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DIABETIC RETINOPATHY IN NEWLY DIAGNOSED TYPE 2 DIABETIC PATIENTS: A CROSS-SECTIONAL STUDY ON PREVALENCE AND SPECTRUM

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Abstract

leading cause of visual impairment. Despite the high prevalence of diabetes in Pakistan, local data on DR among newly diagnosed type 2 DM (T2DM) patients remain limited.

Objective: *To determine the prevalence and morphological patterns of DR among newly diagnosed T2DM patients presenting to a tertiary care hospital in Peshawar, Pakistan.*

Methods: *This descriptive cross-sectional study was carried out at the Department of Endocrinology, Hayatabad Medical Complex, Peshawar, between January and October 2024. A total of 217 newly diagnosed T2DM patients aged 40–70 years were enrolled through non-probability consecutive sampling. Each participant underwent comprehensive metabolic and ophthalmologic assessment, and retinopathy was graded according to the Davis classification. Data analysis was performed using SPSS version 30.*

Results: *Among 217 participants, 142 (65.5%) were male and 75 (34.5%) females, with a mean age of 52.12 ± 7.30 years. The overall prevalence of DR was 15.6% (n = 34). Background retinopathy was most common sub-type (67.65%), followed by pre-proliferative (20.60%) and proliferative DR (11.75%). The likelihood of DR increased with advancing age, BMI, elevated fasting plasma glucose, HbA1c, and urine albumin-to-creatinine ratio levels.*

Conclusion: *DR is prevalent among newly diagnosed T2DM patients in Pakistan, often without symptoms. Early screening and timely intervention are essential to prevent progression to vision-threatening stages. These findings highlight the need for routine ophthalmologic screening at the time of diagnosis.*

INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by persistent hyperglycemia resulting from impaired insulin secretion, action, or both (1). There is steady and progressive increase in the global burden of this disease, with projections indicating that around 783 million people will be affected by the year 2045 (2). Pakistan exhibits an exceptionally high prevalence of diabetes, with an estimated 30.8% of its adult population living with this disease (3).

Diabetic retinopathy (DR), a common and serious microvascular complication of diabetes, remains a leading cause of visual impairment among adults aged 20 to 70 years (4). Chronic hyperglycemia is considered to be the primary contributing factor in the pathogenesis of DR, inducing a cascade of events within the retinal vasculature including thickening of the capillary basement membrane, pericyte loss, microaneurysm formation and neovascularization (5). The global pooled prevalence of DR in newly diagnosed type 2 DM patients is estimated at 13.1% (6), while data from Pakistan indicates a slightly higher prevalence of 17% (7).

Majority of the newly diagnosed type 2 diabetic patients with DR remains asymptomatic until the disease has progressed to advanced stages, therefore, regular screening and timely interventions are essential to prevent severe visual loss (8). Given the paucity of local data and the high burden of diabetes in Pakistan, this study was designed to determine the prevalence and morphological patterns of DR among newly diagnosed T2DM patients presenting to a tertiary care hospital in Peshawar, Khyber Pakhtunkhwa.

Material and Methods

This descriptive cross-sectional study was conducted at the Department of Diabetes, Endocrinology, and Metabolic Diseases Hayatabad Medical Complex (HMC) Peshawar, between January 01 to October 31, 2024. Ethical approval was granted by the Institutional Research and Ethics Board (IREB), and written informed consent was obtained from all participants prior to enrollment. A total of 217 patients were included in the study using non-probability consecutive sampling technique. The sample size was calculated using *Calculator.net* (9) based on a previously reported DR prevalence of 17% (7) among newly diagnosed T2DM patients, with a 95% confidence interval and 5% margin of error. Inclusion criteria comprised of newly diagnosed T2DM patients (diagnosed within the preceding 03 months), aged 40–70 years, recruited from both inpatient and outpatient departments. Patients with Type 1 DM, longstanding diabetes, or comorbid conditions (e.g., hypertension, autoimmune disorders, sickle cell retinopathy, cataract, glaucoma and those unwilling to participate in the research) were excluded.

The diagnosis of T2DM was established according to American Diabetes Association (ADA) guidelines. Clinical evaluation included anthropometric measurements, relevant laboratory investigations (fasting plasma glucose (FPG), post prandial blood glucose (PPBG), glycated hemoglobin (HbA1c), serum creatinine), and detailed fundoscopy using Welch Allyn Ophthalmoscope (REF 11470). Eligible candidates were then referred to the Department of Ophthalmology at HMC for detailed ocular evaluation. A consultant ophthalmologist performed slit-lamp bio-microscopy examination, and DR was classified using the Davis classification system into background, pre-proliferative, and proliferative stages. Data were entered and analyzed using IBM SPSS version 30. Descriptive statistics were used to summarize data. Continuous variables such as age and body mass index (BMI) were reported as mean ± standard deviations, while categorical variables such as gender and DR grades were presented as frequencies and percentages. Results were displayed in both textual and tabular formats for clarity.

Results

The current study was conducted on 217 newly diagnosed consecutive type 2 diabetic patients over a period of 10 months with 65.9% patients being males. The ages of participants ranged from 40 to 70 years with a mean age of 52.12 ± 7.3 years. The study population was further categorized based on their body mass index (BMI) into overweight, class I obesity and class II obesity. Baseline characteristics of the study population are shown in table 1.

Table 1. Baseline Characteristics of the Study Population (n = 217)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	143	65.9
	Female	74	34.1
Age (years)	40–49	108	49.8
	50–59	87	40.1
	60–70	22	10.1
Body Mass Index (BMI)	Overweight (25–29.9)	97	44.7
	Class I Obesity (30–34.9)	116	53.5
	Class II Obesity (35–39.9)	4	1.8
Total		217	100

Diabetic Retinopathy was identified in 34 patients (19 male & 15 female), accounting for a prevalence of 15.7%. Among these cases, background retinopathy was the most common, observed in 23 patients (67.65%), followed by pre-proliferative DR in 07 patients (20.6%), and proliferative DR in 04 patients (11.75%). The prevalence of DR was 10% among patients aged 40 – 49 years, 19.6% in those aged 50 – 59 years and 20% in the 60 – 70 years age group, as shown in table 2.

Table 2. Distribution of DR by Age Groups

Age Group (Years)	Total Patients (n = 217)	Background DR	Pre-Proliferative DR	Proliferative DR	Total DR Cases
40–49	90	06	02	01	09 (10%)
50–59	102	14	04	02	20 (19.6%)
60–70	25	03	01	01	05 (20%)
Total	217	23	07	04	34

Univariate analysis revealed significant differences in clinical parameters between patients with and without DR. Patients with DR were more frequently older with a high body mass index (BMI). Additionally, they exhibited elevated level of fasting blood sugar (FBS), glycated hemoglobin (HbA1c), and urine albumin-to-creatinine ratio (ACR) levels compared to those without retinopathy as shown in Table 3.

Table 3. Chi-square test for Association

Variable	Categories	Retinopathy		Total	P-Value
		No	Yes		
Age (yrs)	40 – 49 yrs	97(89.8%)	11(10.2%)	108(49.8%)	0.04
	50 – 60 yrs	69 (79.3%)	18 (20.7%)	87 (40.0%)	
	60 – 70 yrs	17 (77.3%)	05 (22.7%)	22 (10.1%)	

Gender	Male	124 (86.7%)	19(13.3%)	143 (65%)	0.18
	Female	59 (79.7%)	15 (20.3%)	74 (34.1%)	
BMI	Overweight (25-29.9)	97 (100%)	0 (0%)	97 (100%)	0.0001
	Class I Obesity (30-34.9)	86 (74.1%)	30 (25.9%)	116 (53%)	
	Class II Obesity (35-39.9)	0 (0%)	4 (100%)	4 (100%)	
ACR (mg/mmol)	3-30 (Microalbuminuria)	163 (99.4%)	01 (0.6%)	164 (76%)	0.0001
	>30 (Macroalbuminuria)	20 (37.7%)	33(62.3%)	53 (24%)	
HbA1c (%)	Overall, 8.75% ± 1.8%	7.46% ± 1.05%	12.23% ± 1.51%		0.0001
FBS	Overall, 182.6 ± 26.8 mg/dL	133.15 ± 20.6 mg/dL	207 ± 25.5 mg/dL		0.001

***p-value < 0.05 is considered statistically significant**

As indicated by Table 3, there was a statistically significant association between **age** and the prevalence of diabetic retinopathy (DR) among newly diagnosed T2DM patients (p = 0.04). The prevalence of DR increased with advancing age, being highest in the 50–60 years and 60–70 years age groups. In contrast, **gender** did not show a statistically significant association with DR (p = 0.18). A significant association was observed between **BMI** and retinopathy (p = 0.0001). Notably, no cases of DR were seen in the overweight group (BMI 25–29.9), while all cases occurred in patients with Class I and Class II obesity. Similarly, **albumin-to-creatinine ratio (ACR)** showed a strong association with DR (p = 0.0001). Only 0.6% of patients with microalbuminuria (3–30 mg/mmol) had DR, whereas 62.3% of patients with macroalbuminuria (>30 mg/mmol) were affected.

In terms of glycemic parameters, patients with retinopathy had significantly higher **HbA1c** levels (12.23% ± 1.51%) compared to those without retinopathy (7.46% ± 1.05%, p = 0.0001). Similarly, **fasting blood sugar (FBS)** was markedly higher in patients with DR (207 ± 25.5 mg/dL) compared to those without DR (133.15 ± 20.6 mg/dL, p = 0.001)

Discussion

The current study highlights that diabetic retinopathy (DR) is a common complication even at the time of diagnosis of type 2 diabetes mellitus (T2DM). We found a prevalence of 15.7% among newly diagnosed patients, with background retinopathy being the most frequent morphological type (67.6%), followed by pre-proliferative (20.6%) and proliferative retinopathy (11.7%). The prevalence of DR was significantly associated with age, obesity, poor glycemic control, and elevated urinary albumin-to-creatinine ratio (ACR), while gender did not show a statistically significant relationship.

The prevalence of diabetic retinopathy (DR) observed in our study (15.7%) is comparable to the pooled global prevalence of 13.1% reported in a recent meta-analysis of newly diagnosed type 2 diabetes mellitus (T2DM) patients (10). Similar findings have been reported from regional studies, with rates of 17% in Lahore (2014) and 16.2% in Islamabad (2005) among newly diagnosed T2DM cohorts (11,12). Conversely, lower prevalence has been observed in some Asian populations, including 10.2% in India (13) and 11.5% in China (14). In contrast, studies from Middle Eastern and African regions have documented higher rates ranging from 20% to 30% at diagnosis (15,16). These variations may reflect differences in genetic susceptibility, population characteristics, screening strategies, diagnostic criteria, and health-care accessibility across regions.

In terms of spectrum, background retinopathy was the predominant subtype in our cohort, consistent with other local and international studies where non-proliferative DR is the earliest and most frequent presentation (8, 17). This trend is consistent with the natural progression of DR, wherein background retinopathy typically precedes the more advanced and vision-threatening stages (18)

Importantly, we observed a notable proportion (11.7%) of patients presenting with proliferative DR at the time of diagnosis, suggesting delayed detection of diabetes and the possibility of prolonged asymptomatic hyperglycemia prior to formal diagnosis. This underscores the well-recognized phenomenon that many South Asian patients may remain undiagnosed for several years until complications manifest (19).

Our findings of higher prevalence in older age groups are consistent with previous literature, as advancing age is a recognized risk factor for DR due to cumulative glycemic exposure and vascular aging (20,21). Gender was not significantly associated with DR in our study, in agreement with several reports (22), although some local studies have suggested a slightly higher prevalence in females, possibly linked to obesity and hormonal influences.

Obesity showed a strong and statistically significant association with DR in our population. Notably, no cases were detected among overweight patients, while all cases occurred in those with class I and II obesity. This contrasts with some international studies that found an inconsistent association between BMI and DR (23,24). However, in the South Asian context, obesity is strongly linked with insulin resistance, poor glycemic control, and increased cardiovascular risk, which may explain its closer relationship with DR in our population.

The strong correlation of poor glycemic control (higher HbA1c and fasting blood sugar) with DR is well established. In our study, patients with DR had a mean HbA1c of 12.2%, significantly higher than the 7.4% in those without retinopathy. This mirrors findings from the UK Perspective Diabetes Study (UKPDS), which demonstrated that each 1% reduction in HbA1c decreases the risk of microvascular complications by 35% (25). Similarly, our results showed a robust association between DR and albuminuria, with 62.3% of patients with macroalbuminuria having DR compared to only 0.6% in those without microalbuminuria. This reinforces the concept that DR and diabetic nephropathy share common microvascular pathophysiological mechanisms, and their coexistence may indicate more advanced systemic microangiopathy (26).

The strengths of our study include a well-defined cohort of newly diagnosed T2DM patients and the use of standardized diagnostic criteria for DR classification. However, certain limitations must be acknowledged. Being a single-center study with a relatively modest sample size, the results may not be generalizable to the entire population. Additionally, as a cross-sectional design, causal inferences cannot be established.

Our findings highlight the substantial burden of DR at the time of diabetes diagnosis in Pakistan. Given that most patients were asymptomatic, routine ophthalmological evaluation should be strongly recommended at the time of diagnosis of T2DM, in line with ADA guidelines. Early identification and timely interventions, such as optimal glycemic control, weight management, and treatment of albuminuria, could substantially reduce the risk of progression to vision-threatening stages. Furthermore, public health strategies focusing on early diabetes detection and lifestyle interventions are urgently needed in high-prevalence regions such as Pakistan.

This study has several strengths, including its focus on newly diagnosed T2DM patients and its execution in a well-equipped tertiary care center, allowing for standardized ophthalmologic assessment. However, certain limitations must be acknowledged. The **cross-sectional design** restricts the ability to infer causality. Furthermore, **non-probability sampling** and the **single-center setting** may limit the generalizability of findings to the broader population. Future studies with **larger, multicenter cohorts** and longitudinal follow-up are warranted to evaluate progression patterns and the impact of early interventions.

Conclusion: DR is prevalent among newly diagnosed T2DM patients in Pakistan, often without symptoms. Early screening and timely intervention are essential to prevent progression to vision-threatening stages. These findings highlight the need for routine ophthalmologic screening at the time of diagnosis.

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