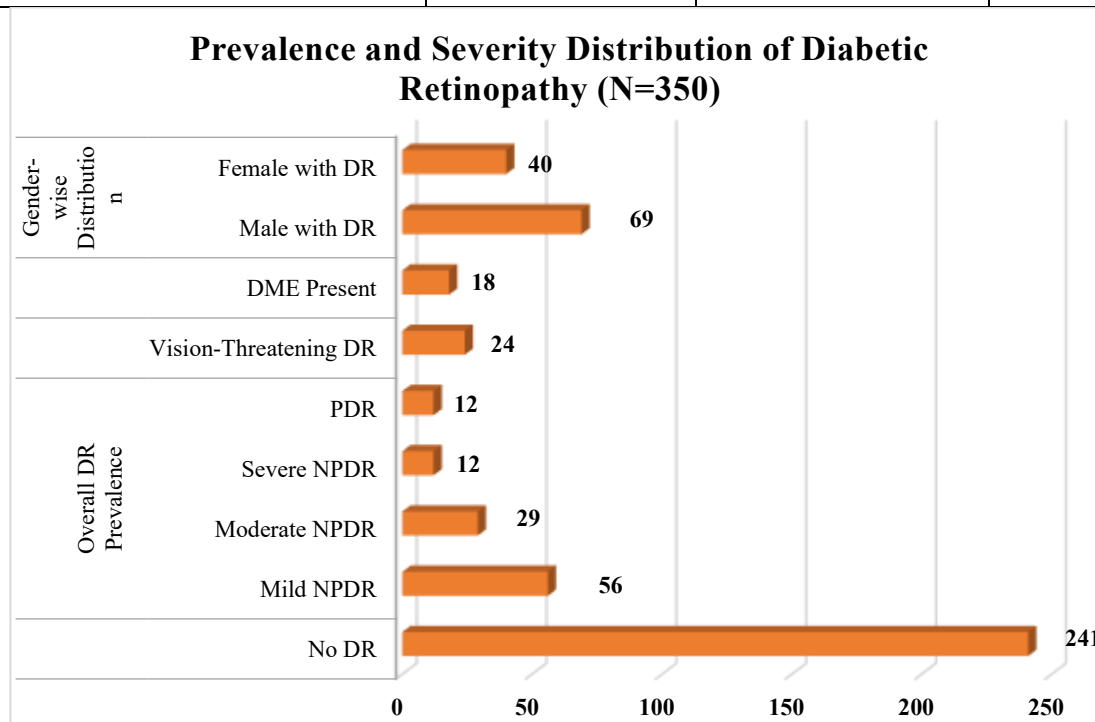


Fig: 2

Table 3: Risk Factors Associated with Diabetic Retinopathy

Risk Factors	DR Present (n=109)	DR Absent (n=241)	Odds Ratio (95% CI)	p-value
Duration of Diabetes (years)				
<5 years, n (%)	12 (11.0)	68 (28.2)	1.0 (Reference)	
5-10 years, n (%)	28 (25.7)	89 (36.9)	1.78 (0.86-3.68)	0.119
11-15 years, n (%)	35 (32.1)	58 (24.1)	3.42 (1.69-6.93)	0.001
>15 years, n (%)	34 (31.2)	26 (10.8)	7.42 (3.45-15.95)	<0.001
Hypertension				
Present, n (%)	78 (71.6)	142 (58.9)	1.74 (1.09-2.78)	0.020
HbA1c Level				
<7%, n (%)	18 (16.5)	87 (36.1)	1.0 (Reference)	
7-9%, n (%)	42 (38.5)	98 (40.7)	2.07 (1.13-3.79)	0.018
>9%, n (%)	49 (45.0)	56 (23.2)	4.23 (2.27-7.87)	<0.001
Family History of DM				
Present, n (%)	67 (61.5)	134 (55.6)	1.27 (0.82-1.98)	0.285
Smoking				
Current/Former, n (%)	32 (29.4)	56 (23.2)	1.37 (0.83-2.26)	0.217
Dyslipidemia				
Present, n (%)	58 (53.2)	118 (49.0)	1.18 (0.76-1.84)	0.455

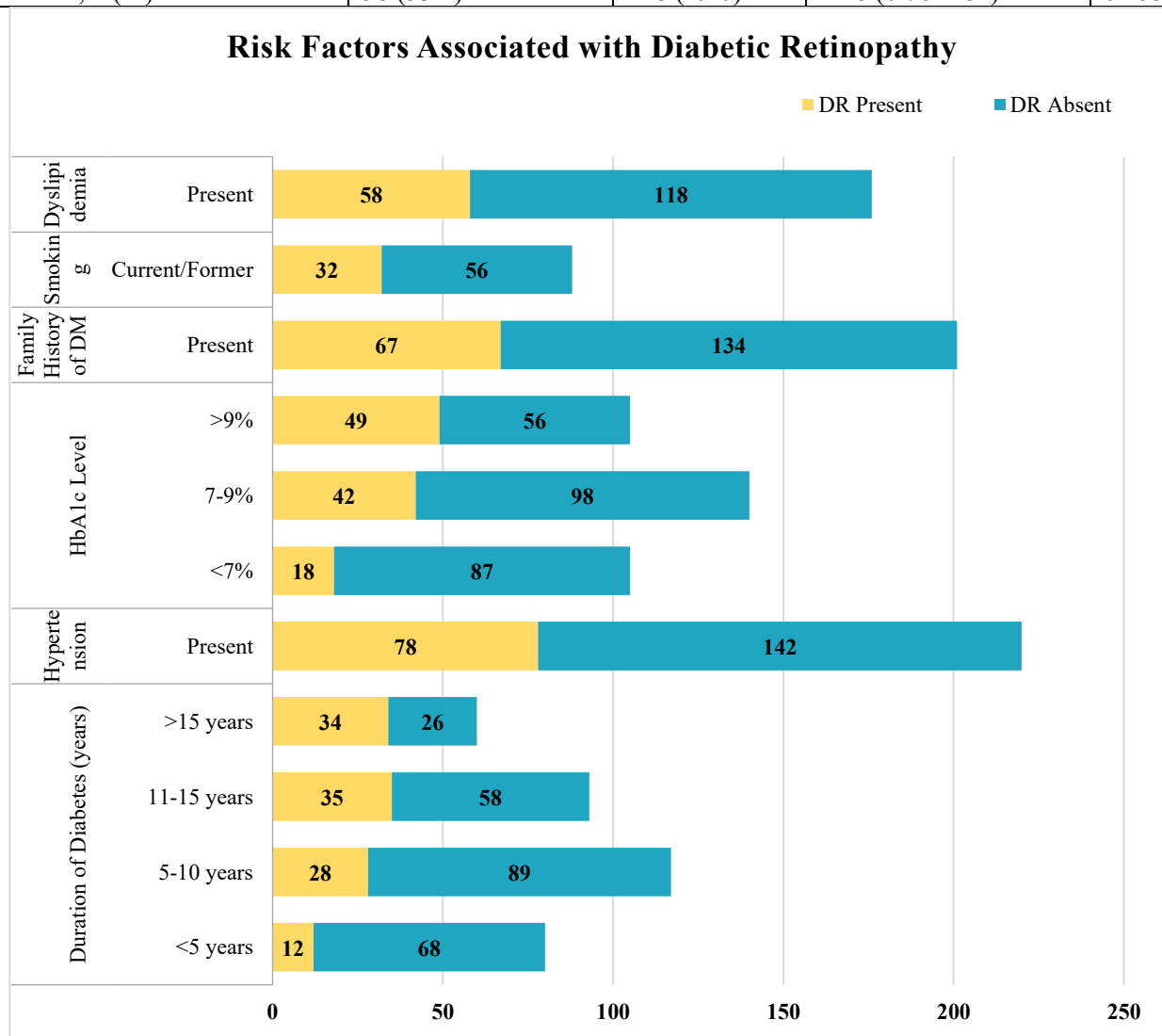


Fig: 3

Table 4: Association between Diabetes Duration and DR Severity

Diabetes Duration	No DR n(%)	Mild NPDR n(%)	Moderate NPDR n(%)	Severe NPDR n(%)	PDR n(%)	Total
<5 years	68 (85.0)	8 (10.0)	3 (3.8)	1 (1.3)	0 (0.0)	80
5-10 years	89 (76.1)	19 (16.2)	7 (6.0)	1 (0.9)	1 (0.9)	117
11-15 years	58 (62.4)	18 (19.4)	10 (10.8)	4 (4.3)	3 (3.2)	93
>15 years	26 (43.3)	11 (18.3)	9 (15.0)	6 (10.0)	8 (13.3)	60
Total	241 (68.9)	56 (16.0)	29 (8.3)	12 (3.4)	12 (3.4)	350
Chi-square = 42.86, p < 0.001						

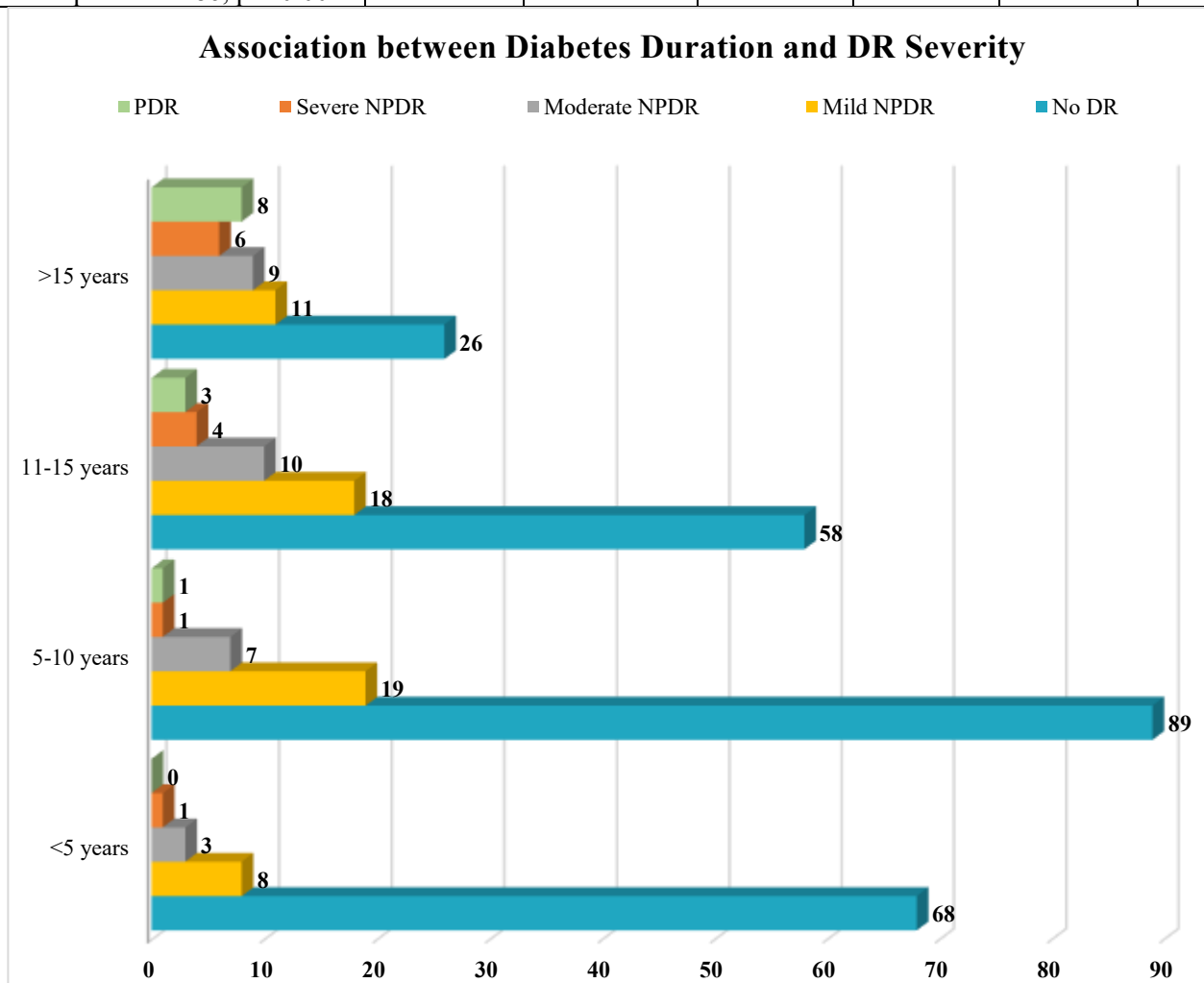


Fig: 4

Table 5: Glycemic Control (HbA1c) Status and Diabetic Retinopathy

HbA1c Category	No DR n(%)	Any DR n(%)	VTDR n(%)	Total	p-value
Good Control (<7.0%)	87 (82.9)	18 (17.1)	3 (2.9)	105	
Moderate Control (7.0-8.9%)	98 (70.0)	42 (30.0)	8 (5.7)	140	
Poor Control (≥9.0%)	56 (53.3)	49 (46.7)	13 (12.4)	105	
Total	241 (68.9)	109 (31.1)	24 (6.9)	350	<0.001
Mean HbA1c (%)					
No DR	7.8 ± 1.4	-	-	-	
Any DR	9.1 ± 1.8	-	-	-	<0.001
VTDR	9.6 ± 1.9	-	-	-	<0.001

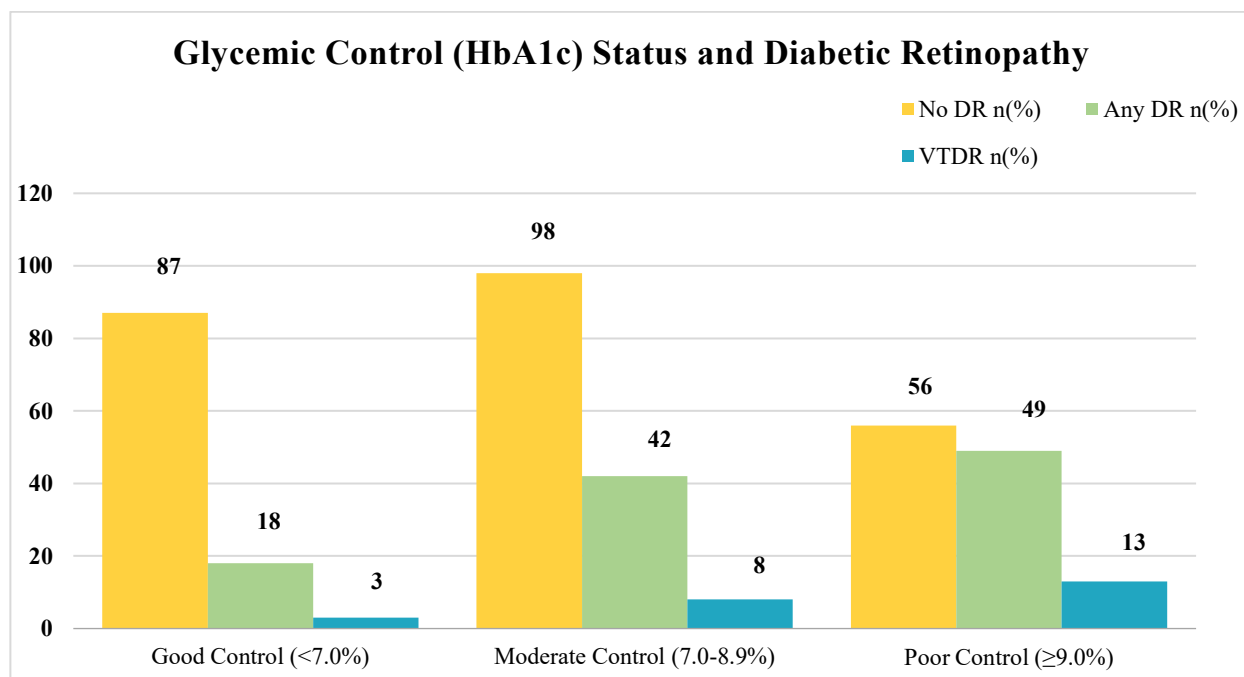


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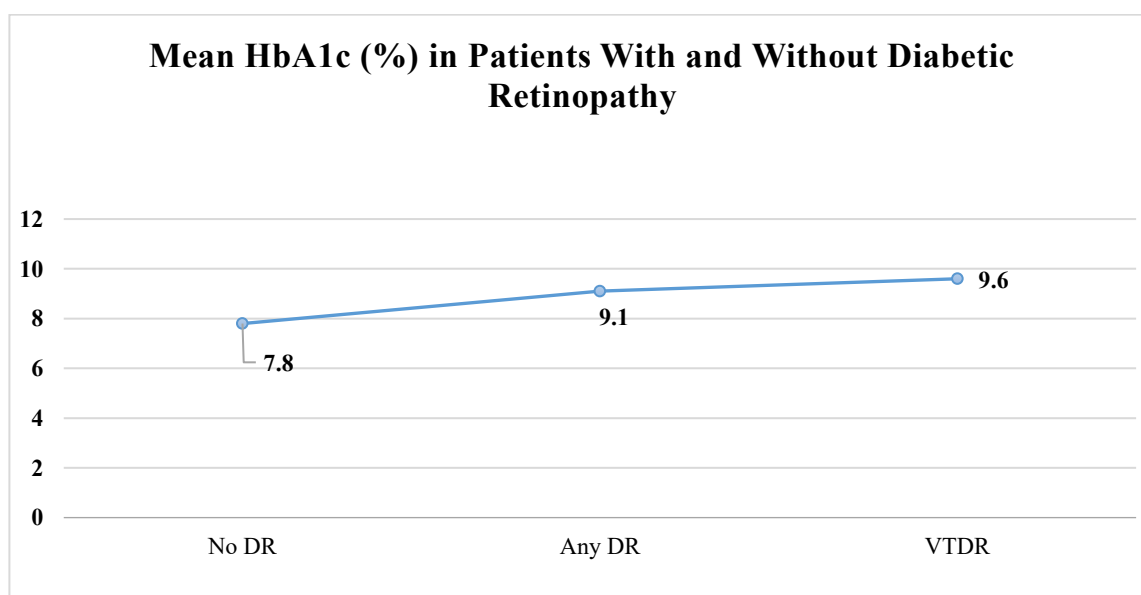


Fig: 5(ii)

Table 6: Visual Acuity Outcomes by Diabetic Retinopathy Severity

DR Severity	Normal VA (≥6/12) n(%)	Mild VI (6/18-6/60) n(%)	Moderate VI (<6/60-6/120) n(%)	Severe VI/Blind (<6/120) n(%)	Total
No DR	228 (94.6)	13 (5.4)	0 (0.0)	0 (0.0)	241
Mild NPDR	52 (92.9)	4 (7.1)	0 (0.0)	0 (0.0)	56
Moderate NPDR	25 (86.2)	4 (13.8)	0 (0.0)	0 (0.0)	29
Severe NPDR	8 (66.7)	3 (25.0)	1 (8.3)	0 (0.0)	12
PDR	6 (50.0)	4 (33.3)	1 (8.3)	1 (8.3)	12
Total	319 (91.1)	28 (8.0)	2 (0.6)	1 (0.3)	350
Chi-square = 31.24, p < 0.001					

VI = Visual Impairment; VA = Visual Acuity

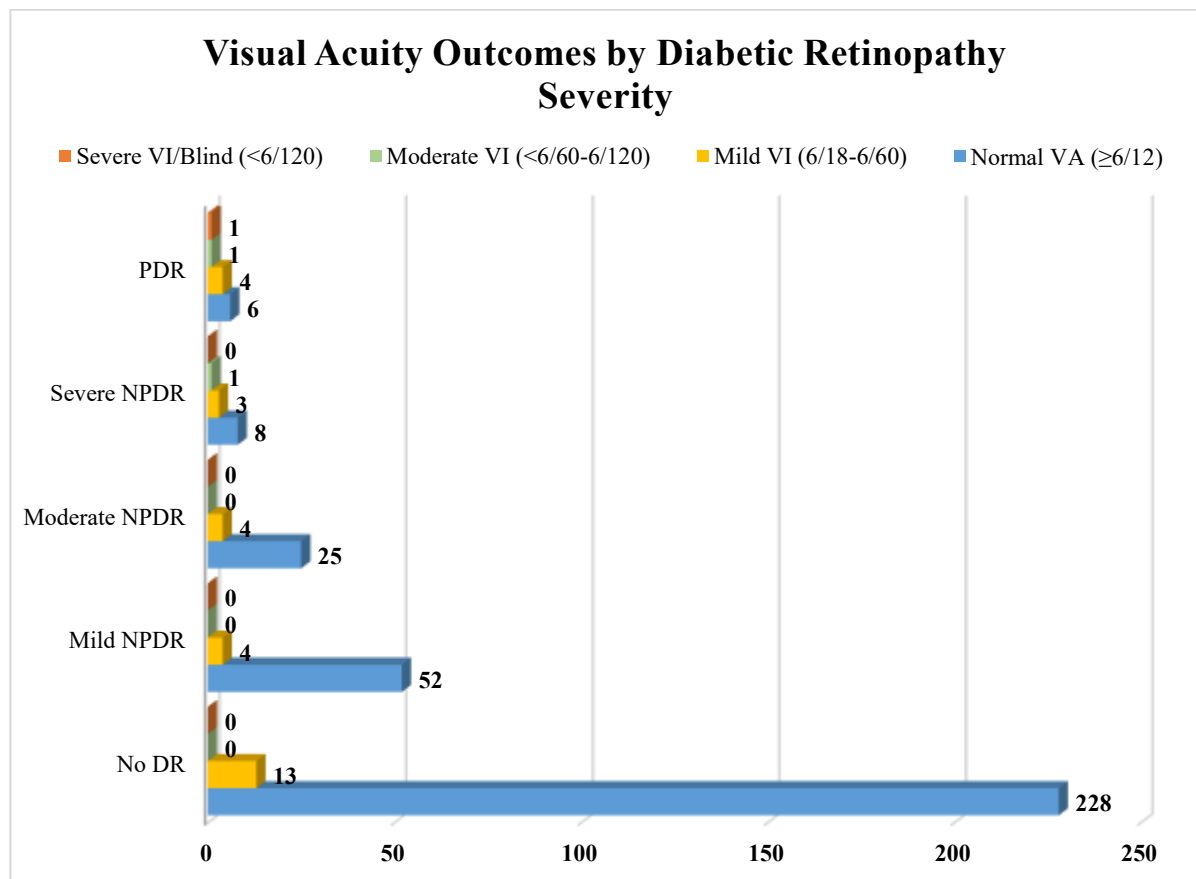


Fig: 6

Discussion

The present study conducted at Vyas Medical College and Hospital, Jodhpur, provides comprehensive insights into the clinical profile of diabetic retinopathy among Type II diabetes mellitus patients in a tertiary care setting in western India. With a prevalence of 31.1% (95% CI: 26.3-36.3%), our findings align closely with previous Indian studies and contribute valuable data to the understanding of diabetic retinopathy burden in the region.

The overall diabetic retinopathy prevalence of 31.1% observed in our study is consistent with recent reports from other Indian tertiary care centers. Devatha and Preethi (2024) reported a prevalence of 30.84% among 5,363 Type II diabetes patients at a tertiary hospital in Bangalore, while Ramavat et al. (2013) found a prevalence of 33.9% in western Indian Type II diabetic population. This consistency across different geographic regions of India suggests a relatively uniform burden of diabetic retinopathy in tertiary care settings, despite regional variations in socioeconomic factors and healthcare accessibility.

Our findings contrast notably with population-based studies such as the SMART India study, which reported a national prevalence of 12.5% among individuals with diabetes aged 40 years and older (Gurudas et al., 2022). This disparity reflects the inherent selection bias in hospital-based studies, where patients with longer diabetes duration, poor glycemic control, or established complications are more likely to seek tertiary care. The higher prevalence in our study underscores the critical role of tertiary care centers in managing advanced diabetic complications.

The demographic distribution revealed interesting patterns, with diabetic retinopathy prevalence increasing significantly with age ($p=0.001$). Patients with diabetic retinopathy had a mean age of 62.1 ± 11.8 years compared to 56.2 ± 12.6 years in those without retinopathy. This age-related increase aligns with global epidemiological data and reflects the cumulative effect of prolonged diabetes duration and associated metabolic dysfunction (Teo et al., 2021).

Gender differences observed in our study showed a higher prevalence among males (34.8%) compared to females (26.3%), though this difference did not reach statistical significance ($p=0.085$). This trend is consistent with previous Indian studies, including the report by Devatha and Preethi (2024), who found significantly higher prevalence rates among males (34.82%) compared to females (25.01%). The underlying mechanisms for this gender disparity remain incompletely understood but may involve differences in metabolic control, lifestyle factors, and healthcare-seeking behavior.

The severity distribution in our cohort revealed that mild non-proliferative diabetic retinopathy (NPDR) was the most common form, affecting 16.0% of all patients, followed by moderate NPDR (8.3%). Severe NPDR and proliferative diabetic retinopathy each affected 3.4% of patients. Vision-threatening diabetic retinopathy was present in 6.9% of the total sample, which corresponds to 22.0% of patients with any diabetic retinopathy. This distribution pattern closely mirrors findings from other Indian studies and international cohorts, reinforcing the validity of our sample.

The prevalence of diabetic macular edema at 5.1% is slightly lower than the global average of approximately 6% reported in recent meta-analyses (Teo et al., 2021), but remains within the expected range for hospital-based populations. The relatively lower prevalence may reflect improved diabetes management protocols and earlier detection strategies in our tertiary care setting. Duration of diabetes emerged as the most powerful predictor of diabetic retinopathy development, confirming well-established epidemiological relationships. Patients with diabetes duration exceeding 15 years demonstrated a 7.42-fold increased risk (95% CI: 3.45-15.95) compared to those with duration less than 5 years. This finding is consistent with the National Survey data from India, which reported that patients with diabetes duration exceeding 10 years had 4.8 times higher odds of developing diabetic retinopathy (Rani et al., 2021).

The progressive increase in diabetic retinopathy severity with longer diabetes duration was particularly striking in our Table 4 analysis. While only 15.0% of patients with diabetes duration less than 5 years had any form of retinopathy, this proportion increased dramatically to 56.7% among those with duration exceeding 15 years. More importantly, proliferative diabetic retinopathy was absent in patients with diabetes duration less than 5 years but affected 13.3% of those with duration exceeding 15 years.

Hypertension emerged as a significant modifiable risk factor, with 71.6% of diabetic retinopathy patients having concurrent hypertension compared to 58.9% of those without retinopathy (OR: 1.74, 95% CI: 1.09-2.78, $p=0.020$). This association has been consistently demonstrated in multiple studies and is supported by recent systematic reviews and meta-analyses (Do et al., 2023). The pathophysiological basis for this association involves hemodynamic alterations, impaired autoregulation, and upregulation of vascular endothelial growth factor expression independent of hyperglycemia (Matthews et al., 2004).

Recent evidence from large population-based studies suggests that blood pressure control above 120/80 mmHg significantly increases diabetic retinopathy prevalence by 10-20% in both hypertensive and normotensive diabetic patients (Zhang et al., 2023). The UKPDS study demonstrated that tight blood pressure control resulted in a 35% reduction in retinal photocoagulation requirements compared to conventional control, emphasizing the clinical importance of aggressive blood pressure management (Matthews et al., 2004).

The relationship between glycemic control and diabetic retinopathy in our study demonstrated clear dose-response patterns. Patients with poor glycemic control ($HbA1c \geq 9.0\%$) had a 4.23-fold increased risk of diabetic retinopathy compared to those with good control ($HbA1c < 7.0\%$). The mean $HbA1c$ among patients with diabetic retinopathy was significantly higher ($9.1 \pm 1.8\%$) compared to those without retinopathy ($7.8 \pm 1.4\%$, $p<0.001$).

These findings align with landmark clinical trials, including the Diabetes Control and Complications Trial (DCCT), which established that intensive glycemic control significantly

reduces the risk of diabetic retinopathy development and progression (The Diabetes Control and Complications Trial Research Group, 1995). Recent quantification studies have shown that patients with average HbA1c of 10.0% or greater have a risk ratio of 5.72 for progression to any retinopathy compared to those with HbA1c of 7.0% or less (Tarasewicz et al., 2023).

However, our study also revealed that 17.1% of patients with good glycemic control (HbA1c <7.0%) still developed diabetic retinopathy, confirming previous observations that optimal metabolic control does not completely eliminate retinopathy risk. This paradox has been attributed to factors including previous glycemic exposure, diabetes duration, genetic predisposition, and other metabolic factors beyond glucose control (Lachin et al., 2001).

The visual acuity analysis revealed a clear inverse relationship between diabetic retinopathy severity and visual function. While 94.6% of patients without diabetic retinopathy maintained normal visual acuity ($\geq 6/12$), this proportion decreased progressively with increasing retinopathy severity, reaching 50.0% among patients with proliferative diabetic retinopathy. Severe visual impairment or blindness was observed only in patients with proliferative diabetic retinopathy, affecting 8.3% of this subgroup.

These findings underscore the critical importance of early detection and intervention programs. The fact that half of patients with proliferative diabetic retinopathy maintained normal visual acuity suggests opportunities for visual preservation through timely treatment. This observation supports current screening guidelines recommending annual ophthalmologic examinations for all diabetic patients, with more frequent monitoring for those with established retinopathy (ElSayed et al., 2024).

Our findings have significant implications for healthcare planning and resource allocation in tertiary care settings. The high prevalence of diabetic retinopathy (31.1%) among patients attending our hospital emphasizes the need for integrated diabetes-ophthalmology care models. The predominance of mild and moderate NPDR cases (24.3% of all patients) suggests substantial opportunities for intervention before progression to vision-threatening stages.

The strong associations observed with modifiable risk factors, particularly glycemic control and hypertension, reinforce the importance of comprehensive diabetes management. Recent advances in artificial intelligence-based screening systems have demonstrated comparable performance to human graders and may offer solutions for expanding screening coverage in resource-limited settings (Rajalakshmi et al., 2018; Bhaskaranand et al., 2016).

Conclusion

This comprehensive clinical profile study of diabetic retinopathy among Type II diabetes mellitus patients at Vyas Medical College and Hospital, Jodhpur, reveals a significant disease burden with 31.1% prevalence. The study confirms duration of diabetes as the strongest risk factor, followed by poor glycemic control and hypertension. The predominance of non-proliferative stages suggests substantial opportunities for early intervention. Clear dose-response relationships between HbA1c levels and retinopathy risk emphasize the critical importance of optimal glycemic control. The progressive visual impairment associated with increasing retinopathy severity underscores the need for systematic screening and timely management. These findings provide valuable baseline data for healthcare planning and reinforce the necessity of integrated diabetes-ophthalmology care models in tertiary care settings.

Recommendations

Implementation of systematic annual diabetic retinopathy screening programs utilizing non-mydriatic fundus photography and artificial intelligence-assisted interpretation should be prioritized to enhance detection efficiency. Aggressive management of modifiable risk factors, particularly targeting HbA1c levels below 7% and blood pressure control below 130/80 mmHg, is essential for preventing diabetic retinopathy development and progression.

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