The Review Of
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Risk Factors For Diabetic Retinopathy

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Abstract

Introduction: Diabetes mellitus is a metabolic disorder characterized by insulin deficiency or resistance, resulting in chronic hyperglycemia and microvascular as well as macrovascular complications. Diabetic retinopathy (DR) accounts for nearly 7% of newly registered blindness cases, and diabetics have a 15-fold higher risk of blindness compared to non-diabetics.
Aim: To evaluate the risk factors associated with diabetic retinopathy.
Methodology: A hospital-based study was conducted on 500 diabetic patients (1000 eyes) over a period of two years.
Results: Duration of diabetes, poor glycemic control, smoking, hyperlipidemia, and hypertension were significantly associated with the onset and progression of DR.
Conclusion: Early detection and modification of risk factors can improve visual outcomes and prevent blindness.

Keywords: Diabetes mellitus, Diabetic retinopathy, Hyperglycemia, Hypertension, Hyperlipidemia, Smoking, Risk factors.

I. Introduction

Diabetes mellitus is a heterogeneous group of metabolic disorders characterized by persistent hyperglycemia resulting from defects in insulin secretion, insulin action, or both[1]. Chronic hyperglycemia is associated with long-term structural damage, dysfunction, and eventual failure of various organs, particularly the eyes, kidneys, nerves, heart, and blood vessels[1]. Among these complications, diabetic retinopathy (DR) is one of the most common microvascular complications of diabetes and remains a leading cause of preventable blindness worldwide[2]. Despite significant advances in glycemic control, screening strategies, laser photocoagulation, and intravitreal therapies, DR continues to represent a major cause of diabetes-related visual morbidity in both developed and developing countries[2].

Diabetic retinopathy develops as a result of progressive microvascular changes in the retinal circulation. Chronic hyperglycemia leads to capillary basement membrane thickening, pericyte loss, formation of microaneurysms, increased vascular permeability, retinal ischemia, and neovascularization[3]. These pathological changes can progress from non-proliferative stages to proliferative diabetic retinopathy and diabetic macular edema, which are the principal causes of visual loss. Globally, DR accounts for approximately 10,000 new cases of blindness each year[3].

The risk of developing diabetic retinopathy and other microvascular complications is strongly influenced by both the duration and severity of hyperglycemia[3]. The United Kingdom Prospective Diabetes Study (UKPDS) demonstrated that poor glycemic control and coexisting hypertension significantly increase the risk and progression of retinopathy[4]. Nearly all patients with type 1 diabetes develop some degree of retinopathy within 20 years of diagnosis[5]. In patients with type 2 diabetes, retinopathy may begin to develop as early as seven years before the clinical diagnosis of diabetes, owing to prolonged asymptomatic

hyperglycemia[5]. Early detection and appropriate management are therefore essential to prevent irreversible visual impairment.

II. Material And Methods

Study Design and Setting

This was a hospital-based observational study conducted in the Department of Ophthalmology at Narayana Medical College and Hospital, Nellore, Andhra Pradesh, India. The study period extended over two years, from 2023 to 2025. The study population consisted of patients attending the ophthalmology outpatient department.

Study Population and Sample Size

A total of 500 patients with a known history of diabetes mellitus or newly diagnosed diabetes were included in the study. Both eyes of each patient were examined, accounting for a total of 1000 eyes evaluated during the study period.

Inclusion Criteria

Participants were included in the study based on the following criteria:

1. Age between 30 and 60 years.
2. Both genders were included without restriction.
3. Patients previously diagnosed with Type 1 or Type 2 diabetes mellitus attending routine ophthalmic check-up or admitted with ocular complaints.
4. Diabetic patients with associated comorbidities such as hypertension and hyperlipidemia.
5. Diabetic patients with a history of smoking.

Exclusion Criteria

The following patients were excluded from the study:

1. Patients below 30 years or above 60 years of age.
2. Patients with acute complications of diabetes such as hyperosmolar non-ketotic coma, diabetic ketoacidosis, or acute systemic infections.

Study Procedure

Detailed history regarding duration of diabetes, associated comorbidities, and lifestyle factors was obtained. Comprehensive ophthalmic evaluation was performed for all participants to assess the presence and severity of diabetic retinopathy.

Statistical Analysis

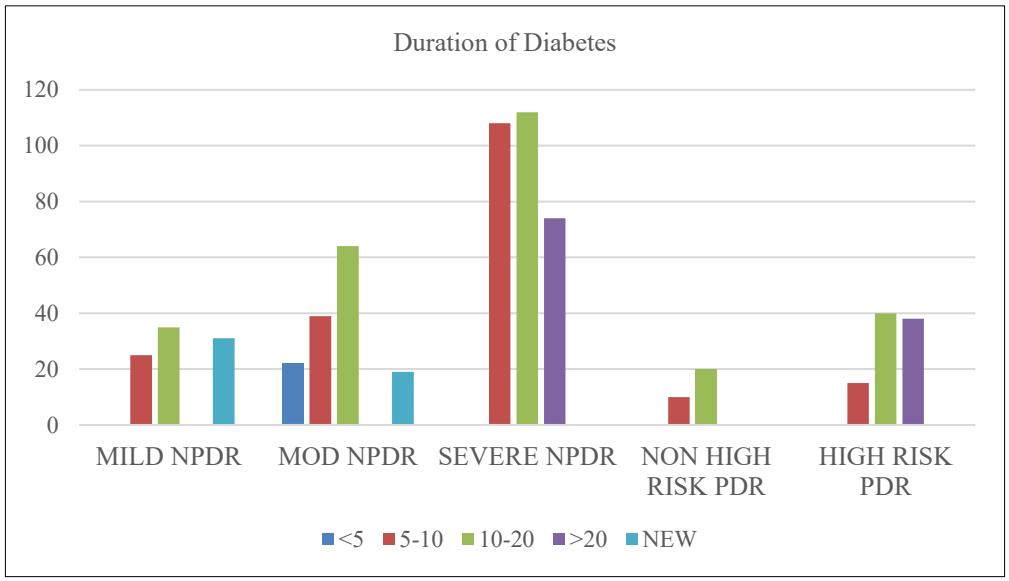
All collected data were compiled and entered into Microsoft Excel and analyzed using appropriate statistical software. Descriptive statistics were used to summarize the demographic and clinical characteristics of the study population. Continuous variables such as age and duration of diabetes were expressed as mean ± standard deviation, while categorical variables including gender, hypertension, hyperlipidemia, smoking status, and stages of diabetic retinopathy were presented as frequencies and percentages. The association between diabetic retinopathy and various risk factors was assessed using the Chi-square test for categorical variables. A p-value of less than 0.05 was considered statistically significant. The results were tabulated and graphically represented wherever necessary for clear interpretation.

Result

1.Duration of Diabetes:

Table – 1: Duration of Diabetes

DURATION OF DIABETES(YRS)	MILD NPDR	MOD NPDR	SEVERE NPDR	NON HIGH RISK PDR	HIGHRISK PDR
<5	0	22	0	0	0
5-10	25	39	108	10	15
10-20	35	64	112	20	40
>20	0	0	74	0	38
NEW	31	19	0	0	0



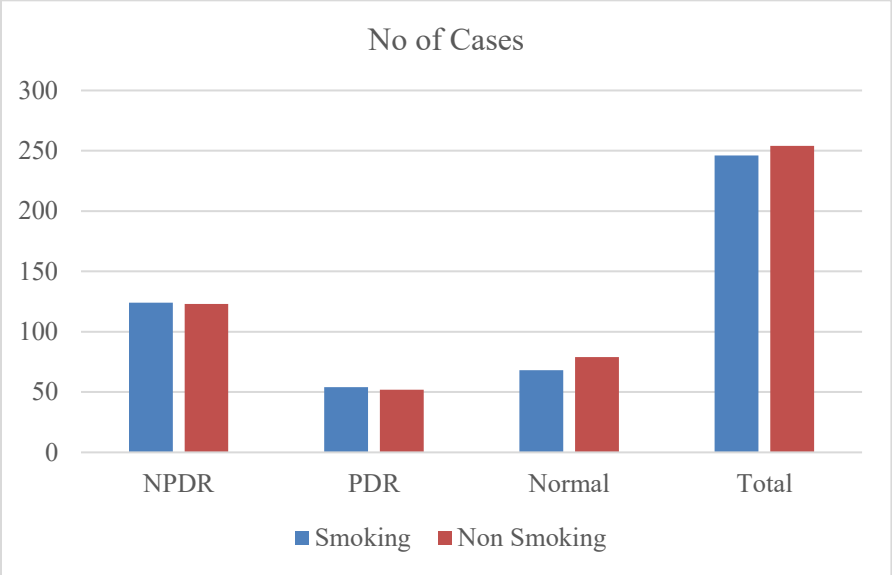
Observation: The prevalence of NPDR 10-20 years after the inception if noninsulin-dependent diabetes mellitus was higher. After 20 or more years, the cases of Severe NPDR increased. Eleven or more years after the inception, 9.8% of the patients had PDR.

Inference: DR and its severity are associated with the duration of diabetes. Prolonged exposure to hyperglycemia is a triggering factor for DR.

2.Smoking:

Table – 2: Association with smoking

	NPDR	**PDR**	**Normal**	**Total**
Smoking	124	54	68	246
Non Smoking	123	52	79	254



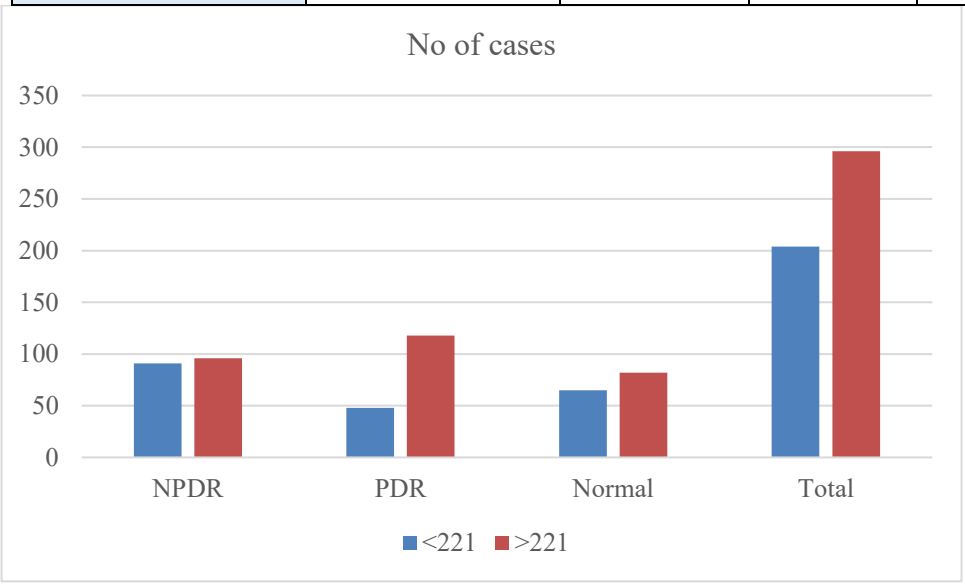
Observation: In this study, out of 500 patients, 246 patients have a known H/o of smoking, 54 Patients have an extended H/o evident with High risk PDR.

Inference: Vasoconstriction caused by smoking leads to aggravation of the disease.

3.Hyperlipidemia:

Table – 3 : Association with Hyperlipidemia

S. Cholesterol	NPDR	PDR	Normal	Total
<200 mg/dl	91	48	65	204
>200 mg/dl	96	118	82	296



Observation: In this study, out of 500 patients, 296 patients have raised. Triglycerides & S.Cholestrol.

Inference: Dyslipidemia is strongly associated with the development and progression of DR.

4.Hypertension:

Table – 4 : Association with Hypertension

Number of patients	Hypertensive	Normotensive
500	362	138

Table – 5 : Showing association with Hypertension

Hypertensive	NPDR	PDR	Normal
362	176	74	112

Table – 6 : DR in normotensives

Normotensive	NPDR	PDR	Normal
138	71	32	35

Observation: In this study, out of 500 patients, 362 patients have systemic hypertension, out of which uncontrolled cases usually have proliferative retinopathy.

Inference: Uncontrolled HTN stimulates the progression of DR.

5.Effect of Control of Blood sugars:

Elevated levels of glycosylated haemoglobin (HbA1C) in all the patients indicates the state of chronic hysterical hyperglycemia which leads to the progression of background retinopathy to a state of proliferative retinopathy. Most of the patients under study have a value of HbA1c of >7.1%

Table – 7 : Effect of Control of Blood sugars

HbA1C	NPDR	PDR	Normal	Total
<7.1%	30	11	15	56
>7.1%	217	95	132	444

Observation: In this study, out of 500 patients, 444 patients had uncontrolled HbA1C out of which 217 had NPDR.

Inference: Most of the cases in study had HbA1C more than 7.1% which shows the strong association with development of DR.

Statical analysis of risk factors:
Multiple logistic regression analysis of dependent variables obtained by Chi-square test . P value <0.01 statististically significant

Table – 8 : Statistical analysis

VARIABLES	Chi square	P value
HbA1C	49.9	0.00001
Smoking	2.68	0.44
Hypertension	33.2	0.00001
S.Cholesterol	10.1	0.01

Inference: According to my study Hypertension, S.cholesterol and HbA1C had significant correlation with the development of diabetic retinopathy but smoking did not show any significant relation with the development of diabetic retinopathy.

III. Discussion

Longer duration of diabetes may represent a longer period of retinal toxicity induced by high glucose levels leading to vascular and neural death in the layers of retina[6]. According to this study, duration of diabetes was between 10-20 years of onset of disease and least being less than 5 years of duration of DM. The results are that prevalence of NPDR after 10-20 years of onset of DM is high (27.10%) and severity of the retinopathy has increased as the duration of DM is increased and 6% developed PDR in 10-20 years.

According to a study conducted by Robert J. McCarter[7] on Biological Variation in HbA1c in diabetic retinopathy patients patients with high Hemoglobin glycation index (HGI = observed HbA1c - predicted HbA1c) had three times greater risk of retinopathy and six times greater risk of nephropathy compared with the low-HGI group. In present study most of the diabetics had abnormal FBS and PPBS levels and HbA1c value more than 7.1%. According to Klein et al, relationship between blood pressure and progression of diabetic retinopathy was not certain.

In present study, out of 500 cases 362 were hypertensives out of which 176 developed NPDR (48.62%), 74 developed PDR (20.44%) and 112 (30.94%) did not develop retinopathy. According to Ramchandran Mohan et al, smoking was associated with progression of diabetic retinopathy. In present study 246 were smokers out of which 124 developed NPDR (50.41%), 54 developed PDR (21.95%) and 68 did not develop any retinopathy. Dyslipidemia is a modifiable and independent risk factor for macro- and microvascular diseases, and control of serum lipids helps to prevent complications due to DR[8,9,10]. In present study, 296 cases had hyperlipidaemia out of which 96 developed NPDR (32.43%), 118 developed PDR (39.86%) and 82 cases (27.70%) did not develop any retinopathy.

IV. Conclusion

Concomitant avoidance of predictive risk factors like hyperglycemia, hyperlipdemia, smoking and hypertension and early diagnosis and treatment of the disease will definitely make the Diabetic individual to live with good health and have a fruitful vision.

Limitations

Short duration of study only 2 years

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