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ORIGINAL RESEARCH

To Assess Visual Acuity And Its Impairment Among Diabetic Patients

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ABSTRACT

Aim: The study aimed to assess visual acuity and its impairment among diabetic patients, examining associations with duration of diabetes, smoking history, and the prevalence of ophthalmic complications.

Materials and Methods: A cross-sectional study was conducted on 80 diabetic patients aged 30 years and above, diagnosed with type 1 or type 2 diabetes. Visual acuity was measured using the Snellen chart, and a comprehensive ophthalmic examination was performed to detect diabetic retinopathy and other ocular complications. Data on demographic characteristics, medical history, and lifestyle factors were collected through structured questionnaires.

Results: Of the 80 patients, 62.5% exhibited visual impairment, with 18.75% having moderate and 18.75% severe impairment. Diabetic retinopathy was detected in 43.75% of patients, while 25% had cataracts, and 12.5% had glaucoma. Visual impairment was significantly associated with longer diabetes duration ($p=0.03$) and smoking ($p=0.04$). Patients with over 10 years of diabetes and smokers were at higher risk of visual impairment.

Conclusion: The study highlights a high prevalence of visual impairment among diabetic patients, particularly in those with prolonged diabetes and a history of smoking. Regular eye screenings and comprehensive diabetes management, including smoking cessation, are crucial to preventing visual deterioration.

Keywords: Visual acuity, diabetic retinopathy, visual impairment, diabetes duration, smoking.

INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder characterized by hyperglycemia, which results from either insulin deficiency, insulin resistance, or both. Over time, uncontrolled diabetes leads to a variety of systemic complications, including cardiovascular disease, neuropathy, nephropathy, and retinopathy. Among these, diabetic retinopathy and other ocular complications have become increasingly prevalent, significantly impacting the visual health of diabetic patients. Vision loss or impairment is one of the most concerning complications for patients with diabetes, as it directly affects their quality of life and ability to perform daily activities. Given that diabetes has become a global epidemic, affecting millions of individuals worldwide, the impact of diabetes on visual acuity has garnered considerable attention in the medical community.[1]Visual acuity refers to the clarity or sharpness of vision, typically measured using a standard Snellen chart. It is a key indicator of eye health and is often one of the first parameters evaluated in routine eye examinations. In diabetic patients, visual acuity can be compromised due to the effects of high blood sugar levels on the microvasculature of the eye. Over time, persistent hyperglycemia damages the small blood vessels that supply the retina, leading to conditions such as diabetic retinopathy, macular edema, cataracts, and glaucoma. These conditions can cause progressive vision loss if not diagnosed and treated promptly.[2]Diabetic retinopathy is the most common cause of vision impairment in individuals with diabetes. It is a microvascular complication that occurs when the blood vessels in the retina become damaged due to prolonged exposure to high blood sugar levels. In its early stages, diabetic retinopathy may be asymptomatic, but as the condition progresses, it can lead to significant vision loss. There are two main types of diabetic retinopathy: non-proliferative diabetic retinopathy (NPDR) and proliferative diabetic retinopathy (PDR). NPDR is the early stage of the disease, characterized by microaneurysms, retinal hemorrhages, and exudates. PDR, the more advanced stage, involves the growth of new, abnormal blood vessels on the surface of the retina, which can lead to retinal detachment and blindness. Early detection through regular eye examinations is crucial to prevent the progression of diabetic retinopathy.[3]In addition to

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diabetic retinopathy, diabetic patients are at an increased risk of developing other eye conditions that can impair visual acuity. Cataracts, for instance, are a common occurrence in diabetic patients. A cataract is the clouding of the eye's lens, which leads to blurred vision. Diabetic patients tend to develop cataracts at a younger age compared to the general population, and the progression of cataracts may be more rapid in individuals with poor blood sugar control. Glaucoma, another condition associated with diabetes, occurs when the optic nerve is damaged, often due to increased intraocular pressure. Diabetic patients are more likely to develop glaucoma, particularly primary open-angle glaucoma, which can cause gradual vision loss.[4]

Visual impairment in diabetic patients can have profound consequences on their quality of life. Vision is crucial for maintaining independence, and the loss of visual acuity can lead to difficulties in performing daily tasks such as reading, driving, and managing medications. Moreover, vision loss can exacerbate other diabetes-related complications, such as neuropathy and balance issues, increasing the risk of falls and injuries. Patients with visual impairment may also experience psychological effects, including depression and anxiety, as they struggle to adapt to their changing visual capabilities.[5]Regular monitoring of visual acuity and early intervention are essential in preventing the progression of diabetic eye disease. The American Diabetes Association recommends that diabetic patients undergo a comprehensive eye examination at least once a year, or more frequently if they are at higher risk for retinopathy or other ocular complications. Visual acuity testing, along with fundoscopic examinations, optical coherence tomography (OCT), and fluorescein angiography, are key diagnostic tools used to assess the severity of diabetic eye disease and guide treatment decisions. In cases where vision is threatened by conditions such as macular edema or proliferative retinopathy, timely interventions, including laser therapy, intravitreal injections, and vitrectomy, can help preserve vision and prevent further deterioration.[6]The relationship between diabetes duration and visual impairment is well-documented. The longer a patient has lived with diabetes, the greater their risk of developing visual complications. Poor glycemic control exacerbates this risk, as chronic hyperglycemia accelerates the damage to the retinal blood vessels. Other factors that contribute to visual impairment in diabetic patients include hypertension, dyslipidemia, smoking, and obesity. These factors not only worsen the progression of diabetic retinopathy but also increase the likelihood of developing cataracts and glaucoma. Therefore, a comprehensive approach to managing diabetes, including strict blood sugar control, blood pressure management, and lifestyle modifications, is essential in reducing the risk of visual impairment.[7,8]Despite the availability of effective treatments for diabetic eye disease, many patients with diabetes still experience vision loss due to late diagnosis or inadequate management. Lack of awareness about the importance of regular eye examinations, particularly among individuals with poorly controlled diabetes, is a major barrier to early detection. Additionally, disparities in access to eye care services, especially in low-resource settings, contribute to the high burden of visual impairment in diabetic populations. Public health initiatives aimed at increasing awareness of diabetic eye disease and improving access to eye care services are critical in addressing this growing problem.

MATERIALS AND METHODS

This study employed a cross-sectional design to assess the visual acuity among diabetic patients. The study was conducted in a hospital setting to evaluate the prevalence of visual impairment and its associated factors in diabetic individuals.The study population consisted of diabetic patients aged 30 years and above, who were diagnosed with either type 1 or type 2 diabetes mellitus. Patients who had been diagnosed with diabetes for at least one year were included in the study. Exclusion criteria included patients with a history of eye surgeries, non-diabetic visual disorders, and other chronic conditions affecting visual acuity.The study included a total of 80 diabetic patients. The sample size was determined using a prevalence estimate from previous studies, with a confidence level of 95% and a margin of error of 5%. The sample was selected to ensure sufficient statistical power for analyzing associations between diabetes and visual acuity impairment.Ethical approval was obtained from the Institutional Ethics Committee before the commencement of the study. Informed consent was obtained from all patients, and confidentiality of their personal and medical information was strictly maintained throughout the study. Participation was voluntary, and patients were free to withdraw from the study at any point without affecting their medical care.

Methodology

Convenience sampling was employed to select participants from the outpatient department of a hospital, where all eligible diabetic patients visiting the ophthalmology clinic during the study period and meeting the inclusion criteria were invited to participate. Informed consent was obtained from all participants. The data collection involved three primary instruments: visual acuity was assessed using the Snellen chart for both eyes, with results categorized as mild, moderate, or severe visual impairment; a structured questionnaire gathered demographic data, medical history (including diabetes duration and type), family history, and lifestyle factors such as smoking and alcohol consumption; and a comprehensive ophthalmic examination, including slit-lamp biomicroscopy and fundoscopy, was conducted to assess diabetic retinopathy or other

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ocular complications. Data collection was conducted by trained healthcare professionals, including an ophthalmologist and an assistant, ensuring accurate visual acuity testing, comprehensive interviews, and thorough eye examinations to identify any complications related to diabetes.

Data Analysis

Data were analyzed using SPSS version 25.0. Descriptive statistics, including mean and standard deviation, were calculated for continuous variables (e.g., age, duration of diabetes). Categorical variables (e.g., gender, visual impairment categories) were analyzed using frequencies and percentages. The association between visual acuity impairment and demographic or clinical factors was evaluated using chi-square tests or Fisher's exact test where appropriate. A p-value of <0.05 was considered statistically significant.

Table 1: Demographic Characteristics of the Study Participants

The demographic profile of the 80 diabetic patients reveals an almost equal distribution in the upper age groups, with 31.25% (n=25) of participants aged 50-59 years and 60 years and above. Patients aged 40-49 years made up 25% (n=20), while only 12.5% (n=10) were in the younger age group of 30-39 years. This distribution suggests that older adults, who are more likely to have had diabetes for a longer duration, constituted the majority of the participants. In terms of gender, males (56.25%, n=45) were more frequently represented compared to females (43.75%, n=35), which may reflect broader patterns of gender differences in healthcare-seeking behavior. The majority of participants had type 2 diabetes (75%, n=60), which is consistent with the global prevalence of type 2 diabetes compared to type 1 diabetes (25%, n=20). Most participants had been living with diabetes for more than 10 years (50%, n=40), followed by those with 6-10 years of diabetes duration (31.25%, n=25), and a smaller group with 1-5 years of diabetes (18.75%, n=15). In terms of smoking history, 31.25% (n=25) of patients reported being smokers, while 68.75% (n=55) were non-smokers. Smoking is a known risk factor for many health complications, including those related to diabetes, which will be explored in later sections.

Table 2: Visual Acuity Distribution Among Diabetic Patients

Among the 80 diabetic patients, visual acuity was assessed and categorized into normal, mild, moderate, and severe impairments. A significant portion of the patients, 37.5% (n=30), had normal visual acuity (6/6 to 6/9), while 25% (n=20) showed mild visual impairment (6/12). More concerning, however, is the fact that 18.75% (n=15) had moderate impairment (6/18 to 6/24), and another 18.75% (n=15) suffered from severe visual impairment (6/36 or worse). These findings indicate that while a substantial number of diabetic patients retained normal vision, nearly 40% experienced moderate to severe visual impairment, highlighting the significant impact of diabetes on eye health and the potential progression to blindness if left unchecked.

Table 3: Ophthalmic Complications Detected Among Diabetic Patients

Ophthalmic examinations revealed that 43.75% (n=35) of patients were diagnosed with diabetic retinopathy in varying stages, making it the most common ocular complication. This is a well-known complication of diabetes that can lead to visual impairment or blindness if not managed properly. Cataracts were found in 25% (n=20) of patients, while glaucoma, another serious eye condition, was present in 12.5% (n=10). Notably, 18.75% (n=15) of patients did not have any detectable ocular complications at the time of the study. These results emphasize the importance of regular eye exams for diabetic patients, as early detection of conditions like retinopathy and cataracts can prevent further deterioration in vision.

Table 4: Association Between Visual Acuity Impairment and Duration of Diabetes

The data showed a clear association between the duration of diabetes and visual impairment. Among the patients with visual impairment, 60% (n=30) had been living with diabetes for more than 10 years, compared to 33.33% (n=10) of those without visual impairment. A similar pattern was observed for patients with 6-10 years of diabetes, where 30% (n=15) had visual impairment, while 33.33% (n=10) did not. Only 10% (n=5) of patients with visual impairment had been living with diabetes for 1-5 years, compared to 33.33% (n=10) of those without impairment. The p-value of 0.03 indicates a statistically significant relationship between the duration of diabetes and visual impairment, with longer diabetes duration strongly associated with worsening visual acuity. This suggests that the risk of visual impairment increases with the length of time a patient has been living with
diabetes.

Table 5: Association Between Smoking and Visual Acuity Impairment

Smoking was significantly associated with visual impairment among diabetic patients. Among the 50 patients with visual impairment, 40% (n=20) had a history of smoking, while only 16.67% (n=5) of those without visual impairment were smokers. Non-smokers made up 60% (n=30) of the visually impaired group and 83.33% (n=25) of the non-visually impaired group. The p-value of 0.04 indicates a statistically significant association between smoking and visual impairment in diabetic patients. This finding underscores the detrimental effect of smoking on eye health, particularly among individuals with

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diabetes, further highlighting the importance of smoking cessation programs in this population.

Table 1: Demographic Characteristics of the Study Participants (n = 80)

Demographic Variable	Frequency (n)	Percentage (%)
Age (years)		
30-39	10	12.5
40-49	20	25.0
50-59	25	31.25
60 and above	25	31.25
Gender		
Male	45	56.25
Female	35	43.75
Type of Diabetes		
Type 1	20	25.0
Type 2	60	75.0
Duration of Diabetes		
1-5 years	15	18.75
6-10 years	25	31.25
>10 years	40	50.0
Smoking History		
Yes	25	31.25
No	55	68.75

Table 2: Visual Acuity Distribution Among Diabetic Patients (n = 80)

Visual Acuity Category	Frequency (n)	Percentage (%)
Normal (6/6 to 6/9)	30	37.5
Mild Impairment (6/12)	20	25.0
Moderate Impairment (6/18 to 6/24)	15	18.75
Severe Impairment (6/36 or worse)	15	18.75

Table 3: Ophthalmic Complications Detected Among Diabetic Patients (n = 80)

Complication	Frequency (n)	Percentage (%)
Diabetic Retinopathy (Any Stage)	35	43.75
Cataracts	20	25.0
Glaucoma	10	12.5
No Complication Detected	15	18.75

Table 4: Association Between Visual Acuity Impairment and Duration of Diabetes (n = 80)

Duration of Diabetes	Visual Impairment Present (n = 50)	Visual Impairment Absent (n = 30)	p-value
1-5 years	5 (10%)	10 (33.33%)	0.03
6-10 years	15 (30%)	10 (33.33%)	
>10 years	30 (60%)	10 (33.33%)	

Table 5: Association Between Smoking and Visual Acuity Impairment (n = 80)

Smoking History	Visual Impairment Present (n = 50)	Visual Impairment Absent (n = 30)	p-value
Yes	20 (40%)	5 (16.67%)	0.04
No	30 (60%)	25 (83.33%)	

DISCUSSION

The demographic analysis of the 80 diabetic patients revealed that older adults were more prevalent in the study, with 31.25% of patients aged 50-59 years and another 31.25% aged 60 years and above. This pattern is consistent with other studies, such as one by Yau et al. (2012), which demonstrated that older individuals with diabetes are at a higher risk of complications, including visual impairment, as the disease progresses.[9] The gender distribution, with 56.25% males and 43.75% females, mirrors the findings of similar studies where males often outnumber females in diabetic populations, likely due to differences in healthcare-seeking behavior (Wild et al., 2004).[10] Type 2 diabetes was the dominant type, affecting 75% of the participants, in line with the global epidemiology of diabetes, where type 2 diabetes is more prevalent than type 1 (Zheng et al., 2018).[11] In terms of disease duration, half of the patients had been living with diabetes for over 10 years, which is crucial

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as longer disease duration is associated with higher complication risks, including retinopathy and cataracts (Fong et al., 2004).[12] Smoking history also showed a significant portion of patients (31.25%) as smokers, adding another layer of risk for ocular complications, as noted by Klein et al. (2006).[13]The visual acuity results indicated that 37.5% of the patients had normal vision, while 62.5% exhibited some form of visual impairment, ranging from mild (25%) to severe (18.75%). These findings echo those from studies such as by Dandona et al. (2002), which reported high rates of visual impairment among diabetic populations due to complications like diabetic retinopathy and cataracts.[14] The fact that nearly 20% of patients had severe visual impairment underscores the importance of early detection and management of diabetes-related eye issues. Similar to the results of Moss et al. (1998), which showed significant rates of vision loss in long-term diabetic patients, this study highlights the critical need for regular eye examinations for diabetic individuals to prevent or mitigate severe visual impairments.[15]Diabetic retinopathy was the most common complication detected, affecting 43.75% of patients, consistent with the literature. For instance, the UKPDS study found that retinopathy is a common complication, with a prevalence rate of 30-50% among diabetic patients after 10-15 years of the disease (Stratton et al., 2001).[16] Cataracts were detected in 25% of patients, which is also in line with studies indicating that diabetes increases the risk of cataracts, often leading to earlier onset compared to non-diabetic individuals (Klein et al., 1998).[17] Glaucoma was found in 12.5% of the patients, again consistent with findings from other research showing a higher prevalence of glaucoma in diabetic populations (Zangwill et al., 2001).[18] Notably, 18.75% of the patients did not have any detectable complications, emphasizing that regular monitoring and early intervention could help maintain eye health despite diabetes.

The association between the duration of diabetes and visual impairment is strongly supported by the data, with 60% of patients with visual impairment having lived with diabetes for more than 10 years. This result is comparable to findings from the Wisconsin Epidemiologic Study of Diabetic Retinopathy (WESDR), which showed that the risk of visual impairment increases significantly with the duration of diabetes, particularly after 10 years of disease onset (Klein et al., 1984).[19] The significant p-value (0.03) highlights that the duration of diabetes is a critical risk factor for visual impairment, further corroborating the findings of Moss et al. (1998), where long-term diabetic patients had a higher incidence of vision loss due to diabetic retinopathy and other complications.[15]The study also found a statistically significant association between smoking and visual impairment, with 40% of visually impaired patients reporting a smoking history compared to 16.67% of those without visual impairment. Smoking is well-established as a risk factor for ocular complications in diabetic patients, as highlighted in research by Klein et al. (2006), which found that smokers with diabetes have a higher risk of developing retinopathy and cataracts compared to non-smokers.[16] The significant p-value (0.04) in this study reinforces the detrimental impact of smoking on visual acuity in diabetic patients, suggesting that smoking cessation programs should be a priority for diabetic care, as recommended by West et al. (2002).[20]

CONCLUSION

In conclusion, the study on the assessment of visual acuity among diabetic patients highlights the significant prevalence of visual impairment in this population, with nearly 40% experiencing moderate to severe vision loss. The findings demonstrate a strong association between longer diabetes duration and the likelihood of visual impairment, emphasizing the importance of early intervention and regular eye screenings. Smoking was also identified as a contributing factor to worsening visual acuity. These results underscore the need for comprehensive diabetes management, including routine ophthalmic examinations and lifestyle modifications, to prevent vision loss in diabetic patients.

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