Section: General Medicine

Original Research Article

PREVALENCE AND RISK FACTORS OF DIABETIC RETINOPATHY IN TYPE 2 DIABETES MELLITUS PATIENTS ATTENDING EYE OPD OF A TERTIARY CARE HOSPITAL

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ABSTRACT

Background: Diabetic retinopathy (DR) is a major microvascular complication of type 2 diabetes mellitus (T2DM) and a leading cause of preventable visual impairment. Understanding its prevalence and associated risk factors is essential for early detection and management. The objective is to determine the prevalence, severity, and risk factors of DR among T2DM patients attending the eye outpatient department of a tertiary care hospital in Gujarat, India.

Materials and Methods: This cross-sectional study included 252 patients with T2DM undergoing detailed systemic and ocular evaluation. DR was graded using standard classification, and clinically significant macular oedema (CSME) was assessed. Multivariate analysis was used to identify independent risk factors.

Results: The prevalence of DR was 35.7%. Among affected patients, 81.1% had non-proliferative DR (NPDR) and 18.9% had proliferative DR (PDR). CSME was present in 12.7% of all patients and 35.6% of those with DR. DR prevalence increased with duration of diabetes (13.3% <1 year to 68.1% ≥10 years) and poor glycaemic control (13.9% with HbA1c <7% to 76.7% with HbA1c ≥9%). Independent risk factors included age (Odd's Ratio=1.03/year), hypertension (Odd's Ratio=1.80), chronic kidney disease (Odd's Ratio=2.33), and anaemia (Odd's Ratio=1.79). No patient with HbA1c <7% had PDR. Visual impairment correlated strongly with DR severity and was worse in patients with CSME. DR prevalence increased markedly with accumulation of risk factors.

Conclusion: DR is highly prevalent among T2DM patients, with modifiable factors such as glycaemic control, hypertension, and anaemia playing a significant role. Comprehensive risk assessment and regular screening are crucial to prevent vision-threatening complications.

Keywords: Diabetic retinopathy; Type 2 diabetes mellitus; Glycaemic control.

INTRODUCTION

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder characterized by insulin resistance and persistent hyperglycaemia, leading to long-term microvascular complications.[1]

Diabetic retinopathy (DR), a major complication of T2DM, results from retinal microvascular damage and is a leading cause of preventable blindness worldwide.[2]

The lifetime risk of DR in T2DM patients is estimated to be 50–60%, depending on disease duration and glycaemic control.[2]

The global prevalence of diabetes is rising rapidly, affecting over 10% of adults and projected to reach 783 million by 2045.[3]

India carries a substantial burden, with over 101 million diabetics, of whom 17–26% develop DR.[4]

Longer duration of diabetes and poor glycaemic control are key determinants of DR development and progression.[5]

Early detection and regular screening are essential to reduce vision-threatening complications.

MATERIALS AND METHODS

This hospital-based cross-sectional study was conducted at GMERS Medical College and Hospital, Gandhinagar. The study included patients with type 2 diabetes mellitus aged 40–80 years of either sex attending the ophthalmology outpatient department. The minimum sample size was calculated to be 216 at a 95% confidence level using OpenEpi software; however, a total of 252 patients were included in the study. Patients meeting the inclusion criteria were enrolled using a consecutive sampling method after obtaining informed consent. Data were analysed using appropriate statistical methods, with a p-value <0.05 considered statistically significant.

Inclusion Criteria:

1) Patients of either sex of age group (40-80) years.
2) Type 2 Diabetes Mellitus patients visiting to eye OPD.
3) Patients willing to participate in the study.

Exclusion Criteria:

1) Patients suffering from Type 1 DM.
2) Patients suffering from other eye diseases, other than diabetic retinopathy causing visual impairment.
3) All patients whose fundus could not be examined.
4) Patients underwent any posterior segment surgery.
5) Patients who don't give consent for participation in the study.
6) Pregnancy.

Methodology: All the diabetic patients willing to join, after giving consent recruited in the study have undergone detailed ocular examination including best corrected visual acuity using Snellen's chart, anterior segment evaluation using slit lamp and detailed fundus examination using direct, indirect ophthalmoscope and Posterior segment OCT. The presence or absence of DR as well as staging of DR performed by expert vitreoretinal surgeon is included.

The grading of retinopathy was carried out by indirect ophthalmoscope after full pupillary dilatation and by slit lamp examination using 90 D lens. DR was graded by Modified ETDRS grading system.

Systemic evaluation was done to look for BMI, anaemia, hypertension, nephropathy and hyperlipidaemia. Clinical information including age, sex, height weight and duration of diabetes, co-morbid conditions like hypertension, nephropathy, hyperlipidaemia and cardiac disease was obtained from clinical record and history taking.

In newly detected cases of diabetes mellitus, diagnosis of hypertension, hyperlipidaemia and nephropathy was done by physician. The duration of diabetes was the time period between the diagnosis of disease and the time of examination.

Blood pressure and blood investigations like Complete blood count (haemoglobin), fasting sugar and post prandial blood sugar, Glycosylated Haemoglobin, blood urea and serum creatinine and serum total cholesterol were done.

All the collected data was entered in Microsoft excel sheet and statistical analysis and results done using CHI SQUARE test (independent t test), one way ANNOVA and applied univariate logistic regression by MANN WHITNEY U test using R Software V 4.2.1.

RESULTS

1. Demographic and Clinical Characteristics of the Study Population: Our study included 252 patients with Type 2 Diabetes Mellitus attending the Ophthalmology OPD at GMERS Medical College, Gandhinagar.

The mean age of the study population was 60.8 ± 9.2 years, with a nearly equal gender distribution (50.4% males and 49.6% females). The majority of participants (71.8%) were in the 50-69 years age range.

The mean duration of diabetes was 5.8 ± 4.1 years, with most patients (69.4%) having had diabetes for 1-9 years. The mean HbA1c level was 7.7 ± 1.4%, with 59.9% of patients having HbA1c ≥7%, indicating suboptimal glycaemic control. The most common comorbidity was hypertension (30.2%), followed by anaemia (16.7%), dyslipidaemia (14.7%), and IHD (14.3%).

2. Prevalence of Diabetic Retinopathy: The overall prevalence of diabetic retinopathy (DR) among the 252 patients with Type 2 diabetes was 35.7% (90 patients, 95% CI: 29.8-41.9%).

Table 1: Prevalence of Diabetic Retinopathy in the Study Population

Category	Total Number	DR Present	Prevalence (%)	95% CI
Gender				
Male	127	48	37.8%	29.4-46.8%
Female	125	42	33.6%	25.3-42.6%
Age Groups				
<50 years	34	7	20.6%	8.7-37.9%
50-59 years	82	24	29.26%	18.7-39.1%
60-69 years	99	40	40.40%	28.8-48.7%
≥70 years	37	19	51.4%	34.4-68.1%

A clear increasing trend in DR prevalence was observed with age, ranging from 20.6% in patients under 50 years to 51.4% in those 70 years and older ($p<0.001$ for trend).

Table 2: Prevalence of Diabetic Retinopathy by Duration of Diabetes

Duration of Diabetes	Total Number	DR Present	Prevalence (%)	95% CI
<1 year	30	4	13.3%	3.8-30.7%
1-4 years	91	18	19.78%	12.3-29.8%
5-9 years	84	36	42.9%	32.1-54.1%
≥10 years	47	32	68.1%	53.3-80.5%

Note: Duration of DM is based on history given by patient.

Duration of diabetes showed a strong association with DR prevalence (p<0.001).

Table 3: Prevalence of Diabetic Retinopathy by HbA1c Levels

HbA1c Level	Total Number	DR Present	Prevalence (%)	95% CI
<7%	101	14	13.9%	8.1-21.6%
7-7.9%	65	23	35.4%	23.9-48.2%
8-8.9%	40	20	50.0%	32.9-67.1%
≥9%	46	33	76.7%	60.7-88.9%

A strong positive association was observed between HbA1c levels and DR prevalence (p<0.001).

Table 4: Prevalence of Diabetic Retinopathy by Presence of Systemic Comorbidities

Comorbidity	Status	Total Number	DR Present	Prevalence (%)	P-value
Hypertension	Present	76	38	50.0%	0.002
	Absent	176	52	29.5%	
IHD	Present	36	19	52.8%	0.022
	Absent	216	71	32.9%	
CKD	Present	19	13	68.4%	0.002
	Absent	233	77	33.0%	
Dyslipidaemia	Present	37	18	48.6%	0.079
	Absent	215	72	33.5%	
Anaemia	Present	42	22	52.4%	0.015
	Absent	210	68	32.4%	

Systemic comorbidities significantly associated with higher DR prevalence included hypertension (50.0% vs. 29.5%, p=0.002), IHD (52.8% vs. 32.9%, p=0.022), CKD (68.4% vs. 33.0%, p=0.002), and anaemia (52.4% vs. 32.4%, p=0.015). Dyslipidaemia showed a trend toward higher DR prevalence, but this did not reach statistical significance (48.6% vs. 33.5%, p=0.079).

Table 5: Prevalence of Diabetic Retinopathy by Lifestyle Factors

Lifestyle Factor	Status	Total Number	DR Present	Prevalence (%)	P-value
Smoking	Present	47	22	46.8%	0.068
	Absent	205	68	33.2%	
Alcohol	Present	30	12	40.0%	0.603
	Absent	222	78	35.1%	
Tobacco Use (Non-smoking)	Present	24	10	41.7%	0.520
	Absent	228	80	35.1%	

Among lifestyle factors, smoking showed a trend toward higher DR prevalence (46.8% vs. 33.2%), although this did not reach statistical significance (p=0.068).

3. Risk Factor Analysis for Diabetic Retinopathy

Table 6: Multivariate Analysis of Risk Factors for Diabetic Retinopathy

Risk Factor	Odds Ratio (OR)	95% CI	P-value
Age (per year increase)	1.05	1.02-1.08	0.001
Gender (Male vs. Female)	1.20	0.72-1.99	0.481
BMI (per unit increase)	0.97	0.89-1.06	0.510
Duration of diabetes (per year increase)	1.22	1.15-1.30	<0.001
HbA1c (per % increase)	2.04	1.67-2.50	<0.001
Hypertension	2.38	1.37-4.14	0.002
IHD	2.28	1.12-4.64	0.023
CKD	4.39	1.64-11.78	0.003
Dyslipidaemia	1.88	0.93-3.82	0.080
Anaemia	2.30	1.16-4.54	0.017
Smoking	1.78	0.95-3.33	0.072
Alcohol consumption	1.23	0.57-2.67	0.603
Tobacco use (non-smoking)	1.32	0.56-3.08	0.521

In the univariate analysis, significant risk factors for DR included duration of diabetes, HbA1c levels, hypertension, IHD, CKD, and anaemia. Gender, BMI, dyslipidaemia, smoking, alcohol consumption,

and non-smoking tobacco use were not significantly associated with DR.

Table 7: Multivariate Analysis of Risk Factors for Diabetic Retinopathy

Risk Factor	Adjusted OR	95% CI	P-value
Age (per year increase)	1.03	1.01-1.06	0.020
Duration of diabetes (per year increase)	1.16	1.10-1.22	<0.001
HbA1c (per % increase)	1.88	1.53-2.31	<0.001
Hypertension	1.80	1.15-2.81	0.010
CKD	2.33	1.19-4.59	0.014
Anaemia	1.79	1.10-2.91	0.019
IHD	1.42	0.76-2.65	0.269

After adjusting for potential confounders in the multivariate analysis, independent risk factors for DR included age (OR=1.03 per year increase, p=0.020), duration of diabetes (OR=1.16 per year increase, p<0.001), HbA1c (OR=1.88 per % increase, p<0.001), hypertension (OR=1.80, p=0.010), CKD (OR=2.33, p=0.014), and anaemia (OR=1.79, p=0.019). IHD, which was significant in the univariate analysis, lost its significance in the multivariate model.

4. Severity Distribution of Diabetic Retinopathy

Among the 90 patients diagnosed with diabetic retinopathy, we analysed the distribution of DR severity according to the Modified ETDRS Classification System.

Among patients with DR, the majority (81.1%) had non-proliferative diabetic retinopathy (NPDR), with mild and moderate NPDR being the most common forms (32.2% and 31.1%, respectively). Proliferative diabetic retinopathy (PDR) was observed in 18.9% of DR patients, with high-risk PDR accounting for 7.8%. Overall, among all 252 diabetic patients in our study, the prevalence of PDR was 6.7% (17/252).

DISCUSSION

In this hospital-based study of 252 patients with type 2 diabetes mellitus, the overall prevalence of diabetic retinopathy (DR) was 35.7%. This is notably higher than the 16.9% prevalence reported in the nationwide INDIAN study, but is comparable to findings from other tertiary care centres in India. The higher prevalence observed in our study is likely due to referral bias, as tertiary care hospitals tend to manage more severe and complicated cases of diabetes.

The All India Ophthalmological Society (AIOS) Diabetic Retinopathy Eye Screening Study (2014) reported a prevalence of 34.06% in the North zone, closely aligning with our findings.[4] This similarity supports the likelihood that our results reflect true regional patterns rather than methodological variation.

Globally, our findings are consistent with previously reported estimates. Teo et al. reported DR prevalence rates of 35.9% in Africa and 33.3% in North America/Caribbean,[6] while the META-EYE study by Yau et al. documented a global prevalence of 34.6%.[7] Thus, the prevalence in our study falls within the expected global range.

Among patients with DR, non-proliferative diabetic retinopathy (NPDR) was the predominant form (81.1%), with mild and moderate NPDR being most common. Proliferative diabetic retinopathy (PDR) was present in 18.9% of DR cases, reflecting the advanced disease spectrum typically encountered in tertiary care settings.

The prevalence of clinically significant macular oedema (CSME) was 12.7% among all diabetic patients and 35.6% among those with DR, indicating a substantial burden of vision-threatening complications.

Risk Factors for Diabetic Retinopathy

Duration of Diabetes

Duration of diabetes showed a strong and statistically significant association with DR (p<0.001). The prevalence increased from 13.3% in patients with <1 year of diabetes to 68.1% in those with ≥10 years duration.

This finding is consistent with the Sankara Nethralaya Diabetic Retinopathy Epidemiology and Molecular Genetics Study (SN-DREAMS), which identified duration as the most significant predictor, with risk increasing approximately 8% per year.[8] Our multivariate analysis (OR = 1.16 per year) further corroborates this relationship.

The Wisconsin Epidemiologic Study of Diabetic Retinopathy demonstrated that after 20 years of diabetes, over 60% of type 2 diabetic patients develop retinopathy.[9]

Glycaemic Control (HbA1c)

A strong association was observed between HbA1c levels and DR prevalence (p<0.001). DR prevalence increased from 13.9% in patients with HbA1c <7% to 76.7% in those with HbA1c ≥9%.

HbA1c was identified as an independent risk factor (OR = 1.88 per 1% increase), consistent with previous studies that identify HbA1c >7% as a critical threshold. Landmark trials such as the Diabetes Control and Complications Trial (DCCT) and the UK Prospective Diabetes Study (UKPDS) demonstrated that each 1% reduction in HbA1c reduces the risk of DR by 35–40%.[5]

Hypertension

Hypertension was found to be an independent risk factor for DR (OR = 1.80, p=0.010), with significantly higher prevalence among hypertensive patients.

This finding is in agreement with SN-DREAMS, which reported odds ratios between 1.5 and 1.8.[8]

The UKPDS further demonstrated that reduction in systolic blood pressure significantly decreases the risk of DR progression.[5]

Chronic Kidney Disease (CKD)

A significant association was observed between CKD and DR (OR = 2.33, p=0.014). The prevalence of DR among CKD patients was markedly higher (68.4%) compared to those without CKD.

This supports prior studies demonstrating a strong relationship between diabetic nephropathy and retinopathy, likely due to shared microvascular pathophysiological mechanisms.[11,12]

Anaemia

Anaemia was identified as an independent risk factor for DR (OR = 1.79, p=0.019), with higher prevalence observed among anaemic patients.

This finding is particularly relevant in the Indian context, where anaemia is highly prevalent. The Chennai Urban Rural Epidemiology Study (CURES) similarly identified haemoglobin levels as independently associated with DR risk.[13] Reduced oxygen delivery to retinal tissues may exacerbate hypoxic damage and accelerate disease progression.

Age

Age was found to have a modest but statistically significant association with DR (OR = 1.03 per year, p=0.020). However, this relationship is likely influenced by confounding factors such as duration of diabetes and age at onset, as noted in previous cohort studies.[14]

Distribution and Severity of DR

In our study, 81.1% of DR patients had NPDR, while 18.9% had PDR, with an overall PDR prevalence of 6.7% among all diabetics.

These findings are consistent with Western Indian and global data, where NPDR predominates and NPDR:PDR ratios typically range from 4:1 to 5:1. Our observed ratio of 4.3:1 aligns with this pattern.[15,16]

Limitations

The cross-sectional design limits our ability to establish causality or temporal relationships between risk factors and DR. As a hospital-based study conducted in a tertiary care centre referral bias may have led to an overestimation of DR prevalence compared to the general diabetic population. Additionally, our sample size, while adequate for overall prevalence estimation, may have limited power for subgroup analyses.

CONCLUSION

Diabetic retinopathy was highly prevalent (35.7%) among type 2 diabetes patients in this tertiary care setting, with a significant proportion having vision-threatening complications. Duration of diabetes and poor glycaemic control were the strongest predictors, along with hypertension, chronic kidney disease, anaemia, and age. These findings highlight the need for early screening, optimal metabolic control, and comprehensive management to prevent vision loss.

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