ORIGINAL ARTICLE

Ocular complications in patients with diabetes mellitus: clinical patterns from a hospital-based study in Chakwal

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ABSTRACT

Background and Objective: Diabetes mellitus (DM) is a major public health concern worldwide, with ocular complications being a leading cause of preventable loss of vision among adults. Early detection through regular ophthalmic screening is critical to prevent irreversible vision loss. The study was designed to determine the frequency of ocular complications in patients with DM presenting to a local teaching hospital in Chakwal for their first eye consultation.

Methods: A cross-sectional observational study was conducted at the monthly Medical Retina Clinic of Munawwar Memorial Hospital Chakwal from September 2022 to November 2022. Detailed clinical assessment and regular ophthalmic examination of 60 diabetic patients, aged 30-90 years, were done to determine the presentation patterns of diabetic eye disease. An optometrist performed refraction and slit lamp examination to evaluate the anterior and posterior segments. A full retinal examination was performed using a 78-diopter lens. The findings were then validated by the attending ophthalmologist.

Results: The mean age of patients was 57.5 $\pm$ 13.5 years, with 45% females and 55% males. Diabetic retinopathy (DR) was found in 62% of patients with recurring vision loss. A total of 62.5% and 34% patients presented with non-proliferative and proliferative DR. Cataract was seen in 28% patients. Other ocular complications included dry eyes, keratitis, and glaucoma. Age and duration of diabetes were significantly associated ($p < 0.05$) with the progression to proliferative diabetic retinopathy.

Conclusion: A high burden of advanced ocular disease, in particular diabetic retinopathy, was observed at first presentation along with other complications such as cataracts, glaucoma, and corneal diseasein patients with chronic diabetes mellitus. These findings underscore the urgent need for community-based screening, early referral pathways, and public awareness campaigns to facilitate timely detection and intervention in diabetic eye disease.

Keywords: Diabetes mellitus, diabetic retinopathy, cataract, glaucoma.

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Introduction

The prevalence of diabetes mellitus (DM) is rising exponentially in both developed and developing countries across the globe. World Health Organization (WHO) predicts that by the year 2030, there will be 366 million diabetic individuals worldwide, [1] anticipating it to be an epidemic in the future. [2] Diabetic retinopathy (DR), the most prevalent and distinct consequence of DM, is also one of the major risk factors for avoidable blindness in these patients [3]. Although current diagnostic and therapeutic advances, such as optimal DM treatment and early diagnosis of DR, can significantly lower the risk of visual impairment, DR still accounts for a significant proportion of global blindness and visual impairment. [4]

DM can also cause many other ocular disorders, including glaucoma, cataracts, ocular surface disorders, and diabetic papillopathy. [5] Bacterial conjunctivitis, microaneurysms, and dry eyes are other prevalent complications. Moreover, physical functional difficulties are experienced by the patients with DR, especially with the severe types. [6,7] DM can also result in an increased frequency of recurrent corneal erosions, ulcers, and diabetic keratopathy, which can be sight-threatening. [8,9] It is widely acknowledged that patients' refractive status varies with changes in blood sugar levels in DM. Myopia fluctuations may be the first symptom of diabetes. [6,9] A study of glucose metabolism pathways found that several hyperglycemia-initiated processes are related to cataract development. [7,10] Iris neovascularization

occurs in up to 7% of eyes with DM and up to 60% in eyes with proliferative retinopathy. [9,11] Neovascular glaucoma is an advanced complication of diabetic retinopathy. The prevalence of iris neovascularization in diabetes lies within the range of 1%-17% [10,12].

Due to its association with microvascular and macrovascular complications, DM is associated with a higher morbidity and mortality rate [11,13]. According to the International Diabetes Federation, in 2022, 26.7% of adults in Pakistan were affected by diabetes, making the total number of cases approximately 33,000,000 [12,14]. The prevalence of DR is reported to be 28.78% in the Pakistani population.[15] Very limited data or scientific publications have been made in population of Northern Punjab. This study was therefore carried out to find out the frequency and patterns of ocular complications in patients of DM presenting to a leading private ophthalmology hospital in District Chakwal, Pakistan, so that this data can assess the disease burden and suggest improved preventive or therapeutic strategies in these patients through healthcare delivery services.

Methods

It was an observational cross-sectional study conducted at Munawwar Memorial Hospital Chakwal (MMH), Pakistan from September 2022 to November 2022. A total of 60 patients suffering from diabetes mellitus were examined at the monthly diabetic clinics. The study was approved by the Institutional Review Board of the Hospital. All consecutive patients presenting with a self-reported history of DM were included in the research. Subjects of both genders and having controlled type-1 and 2 DM for a minimum of last 5 years, from the adult age group were included. Exclusion criteria were patients with uncontrolled diabetes, history of ocular trauma or surgery within the previous 6 months, active ocular infection or inflammation, or any retinal disease of non-diabetic etiology. Pregnant women were also excluded.

All recruited patients were subjected to regular ophthalmic examinations following informed consent as part of their usual clinical visits to the department. The Snellen visual acuity chart was used to test visual acuity. Both objective and subjective refraction were performed. An experienced optometrist performed a slit lamp examination to evaluate the anterior and posterior segments. The intraocular pressure was measured using a Goldmann applanation tonometer. 1% Tropicamide was used to dilate the pupil. For retinal examination, a +78 diopter lens was employed. Diabetic retinopathy was graded according to the Early Treatment Diabetic Retinopathy Study classification. Participants having a tear break time of less than 10 seconds were diagnosed to be suffering from dry eyes. All patients were reviewed by a trained and qualified Ophthalmologist for a second opinion.

Statistical analysis

Data were entered and analyzed using SPSS version 25. Continuous variables were summarized as mean ± standard deviation for approximately normally distributed data or median (interquartile range) for skewed data; normality was assessed using the Shapiro–Wilk test. Categorical variables were presented as frequencies and percentages with 95% confidence intervals where appropriate. The prevalence of ocular complications (and of diabetic retinopathy grades) was calculated with exact binomial 95% CIs. Comparisons between groups (e.g., patients with versus without retinopathy) were done using Student's *t*-test or the Mann–Whitney U test for continuous variables and Pearson's chi-square test or Fisher's exact test for categorical variables, depending on cell counts.

Results

A total of 120 eyes (N = 120) of 60 subjects were included in the study. The ages of screened subjects ranged between 20 and 90 years. The mean age of the subjects was 56.3 ± 9.8 years. The demographic details of the patients are shown in Table 1.

The majority of patients (58%) had diabetes for 5-10 years, while only 1.6% reported duration ≥30 years. The type of diabetes was evenly distributed for Insulin Dependent Diabetes Mellitus (IDDM) and Non-Insulin Dependent Diabetes Mellitus (NIDDM) (IDDM 45%, NIDDM 55%). Applying the Chi-square test to compare gender distribution (Male 55% *vs.* Female 45%) showed no significant association of diabetic complications with the gender ($p > 0.05$). The frequency distribution of diabetes-related ocular complications is shown below in Table 2. These percentages are calculated by dividing the number of each complication by 120 eyes included in this research.

Patients with longer diabetes duration (>10 years) showed a significantly higher proportion of retinopathy compared to ≤10 years (χ^2 = [value], p = 0.012). The majority of eyes had no signs of DR. Diabetic macular edema associated with any stage of DR was observed in 21 eyes (p = 0.039). In our study, moderate visual impairment, severe visual impairment, and blindness were observed in 34%, 20%, and 22% eyes, respectively. Thirty subjects were suffering from bilateral vision loss. However, no statistically significant difference was found between severe visual impairment and blindness ($p > 0.05$).

Discussion

To the best of our knowledge, this is the first study reported to find the ocular complications of DM in the population of Chakwal on screening by ophthalmology experts. However, this is not a community-based study, so it is difficult to

Table 1. *Demographic and clinical characteristics of patients.*

Characteristic		Frequency	Percentage
Gender	Male	33	55
	Female	27	45
Age groups (Years)	20-30	1	1.6
	31-40	6	10
	41-50	10	17
	51-60	20	33
	61-70	17	28
	71-80	5	4
	81-90	1	1.6
Duration of diabetes(Years)	5-10	35	58
	11-20	17	28
	21-30	7	12
	31-40	1	1.6
Type of diabetes	Insulin Dependent Diabetes Mellitus (IDDM)	27	45
	Non-Insulin Dependent Diabetes Mellitus (NIDDM)	33	55
Best corrected visual acuity	6/6-6/12	29	24
	6/18-6/36	41	34
	6/60-3/60	24	20
	Less than 3/60	26	22

Table 2. *Frequency of diabetic ocular complications observed in patients.*

Complications	Number of eyes = *n*	Percentage
DR	75	62.5%
Non-proliferative diabetic retinopathy (NPDR)	41	34%
Proliferative diabetic retinopathy (PDR)	34	28%
Clinically Significant Macular Oedema (CSMO) (with any stage of DR)	21	18%
Cataract	44	37%
Dry eyes	29	24%
Keratitis	25	20%
Glaucoma	13	11%
Rubiosis iridis	7	6%
Blepharitis	5	4%
Traction retinal detachment	3	2.5%

comment on the total burden of disease in the area. Among the reporting $n = 60$ patients from District Chakwal over the study duration, it was observed that dry eye constituted the most prevalent ocular surface consequence, accounting for up to 24% of all cases. The frequency of keratitis was also high (20%). Most eyes (76/120) had vision loss of varying degrees. In the present study, moderate to severe visual impairment with nearly half of the patients who experienced bilateral vision loss, was reported. Although severe visual impairment and blindness were comparable in frequency ($p > 0.05$), this finding highlights the high burden of advanced visual morbidity among diabetic patients in our setting. Previous hospital-based studies from Pakistan and other South Asian populations have reported varying proportions of vision-threatening disease, often with blindness rates lower than those seen in our cohort, possibly reflecting earlier diagnosis and better access to ophthalmic care in those populations. [14-16] In contrast, the relatively high prevalence of blindness in our series may indicate delayed presentation, lack of awareness, or limited screening opportunities in northern Punjab. This underscores the need for strengthening preventive strategies, particularly

early detection of diabetic retinopathy and timely surgical or pharmacological intervention, to reduce progression to irreversible visual loss.

The private hospital chosen as a study setting offers free DR screening to diabetic patients. Only a limited number of patients attend their annual screening despite awareness activities run by the Hospital. This low uptake could be due to socioeconomic factors that influence access to and availability of medical care and the poor health-seeking behavior of the population of Chakwal. Most of the previous studies from Pakistan have overlooked vision loss analysis of diabetic patients in their research. This study includes the analysis of best-corrected vision as part of ocular complications to find the impact of the disease on the patient's visual function.

There is a strong association DM and dry eyes-related complications. [16,17] As compared to 24% in our sample, some other studies have reported that 30%-54.3% frequency of dry eyes in patients with DM. [18,19] Corneal complications were recorded in 20% of the eyes among our patients, while a similar frequency has been reported by a study from Karachi. [20]

The frequency of cataracts was observed to be 37% in our study. In some other investigations, cataract was identified in 19.8%-23.4% of the participants [9,14,21]. This variation can be attributed to the fact that both type I and type II diabetics were included in our study, while the aforementioned studies included only type II diabetics. In this study, 11% of the participants had glaucoma as compared to variably higher and lower range (0.3%-9%) reported in other studies [14,20,22]. This difference is possibly due to different initial baseline characteristics of the population and may partly be explained by differences in sample size, variations in diagnostic criteria and study design, as hospital-based studies tend to capture more advanced or symptomatic cases compared to community-based surveys.

In our study, 62.5% of eyes had signs of diabetic retinopathy. The high frequency of DR was accompanied by a high rate of blindness of about 22% in these eyes. Likewise, in a recent study at Khyber Teaching Medical Hospital Peshawar, the frequency of DR of any form was reported to be 66.9% of diabetics [23]. The prevalence of diabetic retinopathy in DHQ Hospital Gujrat was found to be 55.96% [24]. Data collection method can be a source of this variation in these findings as in research conducted in Khyber Teaching Medical Hospital Peshawar subjects having cataracts were excluded from the study, while in our study there were no such exclusion criteria because of a different perspective. Similarly, in a study carried out at the ophthalmology department of DHQ Gujrat, subjects having Type II DM were included only while in this research subjects having both types of DM were recruited. [24]

In our research, the frequency of NPDR was observed to be 34%, CSMO in 18% of eyes and PDR in 28% of the eyes. A study from Peshawar reported CSMO at 24% and PDR to be 16% [25]. In the same city, Khyber Teaching Medical Hospital Peshawar NPDR and PDR were reported to be 50% and 49% respectively [23] while Ghazipura et al. [26] from Karachi and Zakir et al. [27] from Lahore reported the frequency of NPDR as 43% and 37%, respectively. As in our study analysis was based on ophthalmic examination only rather than optical coherence tomography which might have underestimated these figures.

The current study also highlights the delayed presentation of patients with severe diabetic eye diseases and significant vision loss. Delay in the detection of diabetes, diabetic eye disease, and provision of much-needed eye care results in worsening of diabetic ocular complications and leads to more serious vision loss. The burden of these problems can be reduced and the general quality of life of diabetic people can be improved by increased awareness, and early intervention or management. It is important to carry out future research to find the prevalence of diabetes and its complications in the community to help plan the services. For the freely available screening services available in MMH, to be fully utilized, the degree of public awareness of the dangers of these conditions and availability of the services locally needs to improve. There needs to be a comprehensive awareness drive.

Early detection and treatment should be linked with health promotion and patient education to encourage self-care. Screening for diabetic retinopathy should be prioritized, and family members of diabetic patients should also be screened for diabetes and subsequently for DR if diagnosed. Awareness campaigns utilizing mass media and social media platforms are needed to educate the public about diabetes, related life style changes and prevent occurrence of complications, through regular eye examinations is direly needed.

Limitations of the study

This was a single-canter, hospital-based cross-sectional study with a small sample size, limiting generalizability to the wider population. Only controlled diabetics were included, introducing selection bias and possibly underestimating the true burden of ocular disease. Ocular assessments relied mainly on clinical examination without standardized imaging, which may have led to misclassification. Results were reported per eye without adjusting for within-patient correlation. Larger, multicenter, population-based studies are needed to validate these findings.

Conclusion

This study highlights the substantial burden of ocular complications among diabetic patients in northern Punjab,

with diabetic retinopathy emerging as a key cause of visual morbidity. The findings point toward delayed detection and gaps in preventive care, emphasizing the urgent need for structured patient education, regular screening, and timely referral pathways. Strengthening community-based eye care programs, such as integrating diabetic retinopathy screening into existing outreach services, could play a pivotal role in reducing preventable vision loss in this population.

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List of Abbreviations

(CSMO)	Clinically Significant Macular Oedema
(DM)	Diabetes mellitus
(DR)	Diabetic retinopathy
(IDDM)	Insulin Dependent Diabetes Mellitus
(MMH)	Munawwar Memorial Hospital Chakwal
(NIDDM)	Non-Insulin Dependent Diabetes Mellitus
(NPDR)	Non-proliferative diabetic retinopathy
(PDR)	Proliferative diabetic retinopathy

Conflict of interest

None to declare.

Grant support and financial disclosure

None to disclose.

Ethical approval

The ethical approval for the study was granted by the Ethical Committee of Munawwar Memorial Hospital & College of Optometry Chakwal, Pakistan vide Letter No. MMH/IRB/011/2022 dated October 14, 2022.

Authors' contributions

SH: Conception, design, patient recruitment and assessment, manuscript drafting and critical review.

IK: Acquisition and analysis of data, validation of clinical findings, drafting of manuscript and critical intellectual input.

SH: Study design and execution, data collection, drafting of manuscript and critical intellectual input.

ALL AUTHORS: Approval and responsibility of the final version of the manuscript to be published.

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