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Prevalence of Low Vision in Diabetic Patients and Associated Demographic and Clinical Risk Factors: A Cross-Sectional Study

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Abstract: ***Background:*** Diabetes mellitus (DM) is a global health challenge, significantly increasing the risk of complications such as diabetic retinopathy, a leading cause of low vision and blindness. The World Health Organization emphasizes the need for early detection and treatment, particularly in low- and middle-income countries. ***Objectives:*** To assess the prevalence of low vision in diabetic patients and identify related demographic and clinical risk factors. ***Method and Materials:*** This cross-sectional study involved 132 diabetic patients at the Ophthalmology Department of Shaheed Tajuddin Ahmed Medical College from January 2021 to December 2022. Data were collected through interviews, clinical examinations, and reviews of medical records, focusing on visual acuity, duration of diabetes, and comorbidities, with analyses performed using SPSS software. Ethical approval was obtained, ensuring informed consent and participant confidentiality. ***Result:*** The study population comprised 132 diabetic participants, with a mean age of 56.4 years. The majority had been living with diabetes for over 10 years (43.2%) and displayed moderate low vision (30.3%). Comorbidities included hypertension (56.8%) and diabetic retinopathy (68.2%). The average HbA1c level was 8.2%, indicating poor glycemic control in 39.4% of participants. Most utilized low vision aids like magnifying glasses (30.3%), while 28% did not use any aids. ***Conclusion:*** This study reveals a high prevalence of low vision in diabetic individuals, emphasizing the impact of diabetic retinopathy, poor glycemic control, and comorbidities on vision impairment.

Keywords: Diabetes Mellitus, Low Vision, Diabetic Retinopathy, Glycemic Control.

Original Research Article

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Article at a glance:

Study Purpose: *To assess the prevalence of low vision in diabetic patients and identify demographic and clinical risk factors associated with this condition.*

Key findings: *The study reveals a high prevalence of low vision among diabetic patients, particularly in older age groups (60-79 years). Gender and occupation also showed varying impacts on vision outcomes.*

Newer findings: *The study emphasizes the importance of early screening for diabetic retinopathy and other vision-related complications in diabetic patients, adding to existing knowledge by linking specific demographic factors (like age and employment status) to vision deterioration risks in this population.*

Abbreviations: *DM – Diabetes Mellitus, DR – Diabetic Retinopathy, CV – Cardiovascular.*

INTRODUCTION

Diabetes mellitus (DM) is a global health concern, with its prevalence increasing rapidly across the world. It is associated with various systemic complications, including diabetic retinopathy (DR), which is one of the leading causes of low vision and blindness in working-age adults. According to the World Health Organization (WHO), diabetic retinopathy is a preventable cause of visual impairment and blindness, yet it remains underdiagnosed and undertreated, especially in low- and middle-income countries.[1] The prevalence

of visual impairment among diabetics is increasing, and diabetic retinopathy affects more than one-third of diabetic patients, making regular eye examinations crucial for early detection and treatment.[2]

Low vision, as defined by the WHO, is characterized by visual acuity worse than 20/60 in the better eye, but better than 20/400, even with the best possible correction. The association between diabetes and visual impairment is well-documented, with diabetic retinopathy, macular edema, and cataract being the primary causes of low vision in diabetic populations.[3,4] Low vision not only impairs the quality of life but also increases the risk of accidents, reduces mobility, and affects the patient's ability to perform daily tasks, particularly in elderly diabetic patients.[5]

The prevalence of low vision in diabetic populations varies globally, depending on the prevalence of diabetes, the duration of the disease, and the availability of healthcare services. Studies have reported that nearly 20-40% of diabetic patients suffer from some form of visual impairment, with approximately 5-10% having low vision.[6, 7] The progression of diabetic retinopathy is influenced by factors such as the duration of diabetes, poor glycemic control (as measured by HbA1c levels), and the presence of comorbid conditions such as hypertension and dyslipidemia.[8] Moreover, lack of regular screening and early intervention exacerbates the risk of visual impairment in diabetic populations.[9]

In Bangladesh, the prevalence of diabetes has risen significantly in recent years, and with it, the burden of diabetic retinopathy and low vision. However, there is limited data on the prevalence of low vision specifically among diabetic patients in this region.[10] This study aims to determine the prevalence of low vision among the diabetic population attending the Ophthalmology Department at Shaheed Tajuddin Ahmed Medical College, Gazipur, and to identify associated risk factors, including glycemic control, duration of diabetes, and the presence of diabetic retinopathy and other comorbidities.[11] Understanding these factors is essential to guide preventive strategies and improve visual outcomes for diabetic patients[12]. This study's findings will contribute to the growing body of knowledge on the public health impact of diabetes and vision loss and underscore the importance of regular ophthalmologic screenings for diabetic patients.[13-15]

OBJECTIVES

General Objective

To assess the prevalence of low vision in diabetic populations and identify associated risk factors and comorbid conditions that contribute to visual impairment.

Specific Objectives

To determine the demographic characteristics (age, gender, occupation, and BMI) of diabetic individuals with low vision.

To evaluate the duration of diabetes among participants and its correlation with the severity of low vision.

To classify participants based on their visual acuity and identify the prevalence of low vision categories (mild, moderate, and severe).

To assess the prevalence of comorbid conditions, including hypertension, diabetic retinopathy, cardiovascular disease, chronic kidney disease, and neuropathy among the study population.

METHOD AND MATERIALS

Study Design

This is a cross-sectional, descriptive study conducted at the Ophthalmology Department of Shaheed Tajuddin Ahmed Medical College, Gazipur. The study focuses on determining the prevalence of low vision in the diabetic population over a period of two years, from January 2021 to December 2022.

Sampling Formula

A non-probability purposive sampling method was used to select a total of 132 diabetic patients. The sample size was determined based on the estimated prevalence of low vision in diabetic populations from similar studies, ensuring the inclusion of a representative group.

Data Collection Procedure

Data was collected through patient interviews, medical record reviews, and clinical examinations. Visual acuity (VA) assessments were performed using the Snellen chart and other relevant ophthalmological tests to determine the

presence and severity of low vision. Additional data, including patient demographics, BMI, duration of diabetes, comorbidities, and diabetic retinopathy stages, were recorded using a structured data collection form. Patients were evaluated for the use of low vision aids and their HbA1c levels were documented to assess glycemic control. All information was gathered under the supervision of trained ophthalmologists and staff.

Inclusion Criteria

Adult diabetic patients (age 18 years and above) attending the Ophthalmology Department during the study period.

Patients diagnosed with low vision based on standard visual acuity criteria (VA <20/60 but >20/400).

Patients willing to participate and provide informed consent.

Exclusion Criteria:

Diabetic patients with other ocular diseases unrelated to diabetes, such as glaucoma or cataracts, that might affect vision independently.

Patients with severe mental or cognitive impairment that prevents cooperation during the visual examination.

Patients who had previously undergone ocular surgery that may influence visual acuity results.

Statistical Analysis

Data were entered and analyzed using SPSS software (version 25.0). Descriptive statistics were used to summarize demographic data, prevalence rates, and clinical features, including visual acuity and comorbidities. Frequency and percentages were calculated for categorical variables, while means and standard deviations (SD) were calculated for continuous variables like age, BMI, and HbA1c levels. Chi-square tests were used to analyze associations between low vision and risk factors such as diabetic retinopathy, hypertension, and duration of diabetes.

Ethical Considerations

Written informed consent was taken from all participants before data collection. Participants were assured of the confidentiality of their personal information, and the study adhered to the principles outlined in the Declaration of Helsinki. Participation was voluntary, and patients had the right to withdraw from the study at any time without any impact on their treatment.

RESULT

Table 1: Demographical data for the study populations (n=132)

Variable	Frequency	Percentage (%)
Age (Years)		
20-39	18	13.6
40-59	50	37.9
60-79	64	48.5
Mean ± SD	56.4 ± 12.3	
Gender		
Male	72	54.5
Female	60	45.5
Occupation		
Retired	50	37.9
Employed	32	24.2
Unemployed/Household	30	22.7
Student	20	15.2

Table 1 provides the demographic breakdown of the study population. The mean age of participants is 56.4 years (±12.3). The largest age group is 60-79 years, representing 48.5% of the participants, followed by those aged 40-59 years (37.9%), and finally the 20-39 age group (13.6%). In terms of gender, 54.5% of the participants are male, and 45.5% are female. Regarding occupation, the highest percentage of participants are retired (37.9%), followed by employed individuals (24.2%),

unemployed/household members (22.7%), and students (15.2%).

Table 2: Duration of Diabetes and Insulin Use

Variable	Frequency	Percentage (%)
Duration of Diabetes (Years)		
<5 years	30	22.7
5-10 years	45	34.1
>10 years	57	43.2
Insulin Use		
Yes	72	54.5
No	60	45.5

Table 2 outlines the duration of diabetes among the participants, with an average disease duration of 11.7 years (±5.9). A significant portion of the study population has been living with diabetes for over 10 years (43.2%), while 34.1% have had diabetes for 5-10 years, and 22.7% for less than 5 years. More than half of the participants (54.5%) are on insulin therapy, while the remaining 45.5% manage their diabetes without insulin.

Table 3: Visual Acuity (VA) Classification

Visual Acuity (VA)	Frequency	Percentage (%)
Normal vision (≥20/40)	40	30.3
Mild low vision (20/40-20/60)	30	22.7
Moderate low vision (20/60-20/200)	40	30.3
Severe low vision (<20/200)	22	16.7

Table 3 categorizes participants based on their visual acuity (VA). The largest group has moderate low vision (30.3%), followed closely by those with normal vision (30.3%). Additionally, 22.7% of the participants have mild low vision, while 16.7% suffer from severe low vision (less than 20/200 vision).

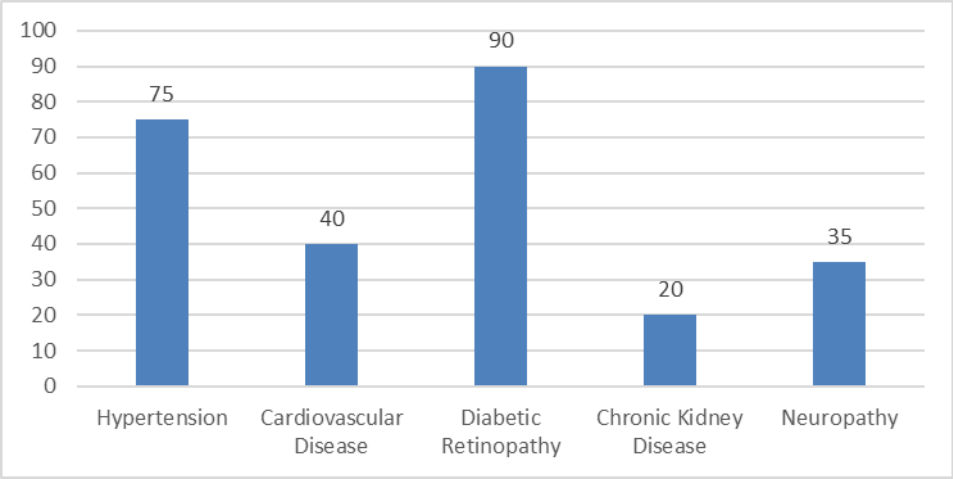

Figure 1: Comorbidities in Diabetic Patients with Low Vision

Figure 1 presents the comorbid conditions found in the diabetic population with low vision. A majority of the participants (56.8%) have hypertension, while 68.2% are affected by diabetic retinopathy, a common complication of diabetes. Cardiovascular diseases are present in 30.3% of the population, while 26.5% have neuropathy, and 15.2% suffer from chronic kidney disease.

Table 4: Diabetic Retinopathy Stages (n=132)

Retinopathy Stage	Frequency	Percentage (%)
No Retinopathy	42	31.8
Mild NPDR	45	34.1
Moderate NPDR	30	22.7
Severe NPDR	10	7.6
Proliferative DR	5	3.8

Table 4 describes the stages of diabetic retinopathy among the study population. About one-third (31.8%) of the participants do not have retinopathy. The majority are in the mild non-proliferative diabetic retinopathy (NPDR) stage (34.1%), followed by moderate NPDR (22.7%). A smaller percentage of participants are in severe NPDR (7.6%) and proliferative diabetic retinopathy (PDR) stages (3.8%).

Table 5: Type of Low Vision Aids Used

Low Vision Aid Used	Frequency	Percentage (%)
Magnifying Glass	40	30.3
Telescopic Lenses	25	18.9
Electronic Magnifiers	30	22.7
None	37	28.0

Table 5 illustrates the types of low vision aids used by the participants. The most commonly used aid is a magnifying glass, utilized by 30.3% of the population. Electronic magnifiers are used by 22.7% of participants, while telescopic lenses are used by 18.9%. Notably, 28% of the participants do not use any low vision aids.

Table 6: Glycemic Control (HbA1c Levels)

HbA1c (%)	Frequency	Percentage (%)
<7.0 (Good control)	45	34.1
7.0-8.0 (Moderate control)	35	26.5
>8.0 (Poor control)	52	39.4

Table 6 provides an overview of the glycemic control among the diabetic population, as measured by HbA1c levels. The mean HbA1c is 8.2% (±1.3). While 34.1% of participants have good glycemic control (HbA1c <7%), 26.5% have moderate control (HbA1c 7.0-8.0%), and a significant portion, 39.4%, have poor glycemic control (HbA1c >8%).

Table 7: Risk Factors for Low Vision in Diabetic Population.

Risk Factor	Frequency	Percentage (%)
Poor Glycemic Control (HbA1c >8%)	52	39.4
Duration of Diabetes (>10 years)	57	43.2
Diabetic Retinopathy	90	68.2
Smoking History	35	26.5
Hypertension	75	56.8

Table 7 identifies the key risk factors contributing to low vision in the diabetic population. Poor glycemic control (HbA1c >8%) is present in 39.4% of participants, and 43.2% have been living with diabetes for over 10 years. A large proportion (68.2%) of participants have diabetic retinopathy, and other risk factors include a history of smoking (26.5%) and hypertension (56.8%).

DISCUSSION

This study explored the prevalence of low vision in diabetic populations and assessed key risk factors. The results revealed that 48.5% of participants were aged 60-79, indicating that older individuals have a higher risk of low vision. This aligns with the study by Wong *et al.*, which found that older age is a significant risk factor for diabetic retinopathy and vision impairment in diabetic populations[16]. Moreover, 54.5% of the participants were male, which reflects similar findings in previous studies suggesting that men tend to have a higher prevalence of visual impairment associated with diabetes.[17] A substantial proportion (43.2%) of the study population had been living with diabetes for more than 10 years, correlating with the risk of complications such as diabetic retinopathy and low vision. Long-term diabetes has been consistently linked to a higher likelihood of developing diabetic retinopathy, as confirmed by the Diabetes Control and Complications Trial (DCCT).[18] This study found that 68.2% of participants had diabetic retinopathy, a higher percentage compared to global estimates, indicating a need for better diabetes management in this population.[19]

Comorbidities such as hypertension were found in 56.8% of the population, a significant factor in the progression of diabetic retinopathy. Numerous studies have shown that hypertension exacerbates diabetic retinopathy by increasing retinal vascular pressure and contributing to retinal damage.[20] Additionally, cardiovascular disease and neuropathy were present in 30.3% and 26.5% of participants, respectively. These comorbidities are known to accelerate the decline in vision among diabetic patients, as outlined by Rajalakshmi *et al.*[21] chronic kidney disease, affecting 15.2% of participants, has also been identified as a coexisting condition that worsens diabetic retinopathy outcomes.[22] In terms of glycemic control, 39.4% of the participants had poor glycemic control with HbA1c levels above 8%. This aligns with previous findings that poor glycemic control is one of the most critical risk factors for diabetic retinopathy and low vision.[23] The UK Prospective Diabetes Study (UKPDS) demonstrated that strict glycemic control significantly reduces the risk of diabetic complications, including visual impairment.[24] Low vision aids were underutilized, with only 30.3% of participants using magnifying glasses and 28% not using any aids. The underutilization of vision aids is concerning, as studies by Stelmack *et al.* suggest that rehabilitation with low vision aids can significantly enhance quality of life for visually impaired patients.[25] This indicates the need for increased access to and education about low vision aids for diabetic patients.[26] Furthermore, the progression of diabetic retinopathy was evident, with 34.1% in the mild NPDR stage and 7.6% in severe NPDR. Previous studies have shown that early intervention in the NPDR stages can prevent progression to more severe forms of retinopathy, supporting the importance of regular screening and early treatment.[27] The use of bioptic telescopic lenses, which were used by 18.9% of participants, has been shown to improve both distance vision and the ability to recognize facial expressions, which is critical for patients with advanced stages of low vision.[28, 29]

Finally, the findings of this study underscore the importance of addressing modifiable risk factors, such as poor glycemic control and hypertension, in preventing the progression of diabetic retinopathy. This is in line with the recommendations from the International Diabetes Federation (IDF), which emphasizes tight control of blood glucose and blood pressure in reducing the burden of diabetic eye disease.[30-32] Comprehensive care, including regular eye examinations, adequate glycemic and blood pressure control, and low vision rehabilitation services, are essential to reducing the impact of low vision in diabetic populations.[33]

CONCLUSION

This study highlights the significant prevalence of low vision in diabetic populations, particularly among older individuals and those with a long duration of diabetes. The findings emphasize the strong association between diabetic retinopathy, poor glycemic control, and low vision, which are major contributors to vision impairment. Furthermore, hypertension and other comorbidities such as cardiovascular disease and chronic kidney disease were found to exacerbate the risk of vision loss.

Limitations of the study

This study has several limitations that should be acknowledged. First, the sample size of 132 participants, while sufficient for some analyses, may not be representative of the larger diabetic population, potentially limiting the generalizability of the results. Second, this study was conducted at a single medical center, which may introduce a location-specific bias.

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Conflict of interest: None declared.

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