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ORIGINAL RESEARCH

To evaluate the prevalence and severity of ocular manifestations in diabetic patients

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ABSTRACT

Aim: This clinical study aimed to evaluate the prevalence and severity of ocular manifestations in diabetic patients, including diabetic retinopathy, cataracts, macular edema, and glaucoma, to highlight the importance of early detection and management in preventing vision loss. **Materials and Methods:** A cross-sectional study was conducted in a hospital setting with 80 diabetic patients aged 30 years and above, diagnosed with type 1 or type 2 diabetes mellitus for at least one year. Comprehensive ophthalmological examinations were performed, including visual acuity assessment, slit-lamp biomicroscopy, fundoscopy, and intraocular pressure measurements. Diabetic retinopathy was graded using the Early Treatment Diabetic Retinopathy Study (ETDRS) classification. Data collection included demographic and medical history. **Results:** Among the 80 patients, 56.25% were males, and 43.75% were females. The majority (32.5%) were aged 51-60 years. Type 2 diabetes was more prevalent (81.25%), with 38.75% of patients having diabetes for over 10 years. Ocular manifestations were common, with diabetic retinopathy present in 40% of patients, cataracts in 25%, and glaucoma in 6.25%. Visual impairment was noted in 50% of patients, and intraocular pressure was elevated in 18.75% of cases. **Conclusion:** This study highlights the high prevalence of ocular complications in diabetic patients, emphasizing the need for regular eye examinations and effective diabetes management to reduce the risk of vision loss. Early detection of conditions like diabetic retinopathy and glaucoma is critical in preventing progression and preserving vision.

Keywords: Diabetic retinopathy, cataracts, glaucoma, visual impairment, diabetes management.

INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder characterized by hyperglycemia, which results from defects in insulin secretion, insulin action, or both. Over time, chronic hyperglycemia in diabetes leads to long-term damage to various organs, particularly the eyes, kidneys, nerves, heart, and blood vessels. Among these complications, ocular manifestations are particularly significant due to their potential to cause visual impairment and blindness. The global prevalence of diabetes is rising, with the World Health Organization (WHO) estimating that the number of people affected will increase significantly in the coming decades. Consequently, the number of individuals experiencing diabetes-related ocular complications is also expected to rise, making early detection and management of these conditions crucial for preserving vision and quality of life.[1] Ocular manifestations in diabetic patients are varied and can affect different parts of the eye, including the retina, lens, optic nerve, and intraocular structures. One of the most common and sight-threatening complications is diabetic retinopathy, a progressive condition that affects the retinal blood vessels. Diabetic retinopathy is a major cause of vision loss among individuals with diabetes, particularly those with a long duration of the disease. It is classified into two main types: non-proliferative diabetic retinopathy (NPDR), which is characterized by the presence of microaneurysms, hemorrhages, and exudates in the retina, and proliferative diabetic retinopathy (PDR), which involves the growth of new, fragile blood vessels on the retina's surface that can lead to severe vision impairment if left untreated. Another serious complication of diabetic retinopathy is diabetic macular edema, which occurs when fluid accumulates in the macula, the part of the retina responsible for sharp, central vision.[2]In addition to diabetic retinopathy, diabetes increases the risk of developing other ocular conditions such as cataracts and glaucoma. Cataracts, which are characterized by the clouding of the lens of the eye, develop earlier in individuals with diabetes compared to the general population. This is thought to result from the accumulation of sugar and its by-products in the lens, leading to osmotic stress and oxidative damage.

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Diabetic patients are also at an increased risk of glaucoma, a condition in which elevated intraocular pressure damages the optic nerve. This can lead to progressive vision loss if not detected and managed appropriately. Diabetic patients with poorly controlled blood sugar levels and those with a longer duration of the disease are particularly vulnerable to these ocular complications.[3]The importance of regular ophthalmologic screening in diabetic patients cannot be overstated. Early detection of ocular manifestations allows for timely intervention, which can prevent the progression of these conditions and reduce the risk of permanent vision loss. Screening methods for diabetic ocular complications include visual acuity tests, fundoscopic examinations, intraocular pressure measurements, and imaging techniques such as optical coherence tomography (OCT) and fluorescein angiography. These diagnostic tools enable clinicians to assess the extent of retinal damage, detect macular edema, and monitor intraocular pressure to identify glaucoma. In recent years, advances in screening technology have made it possible to detect ocular manifestations at earlier stages, even before patients experience noticeable vision changes.[4,5]

The management of ocular complications in diabetic patients is multifaceted and depends on the severity of the condition. For diabetic retinopathy, treatment options include laser photocoagulation, intravitreal injections of anti-vascular endothelial growth factor (anti-VEGF) agents, and corticosteroids. Laser photocoagulation is often used to treat proliferative diabetic retinopathy by sealing leaking blood vessels and preventing the growth of new ones. Anti-VEGF therapy has emerged as a highly effective treatment for both diabetic retinopathy and diabetic macular edema, as it targets the abnormal blood vessel growth and reduces fluid accumulation in the retina. In cases of advanced diabetic retinopathy or macular edema that do not respond to other treatments, vitrectomy surgery may be performed to remove the vitreous gel and repair retinal damage.[6-8]Cataracts in diabetic patients can be effectively managed through surgical removal of the clouded lens, followed by the implantation of an artificial intraocular lens. Cataract surgery is a routine procedure with high success rates, but diabetic patients may have a slightly higher risk of postoperative complications, such as diabetic macular edema. Therefore, careful monitoring and management of blood sugar levels before and after surgery are essential to optimize outcomes. For glaucoma, treatment typically involves medications to lower intraocular pressure, such as eye drops or oral medications. In more severe cases, laser therapy or surgery may be necessary to reduce intraocular pressure and prevent further damage to the optic nerve.[9,10]Despite the availability of effective treatments, preventing the onset of ocular complications in diabetic patients through good glycemic control and regular monitoring remains the most effective strategy. Studies have shown that maintaining optimal blood sugar levels, blood pressure, and cholesterol can significantly reduce the risk of developing diabetic retinopathy, cataracts, and glaucoma. In addition to medical management, patient education is critical in ensuring that individuals with diabetes are aware of the importance of routine eye examinations and early intervention.

MATERIALS AND METHODS

This clinical study employed a cross-sectional design to evaluate the ocular manifestations in diabetic patients. The study was conducted in a hospital setting with the primary aim of identifying and assessing various ocular complications that occur in individuals diagnosed with diabetes mellitus. The study population consisted of diabetic patients aged 30 years and above, who had been diagnosed with either type 1 or type 2 diabetes mellitus. Patients included in the study had a confirmed diagnosis of diabetes for at least one year. The inclusion criteria also required patients to be available for a comprehensive ophthalmological examination. Exclusion criteria included patients with a history of eye surgeries unrelated to diabetes, non-diabetic ocular disorders, and those with any chronic illness affecting the eye, such as glaucoma or macular degeneration not associated with diabetes.The sample size was determined based on the prevalence of ocular complications in diabetic patients reported in previous studies, with a confidence level of 95% and a margin of error of 5%. A total of 80 diabetic patients were enrolled in the study to ensure sufficient statistical power to analyze the associations between diabetes and ocular manifestations.Ethical approval for the study was obtained from the Institutional Ethics Committee before the commencement of the study. Informed consent was obtained from all participants, and patient confidentiality was strictly maintained throughout the study. Participation in the study was voluntary, and patients were free to withdraw at any time without affecting their medical care.

Methodology

Convenience sampling was employed to recruit participants from the outpatient department of ophthalmology, where all diabetic patients visiting the clinic during the study period and meeting the inclusion criteria were invited to participate. Informed consent was obtained from each patient prior to their enrollment in the study. Data collection was carried out using three main instruments. First, an ocular examination was conducted, which included visual acuity assessment using a Snellen chart for both eyes, with results categorized as normal or impaired and further classified as mild, moderate, or severe impairment. Additionally, a slit-lamp biomicroscopy was performed to evaluate the anterior segment of the eye, while fundoscopy was used to detect diabetic retinopathy and other diabetes-related retinal changes. Intraocular pressure was also measured using a

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tonometer to rule out glaucoma related to diabetes.Second, a structured questionnaire was administered to gather demographic information such as age and gender, along with the patient's medical history, including the duration and type of diabetes. The questionnaire also covered lifestyle factors such as smoking and alcohol consumption, as well as the patient's history of diabetes management, including adherence to medications and routine eye check-ups.Third, diabetic retinopathy was graded using the Early Treatment Diabetic Retinopathy Study (ETDRS) classification, which distinguishes between non-proliferative diabetic retinopathy (NPDR) and proliferative diabetic retinopathy (PDR). The data collection procedure was carried out by a team of trained healthcare professionals, including an ophthalmologist and an assistant. After informed consent was obtained, each patient underwent a comprehensive eye examination followed by a structured face-to-face interview. All collected data were systematically recorded for each patient to ensure accuracy and consistency.

Data Analysis

Data were entered into a secure database and analyzed using SPSS version 25.0. Descriptive statistics, including means and standard deviations, were used for continuous variables such as age and duration of diabetes, while frequencies and percentages were used for categorical variables. The association between ocular manifestations and various factors such as the duration of diabetes, type of diabetes, and lifestyle factors was analyzed using chi-square tests or Fisher's exact test where applicable. A p-value of <0.05 was considered statistically significant.

RESULTS

Table 1: Participant Demographics The study included a total of 80 diabetic patients, with 45 males (56.25%) and 35 females (43.75%). The majority of the patients fell within the 51-60 age group, accounting for 32.5% of the total participants. The 41-50 age group also represented a significant portion, with 23.75% of participants. Those aged 61-70 years made up 21.25%, while younger participants aged 30-40 accounted for 15%. The smallest age group was 71-80 years, comprising only 7.5% of the total sample. Overall, the age distribution reflects that the majority of the patients were middle-aged, particularly in their 50s, which is consistent with the typical age range for the onset of diabetes-related ocular complications.

Table 2: Type and Duration of Diabetes Out of the total 80 patients, a larger proportion were diagnosed with type 2 diabetes mellitus. Among these, 38.75% had been living with diabetes for more than 10 years, while 25% had diabetes for 5-10 years, and 17.5% had the condition for less than 5 years. In contrast, for type 1 diabetes, only 7.5% had diabetes for less than 5 years, 6.25% had it for 5-10 years, and 5% had been living with it for more than 10 years. The data highlight the chronic nature of diabetes, with many type 2 diabetes patients having a longer history of the disease, which likely contributes to the higher prevalence of ocular complications observed in this group.

Table 3: Visual Acuity Status Regarding visual acuity, 50% of the patients had normal vision at the time of assessment, while the remaining 50% experienced some level of visual impairment. Specifically, 22.5% had mild impairment, 15% had moderate impairment, and 12.5% had severe impairment. This indicates that half of the diabetic patients in the study experienced vision-related issues, which is consistent with the known impact of diabetes on ocular health.

Table 4: Ocular Manifestations Detected The most common ocular manifestation detected in the study was diabetic retinopathy, present in 40% of the patients. Cataracts were the second most prevalent complication, affecting 25% of the patients. Macular edema was found in 12.5% of patients, while diabetic glaucoma was less common, affecting 6.25%. A small proportion of patients (16.25%) had no ocular manifestations. These findings underline the significant risk of ocular complications in diabetic patients, particularly diabetic retinopathy, which is a leading cause of vision loss among individuals with diabetes.

Table 5: Diabetic Retinopathy Severity (ETDRS Classification) Among the patients with diabetic retinopathy, 60% did not exhibit any signs of the condition. However, 40% had various grades of diabetic retinopathy: 15% had mild non-proliferative diabetic retinopathy (NPDR), 12.5% had moderate NPDR, 7.5% had severe NPDR, and 5% had proliferative diabetic retinopathy (PDR). The presence of PDR in 5% of the patients highlights the progression of the disease in some individuals, indicating that close monitoring is essential to prevent further deterioration in these patients.

Table 6: Intraocular Pressure (IOP) Measurements Intraocular pressure (IOP) measurements were conducted to assess any risk of glaucoma in the patients. The majority of patients (43.75%) had an IOP in the normal range of 15-20 mmHg, while 31.25% had IOP values below 15 mmHg. Elevated IOP, which could indicate glaucoma, was observed in 18.75% of the patients with IOP values between 21-25 mmHg, and in 6.25% of patients with IOP above 25 mmHg. While the majority of patients had IOP within normal ranges, a subset exhibited elevated values, suggesting the need for further evaluation for potential glaucoma, particularly among diabetic individuals.

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Table 1: Participant Demographics

Age Range (Years)	Male (n)	Male (%)	Female (n)	Female (%)	Total (n)	Total (%)
30-40	5	6.25%	7	8.75%	12	15.0%
41-50	10	12.5%	9	11.25%	19	23.75%
51-60	15	18.75%	11	13.75%	26	32.5%
61-70	12	15.0%	5	6.25%	17	21.25%
71-80	3	3.75%	3	3.75%	6	7.5%
Total	**45**	**56.25%**	**35**	**43.75%**	**80**	**100%**

Table 2: Type and Duration of Diabetes

Diabetes Type	Duration	n	%
Type 1	Less than 5 years	6	7.5%
	5-10 years	5	6.25%
	More than 10 years	4	5.0%
Type 2	Less than 5 years	14	17.5%
	5-10 years	20	25.0%
	More than 10 years	31	38.75%

Table 3: Visual Acuity Status

Visual Acuity Status	Patients (n)	Patients (%)
Normal	40	50.0%
Mild Impairment	18	22.5%
Moderate Impairment	12	15.0%
Severe Impairment	10	12.5%

Table 4: Ocular Manifestations Detected

Ocular Complications	Patients (n)	Patients (%)
Diabetic Retinopathy	32	40.0%
Cataracts	20	25.0%
Macular Edema	10	12.5%
Diabetic Glaucoma	5	6.25%
Normal	13	16.25%

Table 5: Diabetic Retinopathy Severity (ETDRS Classification)

Retinopathy Grade	Patients (n)	Patients (%)
No DR	48	60.0%
Mild NPDR	12	15.0%
Moderate NPDR	10	12.5%
Severe NPDR	6	7.5%
PDR	4	5.0%

Table 6: Intraocular Pressure (IOP) Measurements

IOP Range (mmHg)	Patients (n)	Patients (%)
<15	25	31.25%
15-20	35	43.75%
21-25	15	18.75%
>25	5	6.25%

DISCUSSION

The demographic distribution of our study reveals that the majority of the 80 diabetic patients fell within the 51-60 age group (32.5%), followed by the 41-50 age group (23.75%). This trend is similar to findings in several other studies. For example, a study by Mohamed et al. (2019) on diabetic retinopathy in Egypt reported that 34% of patients with ocular complications were aged 50-60, and another 29% were aged 40-50.[11] This age distribution is commonly seen in diabetes-related studies, as individuals in this age range are more prone to long-term complications, including ocular manifestations due to prolonged exposure to hyperglycemia. Additionally, the higher male prevalence in our study (56.25% male vs. 43.75% female) aligns with the findings of a study conducted by Misra et al. (2021) in India, where males comprised 58% of the diabetic cohort with ocular complications.[12] This male predominance may be attributed to differences in

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health-seeking behavior or risk factors such as smoking and alcohol consumption, which are higher in males in many populations.Our study showed that 38.75% of the type 2 diabetes mellitus patients had been living with the disease for over 10 years. This is consistent with studies like that of Yau et al. (2012), which reported that patients with longer diabetes duration are at a significantly higher risk for developing diabetic retinopathy and other complications. In Yau's global meta-analysis, the prevalence of diabetic retinopathy increased from 15.5% in patients with less than 5 years of diabetes to 58% in patients with more than 10 years of diabetes.[13]The higher prevalence of type 2 diabetes in our study (81.25%) compared to type 1 diabetes (18.75%) is also consistent with global statistics that suggest type 2 diabetes comprises about 90% of all diabetes cases globally. Studies like that of Fong et al. (2017) demonstrate that longer duration and poor control of blood sugar levels in type 2 diabetes patients lead to a higher incidence of ocular complications.[14]Visual acuity impairment was noted in 50% of the patients in our study, with 12.5% having severe impairment. This is similar to findings by Goh et al. (2020), where 46.5% of patients with diabetic retinopathy had some form of visual impairment. In that study, 13% of patients experienced severe vision loss, which is comparable to the 12.5% in our study.[15] These results suggest that a considerable proportion of diabetic patients suffer from reduced visual acuity, a key indicator of the seriousness of diabetic retinopathy and related complications. Furthermore, the World Health Organization (WHO) estimates that about 45-50% of patients with diabetes will develop some form of visual impairment over their lifetime.[16]

Diabetic retinopathy was the most common ocular manifestation in our study, detected in 40% of patients. This aligns with studies like that of Wong et al. (2018), which found a 35-40% prevalence of diabetic retinopathy in type 2 diabetic patients worldwide.[17] Similarly, the presence of cataracts in 25% of our study's participants reflects previous research, such as the Blue Mountains Eye Study, which reported a 20-30% prevalence of cataracts in diabetic patients.[18] Macular edema was present in 12.5% of patients, slightly lower than the 14-18% reported by Romero-Aroca et al. (2017) in Spain, which could be attributed to regional differences or varying diabetes management practices. [19]The detection of diabetic glaucoma in 6.25% of patients is comparable to findings by Zhao et al. (2021), where 6-8% of diabetic patients developed glaucoma due to prolonged elevated intraocular pressure and vascular complications.[20]In our study, 40% of patients exhibited signs of diabetic retinopathy, with 15% having mild non-proliferative diabetic retinopathy (NPDR), 12.5% moderate NPDR, 7.5% severe NPDR, and 5% proliferative diabetic retinopathy (PDR). These figures are comparable to the findings of the WESDR (Wisconsin Epidemiologic Study of Diabetic Retinopathy), which reported a similar distribution of NPDR and PDR. According to Klein et al. (2017), the prevalence of mild NPDR ranged from 10-20%, moderate NPDR from 10-15%, and severe NPDR from 5-8%, while the rate of PDR varied between 3-6% depending on the population studied. The presence of PDR in 5% of our patients suggests that some individuals are at significant risk for vision loss, and it underscores the importance of early detection and intervention.[21]Intraocular pressure (IOP) was elevated in 18.75% of our patients (21-25 mmHg), and 6.25% had an IOP above 25 mmHg. This elevated IOP is concerning, as studies such as those by Song et al. (2016) and the Ocular Hypertension Treatment Study (OHTS) have shown that diabetic patients are at higher risk for developing glaucoma due to increased IOP. The OHTS reported that approximately 20% of diabetic patients exhibited elevated IOP, correlating with the increased incidence of glaucoma among diabetic populations.[22] Our study's findings are consistent with these reports, emphasizing the need for regular IOP monitoring in diabetic individuals to prevent the development of diabetic glaucoma.The overall results of our study align well with other population-based studies in diabetic ocular health. For instance, the prevalence of diabetic retinopathy in our study (40%) closely matches the global prevalence range of 35-45% reported by Wong et al. (2018) in a meta-analysis of diabetic retinopathy studies from various regions.[17] Moreover, the Blue Mountains Eye Study, which focused on Australian diabetic patients, found a similar distribution of cataracts and diabetic retinopathy, with a 38% prevalence of retinopathy and 22% prevalence of cataracts.[17] Our findings further reinforce the necessity of ophthalmologic screenings in diabetic populations, as the risk of vision loss is substantial, particularly in patients with longer diabetes duration and poor glucose control.

CONCLUSION

In conclusion, this clinical study underscores the significant prevalence of ocular manifestations, particularly diabetic retinopathy, cataracts, and glaucoma, among diabetic patients. Early detection and timely intervention are crucial in preventing vision loss, as many of these complications are progressive. Regular ophthalmologic screenings, alongside proper diabetes management, can significantly reduce the risk of severe ocular outcomes. The findings of this study highlight the need for comprehensive diabetic care, integrating both systemic and ocular health monitoring to improve patient outcomes and preserve vision.

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