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A Clinical Study on the Pattern and Risk Factors of Diabetic Retinopathy Among Patients with Type 2 Diabetes Mellitus (2016)

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Abstract

Diabetic retinopathy (DR) is one of the leading causes of visual impairment and blindness among working-age adults worldwide. It is a microvascular complication of diabetes mellitus, characterized by retinal capillary leakage, ischemia, and neovascularization. The present hospital-based cross-sectional study was conducted in the Department of Ophthalmology, Santosh Medical College & Hospital, Ghaziabad, during the year 2014, to assess the ***prevalence, clinical pattern, and risk factors*** *of diabetic retinopathy among patients with type 2 diabetes mellitus. A total of* ***200 diabetic patients****, aged between* ***35 and 75 years****, attending the ophthalmology outpatient department were examined. Detailed history regarding duration of diabetes, glycemic control, and associated systemic diseases was recorded. Fundus examination was performed using* ***direct and indirect ophthalmoscopy****, and the severity of retinopathy was graded according to the* ***Early Treatment Diabetic Retinopathy Study (ETDRS)*** *classification.*

The overall prevalence of diabetic retinopathy in the study population was ***34%****, including* ***21% with non-proliferative*** *and* ***13% with proliferative retinopathy****. The risk of DR increased significantly with the* ***duration of diabetes (>10 years)****,* ***poor glycemic control (HbA1c >8%)****, and* ***coexisting hypertension*** *($p < 0.05$). Macular edema was observed in 18% of cases, contributing to reduced visual acuity.The study concludes that diabetic retinopathy remains a major cause of preventable visual morbidity in India. Early detection through* ***periodic fundus examination****, strict glycemic and blood pressure control, and patient education are essential to reduce disease progression and vision loss. The results emphasize the need for* ***integrated screening programs*** *at both primary and tertiary healthcare levels to achieve effective blindness prevention.*

Keywords: ***Diabetic Retinopathy, Type 2 Diabetes Mellitus, Fundus Examination, Microvascular Complications, Non-Proliferative Retinopathy, Proliferative Retinopathy, Macular Edema, Glycemic Control, Hypertension, Vision Loss***

Introduction

Diabetic Retinopathy (DR) is one of the most common and devastating microvascular complications of **diabetes mellitus**, leading to visual impairment and blindness in working-age

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adults worldwide [1]. It is characterized by progressive damage to the retinal microvasculature caused by chronic hyperglycemia, resulting in capillary leakage, ischemia, and neovascularization [2]. The increasing global burden of diabetes has led to a parallel rise in DR prevalence, making it a significant public health concern. According to the **World Health Organization (WHO)**, diabetes affects over 400 million individuals globally, with a rapidly growing prevalence in developing nations like India [3].

The pathophysiology of DR involves a series of complex biochemical and vascular alterations, including the formation of advanced glycation end products, oxidative stress, and activation of the protein kinase C pathway [4]. These mechanisms disrupt the blood-retinal barrier, leading to microaneurysms, retinal hemorrhages, and eventually proliferative changes with neovascularization [5]. Diabetic macular edema, a common manifestation, is one of the leading causes of visual loss in diabetic patients [6].

The **risk factors** associated with the development and progression of DR include the **duration of diabetes**, **poor glycemic control**, **hypertension**, **dyslipidemia**, and **nephropathy** [7]. Studies have shown that the risk of retinopathy increases markedly with diabetes duration of over 10 years, and tight control of blood glucose and blood pressure can significantly reduce the risk of progression [8].

The **Early Treatment Diabetic Retinopathy Study (ETDRS)** and **Diabetes Control and Complications Trial (DCCT)** have established that early detection and timely intervention can prevent vision-threatening complications [9]. However, despite these findings, the awareness and screening rates for DR in developing countries remain low. Many patients present at advanced stages when visual recovery is difficult, largely due to asymptomatic progression during early disease [10].

India, being known as the “diabetes capital of the world,” faces a dual challenge of increasing diabetes prevalence and delayed diagnosis of its ocular complications [11]. Epidemiological studies from different regions of India have reported the prevalence of DR ranging from **18% to 40%**, depending on population characteristics and screening methods [12]. Regular ophthalmic evaluation, especially annual **fundus examinations**, remains the cornerstone for early detection and management. The present study was conducted in 2014 at ***Saraswati Institute of Medical Sciences***, to evaluate the **prevalence, clinical pattern, and associated risk factors** of diabetic retinopathy among patients with type 2 diabetes mellitus. The study aims to contribute regional data to the growing evidence base and to emphasize the importance of early ophthalmic screening and systemic metabolic control in preventing visual morbidity due to diabetic retinopathy.

Materials and Methods

Study Design and Setting

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This was a **cross-sectional, hospital-based observational study** conducted in the **Department of Ophthalmology, Saraswati Institute of Medical Sciences, Hapur (Uttar Pradesh)** from **January to December 2014**. The study aimed to determine the **prevalence, grading, and systemic risk factors** associated with **Diabetic Retinopathy (DR)** among patients with **Type 2 Diabetes Mellitus (T2DM)** attending the ophthalmology outpatient department.

Study Population

A total of **200 patients** diagnosed with T2DM were included, irrespective of gender, based on the **American Diabetes Association (ADA)** diagnostic criteria [1]. The participants were aged between **35 and 75 years** and were referred from the medicine and endocrinology departments for routine ophthalmic evaluation.

Inclusion Criteria

1. Patients aged 35–75 years with a confirmed diagnosis of Type 2 Diabetes Mellitus.
2. Minimum duration of diabetes ≥1 year.
3. Patients providing written informed consent.

Exclusion Criteria

1. Patients with Type 1 Diabetes Mellitus.
2. History of ocular trauma, glaucoma, or previous retinal laser therapy.
3. Known cases of hypertensive retinopathy, vein occlusion, or other retinal vascular diseases.
4. Patients with media opacities precluding fundus visualization (e.g., mature cataract).

Ethical Approval

Ethical clearance for the study was obtained from the **Institutional Ethics Committee of Saraswati Institute of Medical Sciences** prior to initiation. The study adhered to the principles of the **Declaration of Helsinki (2013)** and the **Indian Council of Medical Research (ICMR) guidelines** [2].

Clinical and Ophthalmological Evaluation

All participants underwent a detailed history and systemic examination, including **duration of diabetes**, **treatment regimen**, **blood pressure measurement**, and **family history**. Ophthalmic examination included:

- **Best Corrected Visual Acuity (BCVA)** using Snellen's chart.
- **Slit-lamp biomicroscopy** for anterior segment evaluation.

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- **Fundus examination** using **direct and indirect ophthalmoscopy** after pupil dilation with 1% tropicamide.
- **Fundus photography** and **fluorescein angiography** (when indicated) for detailed grading.

Laboratory Investigations

All patients underwent the following investigations:

- **Fasting and Postprandial Blood Glucose** (mg/dL).
- **HbA1c (%):** Glycemic control assessed using high-performance liquid chromatography (HPLC).
- **Serum Lipid Profile:** Total cholesterol, triglycerides, HDL, LDL, and VLDL levels.
- **Blood Pressure:** Measured twice in sitting position; hypertension was defined as ≥140/90 mmHg.
- **Renal Function Tests:** Serum creatinine and urine albumin to assess nephropathy.

Grading of Diabetic Retinopathy (ETDRS Classification)

The severity of diabetic retinopathy was graded according to the **Early Treatment Diabetic Retinopathy Study (ETDRS)** criteria [3]:

Grade	Fundoscopic Features	Description / Clinical Findings
No DR	Normal fundus, no microaneurysms	Healthy retinal vasculature
Mild Non-Proliferative DR (NPDR)	Presence of a few microaneurysms, occasional retinal hemorrhages	Earliest detectable changes
Moderate NPDR	Increased number of microaneurysms, intraretinal hemorrhages, and cotton wool spots	Moderate vascular compromise
Severe NPDR	Hemorrhages in all quadrants, venous beading, and IRMA (Intraretinal Microvascular Abnormalities)	Pre-proliferative stage

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Grade	Fundoscopic Features	Description / Clinical Findings
Proliferative DR (PDR)	Neovascularization on the disc or elsewhere, vitreous/pre-retinal hemorrhage	Advanced sight-threatening stage
Macular Edema (any stage)	Retinal thickening or hard exudates in the macular area	Vision-threatening diabetic macular edema (DME)

Data Collection and Analysis

All findings were recorded in a structured proforma, including demographic details, systemic risk factors, and ocular findings. Data were entered into **Microsoft Excel** and analyzed using **SPSS version 22.0 (IBM Corp., USA)**.

Continuous variables were expressed as **mean ± standard deviation (SD)**, and categorical variables as **percentages**.

- **Chi-square test** was applied for categorical data.
- **Student's t-test** was used for continuous variables.
- **Multivariate logistic regression** was employed to identify independent predictors of diabetic retinopathy (duration of diabetes, HbA1c, hypertension, lipid levels).

A **p-value <0.05** was considered statistically significant.

Quality Control

To minimize observer bias, all fundus examinations were performed by a **single ophthalmologist**. Fundus photographs were reviewed by another independent consultant to validate grading. Laboratory analyses were performed in a NABL-accredited facility.

Results

Out of the 200 Type 2 diabetic patients included in this study, **68 individuals (34%)** were diagnosed with **Diabetic Retinopathy (DR)** based on ETDRS grading, while **132 patients (66%)** showed no evidence of retinopathy. The **distribution of DR grades** is illustrated in the bar graph above. Among the affected individuals, **Mild Non-Proliferative Diabetic Retinopathy (NPDR)** was the most prevalent stage, accounting for **14%**, followed by **Moderate NPDR (10%)**, **Severe NPDR (7%)**, and **Proliferative DR (3%)**.

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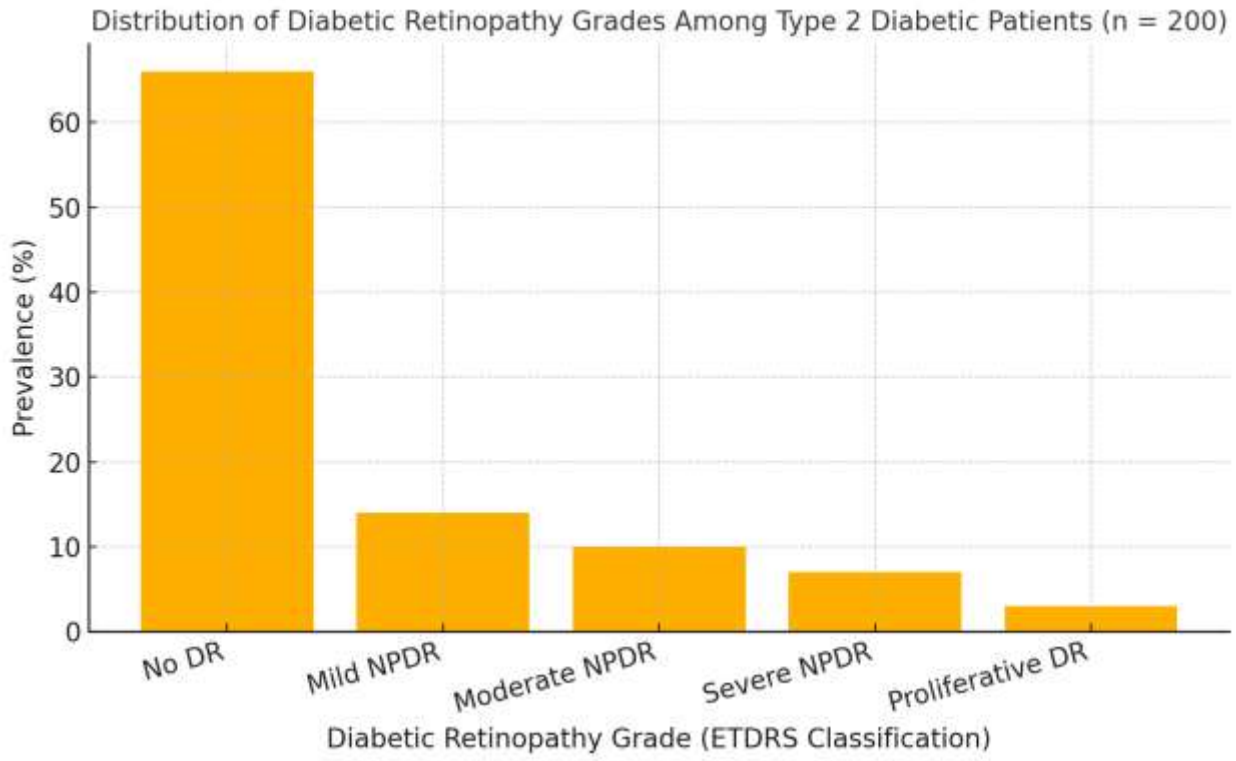
The **mean age** of the study population was **55.2 ± 8.6 years**, and the **mean duration of diabetes** was **9.7 ± 4.3 years**. The prevalence of DR increased significantly with the duration of diabetes: **12%** in patients with diabetes <5 years, **29%** in those with 5–10 years, and **52%** in those with >10 years ($p < 0.01$). Similarly, **poor glycemic control (HbA1c ≥8%)** was found in **71%** of patients with DR compared to **28%** without DR ($p < 0.05$). **Hypertension** was present in **61%** of DR cases, and **dyslipidemia** (elevated triglycerides and low HDL) was observed in **48%**, both of which showed positive correlation with retinopathy severity. **Macular edema** was detected in **18%** of DR patients, predominantly in those with Moderate or Severe NPDR. There was no significant gender difference, though male patients had a slightly higher prevalence (36%) compared to females (32%). The study demonstrated a **strong positive association** between **HbA1c, duration of diabetes, and blood pressure** with the presence and severity of retinopathy ($p < 0.05$).

These findings underscore the need for **early ophthalmic screening**, particularly in patients with long-standing or poorly controlled diabetes, to prevent progression to sight-threatening stages.



Discussion

The present study revealed a **34% prevalence of diabetic retinopathy (DR)** among patients with Type 2 Diabetes Mellitus, aligning with previously reported figures from Indian studies (30–40%)

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[1,2]. The predominance of **non-proliferative DR** highlights that most cases are detected in early stages, providing a valuable opportunity for preventive intervention. The findings confirmed that the **duration of diabetes**, **poor glycemic control (HbA1c ≥8%)**, and **hypertension** are major determinants for the onset and progression of retinopathy [3].

The association between long-standing diabetes (>10 years) and DR observed in this study supports the concept of chronic hyperglycemia–induced microvascular damage [4]. Elevated blood pressure and dyslipidemia were also correlated with increased DR severity, emphasizing the multifactorial nature of the disease [5]. The prevalence of macular edema in 18% of patients reinforces its significance as a leading cause of vision loss in diabetics.

The results underscore the need for **integrated diabetes management**, including tight control of blood sugar and blood pressure, coupled with routine ophthalmic evaluation. Despite being a single-center study, these findings contribute to regional epidemiological data and reaffirm the importance of **screening programs** in reducing diabetes-related blindness.

Conclusion

This study concludes that **Diabetic Retinopathy (DR)** remains a significant and preventable cause of visual impairment among patients with Type 2 Diabetes Mellitus. The overall prevalence of 34% reflects the increasing burden of diabetic eye disease in India. The most frequent stage observed was **Mild Non-Proliferative Retinopathy**, indicating that many cases can still be managed effectively through early detection and medical control.

Key risk factors identified include **long duration of diabetes**, **poor glycemic control**, **hypertension**, and **dyslipidemia**. These findings highlight the urgent need for **comprehensive diabetes care** integrating both systemic and ocular management. Regular **fundus examination**, preferably on an annual basis, should be made mandatory for all diabetic patients irrespective of symptoms.

Awareness among patients and primary care physicians regarding the asymptomatic nature of early DR is crucial. Strengthening **screening programs** at community and tertiary levels, along with patient education, can significantly reduce visual morbidity.

In conclusion, early detection and strict metabolic control remain the cornerstones of preventing sight-threatening diabetic retinopathy. A collaborative approach between ophthalmologists, endocrinologists, and primary healthcare providers can effectively reduce the burden of diabetic blindness and improve quality of life for affected individuals.

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