e-ISSN: 0975-5160, p-ISSN: 2820-2651

Available online on www.ijtpr.com

International Journal of Toxicological and Pharmacological Research 2023; 13(12); 375-383

Original Research Article

Prevalence and Pattern of Ocular Complications in Diabetes Mellitus: A Hospital-Based Study (2009)

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Received: 10-10-2023 / Revised: 14-11-2023 / Accepted: 20-12-2023

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Conflict of interest: Nil

Abstract

Background: DM is a relevant and global health problem that has several systemic complications in which ocular issues play a significant role in creating visual disability and avoidable blindness. The chronic hyperglycemia that causes Diabetic Retinopathy, cataract, glaucoma, refractive error, dry eye syndrome and Macular edema may affect the eyes, namely the retina, lens, optic nerve and the eye surface. This is necessary to minimize loss of vision because of diabetes through early diagnosis and treatment.

Aim: To determine the prevalence and trend of ocular complications in patients with diabetes presenting at the tertiary care hospital and establish the relationships between ocular complications and the duration of diabetes and glycemic control of diabetes.

Methodology: It was a cross-sectional observational study, which was conducted within one year in a hospital among 180 patients with diabetes mellitus. Patients were exposed to a comprehensive history taking, physical examination, laboratory tests with HbA1c and a comprehensive eye examination that included visual acuity, slit-lamp examination, IOP and intra fundal examination. Descriptive statistics, Chi-square test and Independent t-test were used whereby, $p<0.05$ was taken as statistically significant.

Results: Majority of the patients were aged 46 60 years (48.9%), and male population used in the study was 62.2 %. Diabetic Retinopathy (28.9), Cataract (21.1), refractive error (13.3), dry eye syndrome (10.0), glaucoma (5.6), and macular edema (4.4) were the most common eye complications. Patients with a duration of diabetes of over 10 years and HbA1c levels greater than 9% had a higher rate of ocular complications ($p<0.001$).

Conclusion: Ocular complications are very common in diabetic patients and the most common type of ocular complication to develop is diabetic retinopathy. Poor glycemic control and extended diabetes are risks of ocular morbidity. Routine check-up of the eye, early diagnosis and meticulous management of metabolism should be conducted in order to avoid impairment of the eye and enhance the quality of life of diabetic patients.

Keywords: Diabetes Mellitus, Diabetic Retinopathy, Cataract, Glaucoma, Ocular complications, Blindness.

Introduction

Diabetes Mellitus is one of the most prevalent endocrine diseases on the planet and the soon to be popular endocrine disease worldwide [1]. The ongoing excessive blood sugar results in the damage of various body organs, such as kidney, nerves, heart and eyes. One of the most disabling complications is ocular involvement due to its possible ability to cause visual impairment and blindness when not prevented in the initial stages [2].

The general eye symptoms of diabetes are Diabetic Retinopathy, cataract, glaucoma, cranial nerve palsies, refractive changes and dry eye disease [3]. The first cause of blindness in working-age adults around the world is diabetic retinopathy [4].

The number of diabetics is rapidly increasing in India and as the life expectancy increases, ocular complications are becoming a major health issue to the masses. Hospital based research will help in the interpretation of the burden and trend of ocular disease in patients with diabetes and help in the establishment of screening plans [5].

Subsequently, the present paper was conducted on the basis of establishing the prevalence and trend of the ocular complications amongst diabetic patients in one of the tertiary care hospitals.

Background of the Study: Long-term hyperglycemia causes development of diabetes related ocular disease that causes microvascular damage, oxidative stress, neuropathy and alteration

of ocular tissue metabolism [6,7]. Diabetic retinopathy is an outcome of leakage of retinal capillaries and ischemia. Cataract formation is spurred by Lens protein glycation, and aqueous dynamics changes could lead to glaucoma [8].

The likelihood of the development of ocular complications grows depending on the length of diabetes, ineffective glycemic regulation, high blood pressure, dyslipidemia, and age. During the initial phases, most of the patients do not show any symptoms and hence there is need to have an eye check-up periodically [9,10].

Research Objectives

The objectives of the study are:

- To determine the prevalence of ocular complications among diabetic patients.
- To assess the pattern of different ocular complications.
- To evaluate the association of duration of diabetes with ocular complications.
- To assess the relation between glycemic control and ocular complications.

Methodology

Study Design: The present study article was formulated as an observational study (cross-sectional study) within a hospital to establish the prevalence and trend of ocular complications in individuals with Diabetes Mellitus. The objective of the study was to find the correlation between demographic and clinical factors and ocular expression of diabetes.

Study Area: This was conducted in the Department of Ophthalmology, ICARE Institute of Medical Sciences and Research, Dr. Bidhan Chandra Roy Hospital, Haldia, West Bengal, India

Study Duration: The study was conducted over a period of one year.

Study Population: The patients were screened in the outpatient and inpatient department of the hospital where they had a confirmed diagnosis of Diabetes Mellitus and were recruited with informed consent.

Inclusion Criteria

The following patients were included in the study:

- Patients diagnosed with Diabetes Mellitus (Type 1 or Type 2)
- Age **above 30 years**
- Patients willing to participate in the study
- Patients available for detailed ophthalmic examination

Exclusion Criteria

The following patients were excluded from the study:

- Non-diabetic individuals
- Patients with history of ocular trauma or previous ocular surgery
- Patients with congenital eye disorders
- Patients with severe systemic illness preventing examination
- Uncooperative patients or those unwilling to participate

Sample Size and Sampling Technique: The study involved a total of 180 diabetic patients and the sampling technique employed was convenient. The sample group was chosen according to the availability of patients at the time of study and the possibility to conduct the detailed ophthalmic examination.

Study Procedure: All the eligible participants received a structured clinical and ophthalmic assessment following a written informed consent. Data were gathered with the help of a predefined proforma.

The following details were recorded:

A. **Demographic Variables**

- Age
- Gender
- Residence
- Occupation

B. **Clinical Variables**

- Type and duration of diabetes
- Treatment history
- Associated hypertension or other comorbidities
- Family history of diabetes

C. **Laboratory Parameters**

- Fasting blood sugar
- Postprandial blood sugar
- HbA1c level

D. **Ophthalmic Examination**

Each patient underwent the following ocular evaluation:

- Visual acuity assessment using Snellen chart
- Refraction testing
- Slit lamp examination of anterior segment
- Tonometry of the intraocular pressure.
- Direct/indirect ophthalmoscopy post-dilation- fundus examination.
- The evaluation of diabetic Retinopathy, cataract, glaucoma, dry eye syndrome, refractive error, and macular edema.

Outcome Measures

The outcomes measured were mainly:

- Ocular complications prevalence in diabetic patients.
- Pattern of ocular complications.
- Severity of Diabetic Retinopathy.
- Correlation of complication of eyes with diabetes duration and glycemic control.

Results

A total of 180 patients diagnosed with Diabetes Mellitus were included in the present hospital-based study. The data collected were analyzed to know the prevalence and pattern of ocular complications of diabetic patients. The results are as given in the tables below.

Table 1: Age Group Distribution of Study Participants and Gender Distribution of Study Participants.

Variable	Category	Frequency (n=180)	Percentage (%)
Age Group (Years)	30–45	42	23.3%
	46–60	88	48.9%
	>60	50	27.8%
Gender	Male	112	62.2%
	Female	68	37.8%

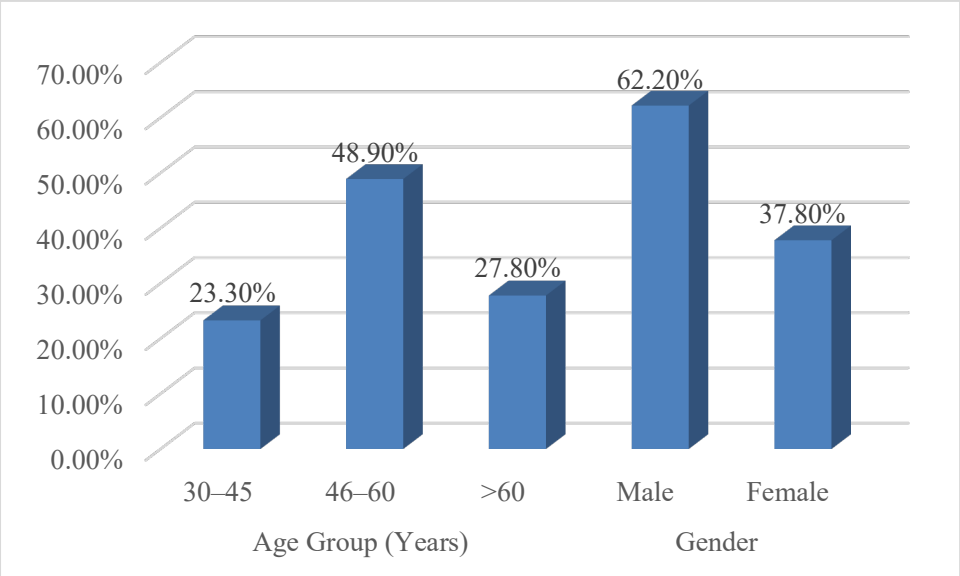

Figure 1: Graphical Representation on the percentage of Distribution of study Participants

The age-wise distribution of the study subjects indicated that most of the diabetic patients fell under the age category of 46-60 years, with 88 patients (48.9%), meaning that middle-aged adults were the greatest population of the study subjects. This was then followed by those aged over 60 years of age since they constituted 50 participants (27.8%), with 30-45 years age group being the least with 42 participants (23.3%). The results indicate that diabetes and its accompanying hospital admission were higher in middle-aged and elderly patients. In terms of gender distribution, the male patients dominated, 112 participants (62.2%), and the female patients, 68 participants (37.8%). The increased percentage of males can be a sign of higher prevalence of diagnosed Diabetes Mellitus in males in the study context or increased health-seeking behaviour in male patients. In general, the research sample was mostly made up of middle-aged diabetic men.

Table 2: Incidences of Ocular Complications in Diabetic Patients.

Ocular Complication	Frequency	Percentage (%)
Diabetic Retinopathy	52	28.9%
Cataract	38	21.1%
Refractive Error	24	13.3%
Dry Eye Syndrome	18	10.0%
Glaucoma	10	5.6%
Macular Edema	8	4.4%
No Ocular Complication	30	16.7%
Total	180	100.0%

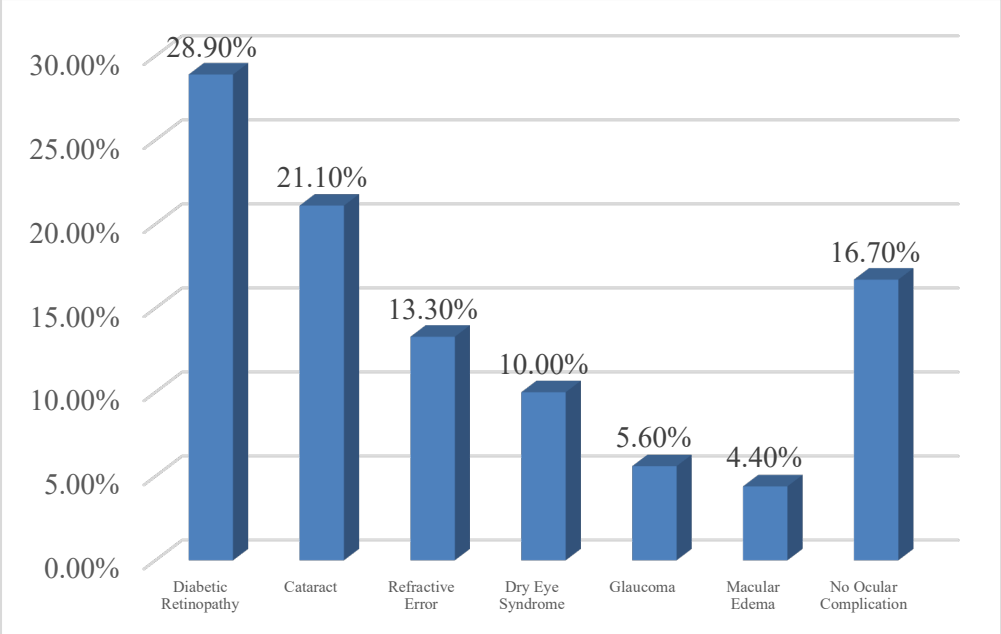

Figure 2: Graphical Representation on the percentage of Ocular Complication

The table 2 above shows the prevalence of the ocular complications among the 180 patients diagnosed with Diabetes Mellitus. The results show that the most prevalent ocular complication was Diabetic Retinopathy with 52 patients (28.9%), and the retinal involvement is still the primary complication of diabetes in the subjects. This was then followed by cataract which was seen in 38 patients (21.1%), which gave a high prevalence of lens opacities in diabetics. The most common visual and ocular surface issues that were prevalent with diabetes were the refractive errors (13.3% and 24 patients) and the dry eye syndrome (10.0% and 18 patients). The fewer patients prevalence occurred in glaucoma and macular edema (10 and 8 patients, respectively) and had lower levels of prevalence (5.6 and 4.4). It is noteworthy that 30 patients (16.7) did not have any ocular complications. In general, the findings suggest that a significant percentage of diabetic patients experienced at least one or more ocular abnormalities emphasizing the significance of regular ophthalmic screening, its early detection, and timely intervention to avoid visual impairment.

Table 3: Pattern of retinopathy severity in diabetes.

Severity of Retinopathy	Frequency	Percentage (%)
Mild NPDR	20	11.1%
Moderate NPDR	16	8.9%
Severe NPDR	9	5.0%
PDR	7	3.9%
No Retinopathy	128	71.1%
Total	180	100.0%

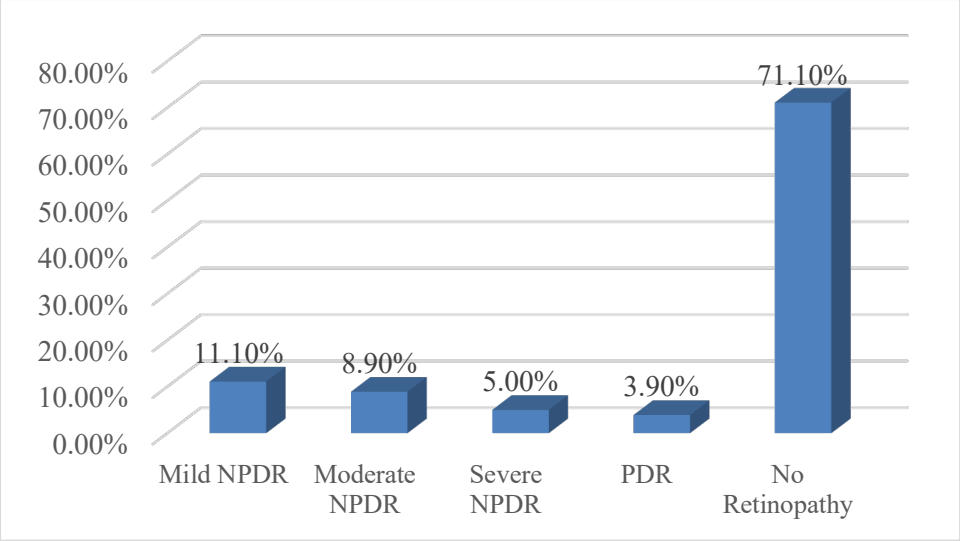

Figure 3: Graphical Representation on the percentage of Severity of Retinopathy

Table 3 shows the severity distribution of Diabetic Retinopathy of the overall study sample, 180 diabetic patients. The results indicate that most patients, 128 (71.1%), did not have retinopathy which shows that a significant number of participants did not exhibit retinal involvement during the test. The most frequent stage (Mild Non-Proliferative Diabetic Retinopathy (NPDR)) was present in 20 patients (11.1%), indicating the initial retinal microvascular alterations in a significant number of patients. Moderate NPDR was identified in 16 (8.9) patients and Severe NPDR was found in 9 (5.0) patients, which show progressive retinal damage. The most common but least prevalent was Proliferative Diabetic Retinopathy (PDR) with 7 patients (3.9%), where the retina exhibited evidence of abnormal neovascularization and more sensitive to having extreme loss of vision. This table shows that despite the fact that majority of the patients have not suffered retinopathy, a lot of patients had different levels of retinal disease and it is essential to mention that the retina should be screened regularly and diabetic patients should be treated at an early stage.

Table 4: Time of Diabetes and the Ocular Complications.

Duration of Diabetes	Ocular Complication Present	Absent	Total
<5 years	24	26	50
5–10 years	48	18	66
>10 years	70	4	74
Total	142	48	180

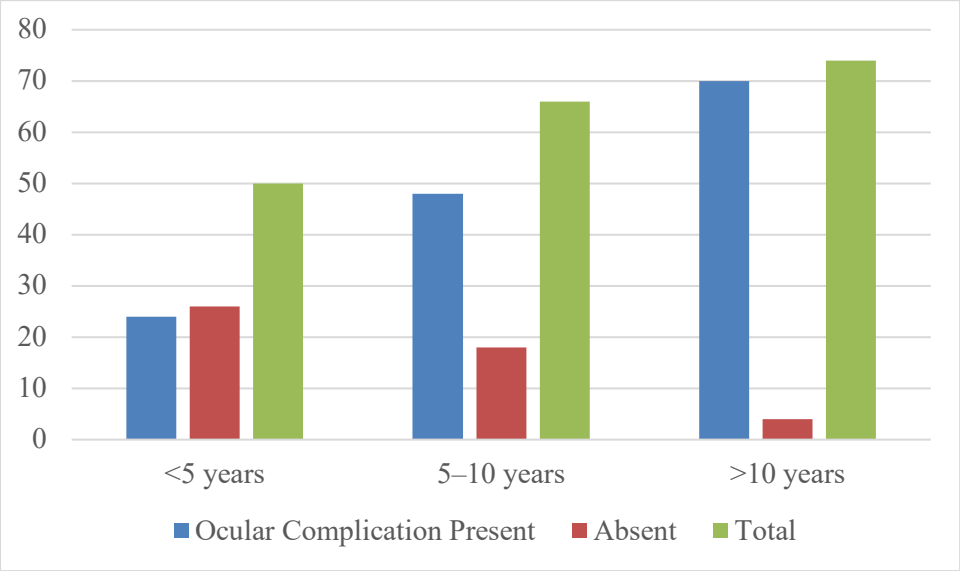

Figure 4: Graphical Representation on the percentage of Duration of Diabetes

Table 4 illustrates the relationship between the years of Diabetes Mellitus and the occurrence of ocular complications among the participants in the study. The results clearly show that the incidence of ocular complications rose with the protracted duration of diabetes. Ocular complications were observed in 24 patients and no complications in 26 patients having a disease duration of less than 5 years, which shows that the burden of ocular complications was relatively lower in the first years of illness. Ocular complications were noted among the 5-10 years duration group of 48 patients and no complications in 18 patients indicating that ocular involvement increased significantly with longer duration of the study. The prevalence was highest in patients whose diabetes duration was over 10 years with 70 patients getting ocular complications and 4 patients not getting complications indicating a very high rate of occurrence in long-standing diabetes. In general, the evidence indicates a significant risk of ocular complications development with long-term diabetes and the need to conduct regular eye check-ups and preventive treatment at the earliest stage, especially in long-term patients.

Table 5: Glycemic Control (HbA1c) and Ocular Complications.

HbA1c Level	Complication Present	Absent	Total
<7%	26	24	50
7–9%	54	18	72
>9%	62	6	68
Total	142	48	180

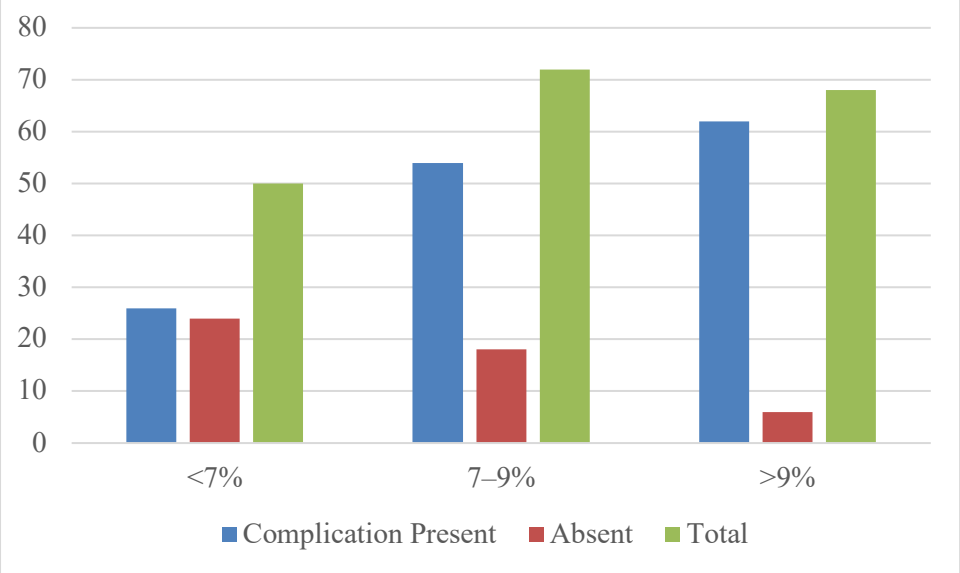

Figure 4: Graphical Representation on the percentage of HbA1c Level

Table 5 shows the correlation between glycemic control, as measured by HbA1c levels, and the occurrence of ocular complications in patients with Diabetes Mellitus. The results suggest that ocular complications were more prevalent in case of worse glycemic control. In patients with HbA1c below 7, which is quite good glycemic control, the patients with ocular complications were 26, whereas only 24 showed no complications, and the distribution was relatively balanced. In the group with HbA1c between 7 and 9, 54 out of 72 patients were found to be having complications and 18 patients none whatsoever had any ocular involvement indicating a substantial escalation of the complications with intermediate hyperglycemia. Patients with ocular complications were noted to be the highest in cases where patients had HbA1c levels over 9 and 62 and 6 patients had ocular complications and were without ocular disease respectively which demonstrates that there is a strong correlation between poor glycemic control and eye-related complications. In general, the data indicate that uncontrolled diabetes is a major risk factor in the pathogenesis of ocular complications, and it is necessary to adhere to the glycemic control, periodically check the level of HbA1c, and detect the presence of ophthalmic complications at the initial stages to avoid the consequences that can lead to the loss of vision.

Table 6: Correlation of Clinical Variables with ocular Complications.

Variable	Test Applied	Test Value	p-value	Significance
Duration of Diabetes vs Ocular Complications	Chi-square	32.84	<0.001	Significant
HbA1c vs Ocular Complications	Chi-square	26.19	<0.001	Significant
Mean Duration (With vs Without Complications)	Independent t-test	5.96	<0.001	Significant

Table 6 shows the statistical relationship between the variables of choice and ocular complications in patients with Diabetes Mellitus. The results show that the correlation between the length of diabetes and ocular complications is very strong because the Chi-square test value of 32.84 and p-value of less than 0.001 show that the longer the disease is, the greater the risk of developing ocular complications. In the same way, the relationship between the level of HbA1c and ocular complications was statistically significant, with Chi-square value of 26.19 and p-value <0.001 indicating that high levels of glucose in the blood are closely related to occurrence of diabetes-related eye disorders. Moreover, the mean duration of diabetes in diabetics with and without ocular complications was compared using Independent t-test, the result of which was a test value of 5.96 and a p-value of less than 0.001, indicating that patients who developed ocular complications had a longer period of diabetes compared to those who did not develop the complication. In general, the results of this table prove that the long-term period of diabetes and insufficient glycemic regulation are key factors that predispose ocular complications, and timely diagnosis, follow-up, and proper metabolic management should be used to minimize vision threatening outcomes.

Discussion

The current hospital-based research was carried out to determine the incidence and trend of ocular complications in Diabetes Mellitus patients [11]. The results of the study indicated that most of the patients who came to see the hospital were between the ages of 46-60 years (48.9%), then patients over 60 years of age (27.8%), which means that the middle-aged and elderly population was the greatest burden of diabetic patients in the hospital [12]. The prevalence in men (62.2) as compared to women (37.8) could be blamed on lifestyle factors, or increased exposure to systemic risk factors, or more favorable healthcare-seeking behavior in men [13]. The same gender and age pattern has been observed in earlier hospital based research where the rising age was observed to be a significant factor to diabetes and its associated complications. These results indicate that the age effect is still a major risk factor of ocular morbidity in diabetic patients [14].

The cases of ocular complications in the present study were very high which highlights the deplorable implications of diabetes to the ocular state. The most prevalent complication, as was found, was Diabetic Retinopathy since it was found in 28.9% of the patients, which can also be supported by the previous evidence that diabetic retinopathy is the most prevalent microvascular eye complication, and a significant cause of avoidable blindness [15]. The second most prevalent illness was cataract (21.1% of patients), then came refractive error (13.3%), dry eye syndrome (10.0%), glaucoma (5.6%), and macular edema (4.4%). These results show that retinal disease is not the only problem prone to diabetic patients, but also lens, optic nerve, and ocular surface diseases [16]. The pattern of the severity of the retinopathy also revealed that Mild NPDR was the most prevalent other than higher percentages had the advanced stages like PDR which indicated that a substantial number of patients were diagnosed at a young age although some still managed to turn up with vision threatening disease at a late age [17].

The second significant finding of the research was that the association between ocular complications and the duration of diabetes, as well as the glycemic control, were statistically significant [18]. Ocular complications were most prevalent in patients with a duration of diabetes of over 10 years, suggesting that hyperglycemia has a cumulative microvascular effect over time. Equally, patients whose HbA1C was above 9% were found to have the highest burden of ocular disease which proves that poor glycemic control significantly predisposes patients to eye complications [19]. The results of the Chi-square and Independent t-tests showed that the associations between metabolic control and disease duration were highly significant ($p<0.001$) and confirmed that the two are significant predictors of ocular morbidity [20]. Altogether, the current research stresses that routine ophthalmic examination, early diagnosis, close monitoring of blood sugar levels, and prompt treatment are the key measures to minimize the risk of loss of visual function in diabetes and enhance the quality of life of patients with it.

Conclusion

The current hospital-based research is able to conclude that ocular complications are prevalent in patients with Diabetes Mellitus and are a major cause of morbidity and possible visual impairment. The most common ocular complication was found to be Diabetic Retinopathy then cataract, refractive error, dry eye syndrome, glaucoma and macular

edema. These results show that diabetes can negatively impact various ocular structures and be progressive in causing visual impairment unless it is treated or detected.

The study also revealed that the risk of developing ocular complications increased significantly with the duration of diabetes and poor glycemic control particularly in patients with HbA1c levels greater than 9% and a disease duration of more than 10 years. This proves that chronic hyperglycemia and long-term exposure to the disease are also key determinants of eye disease related to diabetes.

In general, the results highlight the importance of regular thorough eye tests, early diagnosis, educating and training patients, lifestyle change, and rigorous blood sugar control as key elements of diabetic management. Prompt ophthalmic care and multidisciplinary care can significantly decrease the blindness which is avoidable and enhance the quality of life of diabetic patients as a whole.

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