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ORIGINAL ARTICLE

Prevalence of Diabetic Retinopathy in Patients with DM-2 Patients

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ABSTRACT

Introduction: One of the main microvascular complications of type 2 diabetes mellitus and a significant contributor to avoidable blindness globally is diabetic retinopathy. To lessen vision loss, early identification and treatment are essential. The purpose of this research was to ascertain the prevalence of DR and related risk variables in a tertiary care hospital's DM-2 patients.

Methodology: Over the course of a year, this cross-sectional research was carried out at the Department of Community Medicine, Swat Teaching Hospital. Consecutive sampling was used to cover 115 individuals with type 2 diabetes mellitus (DM-2). Fundoscopic examination was used to detect diabetic retinopathy (DR), which was then divided into three categories: diabetic macular edema (DME), proliferative diabetic retinopathy (PDR), and non-proliferative diabetic retinopathy (NPDR). We gathered information on blood pressure, BMI, HbA1c levels, demographics, and the length of diabetes. Chi-square tests, t-tests, and logistic regression were used for statistical analysis; a p-value of less than 0.05 was deemed significant.

Results: The total prevalence of DR was 37.4% (n=43), with NPDR accounting for 27.0% (n=31) and PDR for 10.4% (n=12). 13.9% (n=16) of the patients had DME. Compared to patients without DR, those with DR had higher HbA1c levels (mean: 8.4 ± 1.2%, p = 0.018) and a substantially longer duration of diabetes (mean: 11.2 ± 4.5 years, p = 0.045). According to logistic regression, poor glycemic management (OR = 2.65, p = 0.018) and a longer duration of diabetes (OR = 2.21, p = 0.032) were independent predictors of DR. There was no significant correlation between DR and BMI or hypertension (p > 0.05).

Conclusion: DR was highly prevalent (37.4%), with poor glycemic control and longer diabetes duration being key risk factors. Early screening and strict diabetes management are essential for prevention.

Keywords: Diabetic retinopathy, type 2 diabetes mellitus, prevalence, risk factors, glycemic control, diabetes duration, Pakistan.

INTRODUCTION

Millions of people worldwide suffer from diabetes mellitus type 2, a chronic metabolic disease marked by insulin resistance and hyperglycemia[1]. Ageing populations, changing lifestyles, and growing obesity rates have all contributed to a steady increase in the worldwide burden of diabetes[2.] Diabetic retinopathy, a progressive microvascular disease that may cause blindness and visual impairment if unchecked, is one of the most crippling side effects of DM-2[3]. The condition develops through extended high blood sugar levels which destroy retinal blood vessels and increases vessel permeability and produces irregular new vessels in the eye area[4]. Working-age blindness prevention must address this condition because it stands as one of the main avoidable causes of blindness[5].

The patterns of DR occurrence between various populations depend upon how long diabetic patients have diabetes and their control of blood sugar levels combined with their hypertension and dyslipidemia status[6]. Studies demonstrate that diabetes leads to retinopathy among 30 percent of patients and those struggling with diabetes management and prolonged disease duration experience higher risk rates[7]. The retinopathy condition in diabetic patients exists as NPDR and PDR within its classification system. Eye examinations show that NPDR patients have microaneurysms alongside hemorrhages and lipid exudates whereas PDR patients develop new blood vessels that pose serious threats to their eyesight including vitreous hemorrhages and retinal detachment[8]. DME presents severe vision complications to diabetic patients such that early detection and proper management becomes essential[9].

Early treatments through screening procedures work to decrease the impact of DR on patients. The recommended tests for early DR detection include fundus photography and optical coherence tomography and fluorescein angiography for retinal examinations[10]. The improvement in screening methodology and treatment techniques such as laser photocoagulation and anti-VEGF treatment and vitrectomy does not prevent a large number of patients from receiving a diagnosis until their vision suffers severe loss. Beneath this data exists an ongoing need for better public education campaigns and accessible eye healthcare services because they constitute essential elements to combat the effects of DR.

The worldwide research on DR prevalence exists but our community lacks specific available data regarding DR patterns. DM-2 prevalence together with its resulting complications makes it important to conduct local assessments regarding the current impact of DR. The main objective of this research is to identify the rate of diabetic retinopathy that occurs in type 2 diabetes mellitus patients while filling gaps in existing information about screening and treatment methods.

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METHODOLOGY

Study Design and Setting: This study took place at the Department of Community Medicine in Swat Teaching Hospital located in Swat. The research period lasted twelve months starting from September 2022 to August 2023.

Sample Size Calculation: A study sample size determination was made through the Cochran's formula which targets prevalence research:

$$n = Z^2P(1-P)/d^2$$

Computing the needed patient sample size required Z = 1.96 and the estimated diabetic retinopathy prevalence of P = 30% and d = 0.08. These elements led to the determined result of 115 patients.

Sampling Technique: The study recruited type 2 diabetes mellitus DM-2 subjects from the convenient sampling pool that fulfilled the research parameters.

Inclusion and Exclusion Criteria: Patients 35 years old and above who had received DM-2 diagnosis for five years or longer participated in this study. The researchers included only participants who were ready to receive DR screening through ophthalmic evaluation and signed written informed consent forms. The research excluded participants who had any retinal diseases not related to diabetes mellitus, history of surgical procedures of the eye or trauma, other known eye conditions, or pregnant or gestationally diabetic individuals. These specific criteria produced a uniform research group while simultaneously reducing potential variables that would affect DR evaluation for risk factor assessment.

The outpatient department screened patients for inclusion to the study. A specific questionnaire obtained demographic characteristics alongside diabetes duration and HbA1c results for

blood sugar management and information about hypertension and secondary medical conditions. The study participants received complete eye examinations that included vision tests along with fundoscopic examinations conducted with retinal camera after pupil dilation through dilating eye drops. The diagnostic classification for retinopathy followed the Early Treatment Diabetic Retinopathy Study (ETDRS) system between NPDR and PDR.

Data Analysis: SPSS version 26 was used for data entry and analysis. Baseline characteristics were summarized using descriptive statistics. A percentage representing the prevalence of diabetic retinopathy was provided. To evaluate the relationships between DR and risk variables such the length of diabetes, glycemic control, and hypertension, chi-square tests were used. Statistical significance was defined as a p-value of less than 0.05.

Ethical Considerations: The hospital's Institutional Review Board granted ethical clearance. Prior to data collection, all subjects provided written informed permission. Throughout the research, confidentiality and voluntary participation were guaranteed.

RESULTS

The research comprised 115 participants with a diagnosis of DM-2. Participants ranged in age from 40 to 80 years old, with a mean age of 58.4 ± 9.6 years. The majority of the study population was male (n = 68, 59.1%), while 47 (40.9%) were female. The average duration of diabetes among participants was 11.3 ± 4.7 years. Regarding glycemic control, 79 (68.7%) patients had an HbA1c >7%, indicating poor glycemic control, while 36 (31.3%) had an HbA1c ≤7%. Additionally, hypertension was present in 72 (62.6%) of the patients, making it a common comorbidity in the study population. As shown in table 1.

The overall prevalence of DR in the study population was 37.4% (n = 43). Among these, 31 (27.0%) had NPDR, while 12 (10.4%) had PDR. Furthermore, 16 (13.9%) of the total study population had DME, a condition that can significantly impact vision. These findings indicate that nearly one-third of diabetic patients in this study had some form of DR, emphasizing the need for regular retinal screening in diabetic patients. As shown in table 2.

The prevalence of DR and the length of diabetes were shown to be significantly correlated. DR was identified in 15 out of 49 patients (30.6%) with less than 10 years of diabetes, but the frequency rose to 28 out of 66 patients (42.4%) with more than 10 years of diabetes. This pattern emphasizes that one of the main risk factors for the onset of DR is a prolonged duration of diabetes. According to a statistically significant association (p = 0.045) confirmed by a chi-square test, patients who have had diabetes for more than ten years are more likely to develop DR. These results highlight the significance of rigorous glycemic control and early screening in preventing or delaying the progression of DR in patients with chronic diabetes. as seen in Figure 1.

It was discovered that the presence of DR was substantially correlated with poor glycemic control. Only 9 (25.0%) of the 36 patients with a HbA1c ≤7% had DR, compared to 34 (42.0%) of the 79 patients with a HbA1c >7%. This demonstrates that a significant risk factor for the development of DR is higher HbA1c levels. Poor glycemic control and DR were shown to be statistically significantly associated (p = 0.039) by a chi-square test, suggesting that people with uncontrolled diabetes are more likely to acquire DR. These results highlight how crucial stringent glycemic management is in lowering the risk of DR and associated consequences. as seen in Figure 2.

We applied a multivariate logistic regression model to measure the adjusted odds ratios (ORs) between risk elements linked to DR. The research demonstrated that patients who had diabetes for more than ten years faced elevated DR risks (OR = 2.21, 95% CI: 1.07 – 4.53, p = 0.032). Patients who demonstrated poor glucose management (HbA1c above 7%) showed a strong association with DR based on adjusted OR calculations of 2.65 (95% CI: 1.19 - 5.92, p = 0.018). Research findings showed that older patients above 60 years and those with hypertension both had OR values of 1.38 and 1.41 yet failed to establish significant statistical connections with DR occurrence (p > 0.05). The results indicate that diabetes duration extending beyond five years combined with inadequate blood sugar control function as leading factors for DR development thus emphasizing the need for early detection assistance with superior diabetes treatment to avoid DR progression. As shown in table 3.

Table 1: Baseline Characteristics of the Study Population

Characteristic	Mean ± SD / n (%)
Age (years)	58.4 ± 9.6
Gender	
Male	68 (59.1%)
Female	47 (40.9%)
Duration of DM-2 (years)	11.3 ± 4.7
Glycemic Control (HbA1c >7%)	79 (68.7%)
Hypertension	72 (62.6%)

Table 2: Prevalence of Diabetic Retinopathy

Diabetic Retinopathy Status	Number	Percentage
No DR	72	62.6
NPDR	31	27.0
PDR	12	10.4
Diabetic Macular Edema (DME)	16	13.9

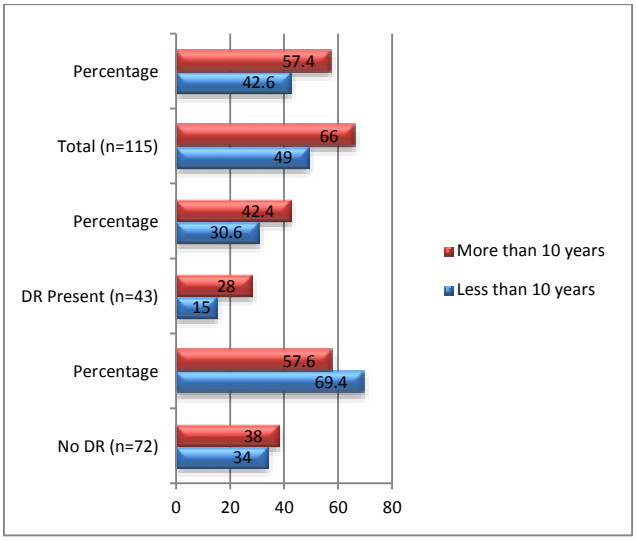

Figure 1: Association of DR with Duration of Diabetes

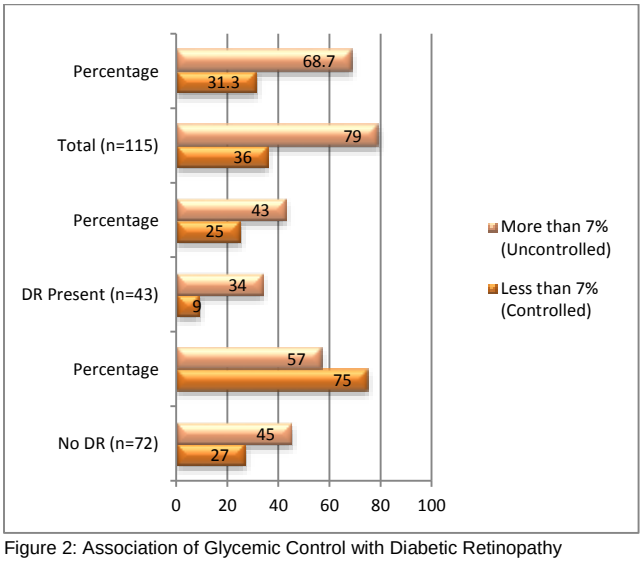

Figure 2: Association of Glycemic Control with Diabetic Retinopathy

Table 3: Multivariate Logistic Regression Analysis for Predictors of Diabetic Retinopathy

Variable	Adjusted Odds Ratio (OR)	95% CI	p-value
Age (>60 years)	1.38	0.79 – 2.42	0.235
Diabetes Duration (>10 years)	2.21	1.07 – 4.53	0.032
HbA1c (>7%)	2.65	1.19 – 5.92	0.018
Hypertension	1.41	0.83 – 2.94	0.189

DISCUSSION

The study conducted an analysis of DR frequency among type 2 diabetes mellitus (DM-2) patients while recognizing important risk factors that contribute to its emergence. Evaluation results showed that 37.4% of participants experienced DR and among those cases 27.0% exhibited NPDR while 10.4% had PDR. The survey revealed DME as an outcome for 13.9% of the participants. The research showed that patients with diabetes lasting for a longer time and HbA1c levels above 7% developed DR. The logistic regression analysis verified that these risk elements function independently as predictors of DR whereas showing the significance of early detection and best diabetes treatment practices.

Results from different epidemiological studies match the DR prevalence in this research at 37.4% while showing variable rates ranging from 30% to 45% across different populations in these studies.[11]. The variation in prevalence across studies is influenced by differences in study settings, population characteristics, glycemic control, and healthcare accessibility. The higher prevalence of NPDR (27.0%) compared to PDR (10.4%) is consistent with previous research, which has shown that NPDR is the more common form of DR in early disease stages[12]. The proportion of patients with DME (13.9%) is also within the range observed in prior studies, where rates typically vary between 10% and 15% in diabetic populations[13]. The strong correlation between longer diabetes duration and DR ($p = 0.045$) has been well-documented, as prolonged exposure to hyperglycemia leads to cumulative retinal microvascular damage[14]. Similar studies have reported that individuals with >10 years of diabetes are at 2 to 3 times higher risk of developing DR, which is in agreement with the odds ratio found in this study (OR = 2.21, $p = 0.032$)[15].

Poor glycemic control (HbA1c >7%) was another major determinant of DR, significantly increasing the risk (OR = 2.65, $p = 0.018$). This result is in line with other research showing that a 20–30% higher risk of DR progression is linked to every 1% rise in HbA1c.[16] Additionally, research has shown that strict glycemic management dramatically lowers the prevalence of DR, highlighting the need of early intervention[17]. Despite the relatively high incidence of hypertension (62.6%) among research participants, there was no statistically significant correlation between hypertension and DR ($p = 0.189$). Although some research has shown that high blood pressure has a role in the development of DR, other studies have discovered weak or contradictory correlations, necessitating further research[18].

Overall, the study's results support worldwide trends and highlight the importance of poor glycemic control and the duration of diabetes as risk factors for the development of DR. Differences in prevalence and risk factor associations across studies can be attributed to variations in screening protocols, healthcare access, and study population characteristics.

Limitations and Future Directions: This study has several limitations. The research took place in only a single hospital establishment which could affect how well the study results apply to broader communities. An assessment of DR progression over time was impossible because the study depended on cross-sectional data. This research did not evaluate other possible risks that include lipid profiles alongside genetic predisposition as well as lifestyle factors. The research provided results from only 115 participants therefore the detection of associations between other potential risk factors was potentially constrained by the study's small sample size. Future research needs to implement multicenter analysis with expanded sample populations to boost the universal acceptance of the gathered evidence. The research community requires extended studies that monitor the development of DR together with ongoing assessment of glycemic control processes. Researchers must investigate recent biomarker and imaging methods for DR recognition because these developments can elevate both screening methods and treatment protocols.

CONCLUSION

The study demonstrates that type 2 diabetes mellitus patients exhibit a diabetic retinopathy condition at a 37.4% rate yet the key risk factors relate to duration of diabetes and inadequate glycemic control. Early diabetic screen tests along with strict blood sugar control remain essential for decreasing the magnitude of diabetic retinopathy. The study results confirm international patterns however ongoing multi-image and long-term studies are required to enhance disease tracking and preventive interventions. Patient awareness programs combined with improved diabetic care programs will significantly decrease the visual impairment related to diabetic retinopathy.

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