Section: Ophthalmology

Original Research Article

CLINICAL FACTORS ASSOCIATED WITH PROGRESSION TO PROLIFERATIVE DIABETIC RETINOPATHY IN PATIENTS WITH TYPE 2 DIABETES MELLITUS

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ABSTRACT

Background: Diabetic retinopathy (DR) is a major microvascular complication of diabetes and an important cause of preventable visual impairment. Identifying patients at higher risk of progression to proliferative diabetic retinopathy (PDR) is essential for timely management. The aim is to identify clinical and systemic factors associated with progression from non-proliferative diabetic retinopathy (NPDR) to PDR in patients with type 2 diabetes mellitus (T2DM).

Materials and Methods: Records of 180 patients aged >40 years with T2DM for at least 5 years and established DR were reviewed. Patients were categorized as NPDR (n=120) or PDR (n=60). Demographic characteristics, diabetes duration, treatment, hypertension, ischemic heart disease, lipid profile and renal parameters were assessed.

Results: Diabetes duration >10 years was more frequent in PDR than NPDR (75.8% vs 58.4%). Renal dysfunction was also substantially more common in PDR; serum creatinine >1.35 mg/dL was present in 63.4% of PDR patients compared with 22.5% of NPDR patients. Elevated serum urea and triglycerides were also more frequent in PDR. Elevated serum creatinine remained independently associated with PDR.

Conclusion: Long duration of diabetes and renal dysfunction were important factors associated with progression to PDR. Patients with long-standing T2DM and impaired renal function may require closer retinal surveillance and coordinated systemic care.

Keywords: Type 2 diabetes mellitus; diabetic retinopathy; NPDR; PDR; renal dysfunction; serum creatinine.

INTRODUCTION

Diabetic retinopathy is a chronic neurovascular complication of diabetes caused by progressive retinal microvascular and neural injury. Chronic hyperglycemia, increasing duration of diabetes, hypertension, dyslipidemia and nephropathy are recognized risk factors for development and progression of DR. The 2026 American Diabetes Association (ADA) Standards of Care emphasize optimization of glycemia, blood pressure and lipids and recommend retinal examination at the time of diagnosis in patients with T2DM. Patients with established DR generally require at least annual retinal assessment, with more frequent follow-up when disease is progressing or sight-threatening.[1-5]

Renal disease is of particular clinical interest because diabetic retinopathy and diabetic kidney disease share several microvascular mechanisms. Recognition of renal dysfunction may therefore help identify patients with a greater systemic vascular burden and increased risk of advanced retinopathy.

This study evaluated the association of diabetes duration, renal function and other systemic factors with progression from NPDR to PDR in patients with T2DM.

MATERIALS AND METHODS

This retrospective comparative study was conducted in the Department of Ophthalmology, MCGMC

AND RTR Hospital, Koriawas, Narnaul. Clinical records of 180 patients aged >40 years with T2DM of at least 5 years' duration and documented DR were reviewed. Patients with incomplete relevant clinical or retinal records were excluded. The study included 120 patients with NPDR and 60 with PDR.

Retinopathy was classified according to ETDRS-based criteria. Recorded variables included age, duration of diabetes, treatment modality, hypertension, chronic kidney disease, serum urea, serum creatinine, total cholesterol and triglycerides.

Data were summarized descriptively and associations between the study variables and retinopathy severity were assessed. The study was based on previously consented clinical records and excluded patient-identifiable information.

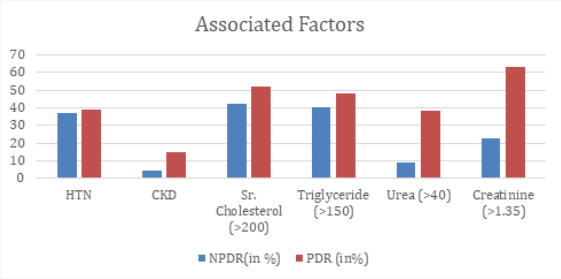
RESULTS

Among 180 patients, 120 had NPDR and 60 had PDR. A diabetes duration of >10 years was present in 58.4% of NPDR patients and 75.8% of PDR patients. Renal biochemical abnormalities were markedly more frequent in PDR: serum urea >40 mg/dL was present in 38.4% versus 9.2%, while serum creatinine >1.35 mg/dL was present in 63.4% versus 22.5% of PDR and NPDR patients, respectively.

Hypertriglyceridemia was present in 48.3% of PDR patients compared with 40.0% of NPDR patients. Age >60 years, hypertension, elevated total cholesterol and treatment modality did not show a clear association with PDR in this cohort. Elevated serum creatinine was identified as an independent factor associated with PDR.

Table 1: Patients showing NPDR and PDR with following characteristics

Clinical Information	NPDR(in %)	PDR (in%)
Total Patients (100%)	67	33
Age>60 yr	46	52
Duration of DM>10 yr	58.4	75.8
Type of Treatment		
Tablets	64.2	55
Insulin	13.3	18.2
Tablets +Insulin	22.5	26.8
Associated Factors		
HTN	37	39.2
CKD	4.2	15
Sr. Cholesterol (>200)	42	51.8
Triglyceride (>150)	40	48.3
Urea (>40)	9.2	38.4
Creatinine (>1.35)	22.5	63.4



DISCUSSION

The present study identified longer duration of diabetes and renal dysfunction as the main factors associated with progression to PDR. The relationship with diabetes duration is consistent with established evidence that cumulative exposure to chronic hyperglycemia contributes to progressive retinal vascular damage. The ADA 2026 Standards of Care similarly recognize diabetes duration and chronic hyperglycemia as major determinants of DR risk.[6,7]

Renal dysfunction showed a particularly strong association with advanced retinopathy. Diabetic retinopathy and diabetic kidney disease share endothelial dysfunction, oxidative stress, inflammation and microvascular injury. Thus, impaired renal function may serve as an indicator of greater systemic diabetic microvascular burden. The present findings support the importance of assessing renal function in patients with established DR, especially those with long-standing diabetes.[8,9]

Triglyceride elevation was more frequent among patients with PDR, supporting the possible contribution of dyslipidemia to retinal vascular injury. However, hypertension and total cholesterol were not significantly associated with PDR in this cohort. These findings may reflect differences in population characteristics, treatment and other unmeasured factors and should not be interpreted as excluding their established clinical importance.[10]

From a clinical perspective, patients with long-standing T2DM and renal impairment may benefit from closer retinal surveillance and coordinated systemic management. Early detection and appropriate treatment of sight-threatening DR can reduce avoidable visual loss.[11]

Clinical Implications: Patients with long-standing T2DM and established DR should be considered at increased risk of progression, particularly when renal dysfunction is present. A practical risk-based approach should include regular dilated retinal assessment, appropriate use of retinal photography where available, assessment and optimization of glycemic control, blood pressure and lipid status, and evaluation of renal function. Patients with moderate or worse NPDR, PDR or diabetic macular edema

should be referred promptly for specialist retinal management.

Limitations: This was a retrospective, hospital-based study and therefore cannot establish causality. Important variables such as HbA1c, estimated glomerular filtration rate, albuminuria, body mass index and smoking status were not available. The study included patients with established DR and therefore does not estimate the prevalence of DR in the general diabetic population.

CONCLUSION

Longer duration of diabetes and renal dysfunction were the principal factors associated with progression to PDR in this cohort of patients with T2DM. Elevated serum creatinine was independently associated with PDR. Patients with long-standing diabetes, particularly those with impaired renal function, should receive regular retinal assessment along with appropriate systemic risk-factor management.

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