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Study to Understand The Correlation Between Hba1c Values and Severity of Diabetic Retinopathy

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ABSTRACT

Purpose: The purpose of this study is to understand the correlation between HbA1C values and severity of disease in diabetic patients with diabetic retinopathy and diabetic patients without diabetic retinopathy.

Methods: 47 patients with diabetes were examined at a tertiary center. All of these patients underwent tests like visual acuity, slit lamp examination, dilated fundus examination, blood tests including random blood sugars and HbA1C levels. Duration of the disease and medications taken were also noted for all the patients.

Results: In this study, a total of 47 patients were evaluated with a mean age of 57.72 ± 12.42 years. 18 out of 27 patients (66.6%) with HbA1c values more than 10% showed signs of diabetic retinopathy with a mean HbA1c value of 12.5 ± 1.8 %. 4 out of 13 patients (30.7%) with HbA1c values between 6.9% to 10% showed signs of diabetic retinopathy with a mean HbA1c value of 8.7 ± 1.3 %. None of 7 patients with HbA1c values less than 6.9% showed signs of diabetic retinopathy.

Conclusion: Higher levels of HbA1C levels and longer duration of disease are found to be associated with diabetic retinopathy disease.

KEYWORDS

• Diabetes Mellitus • Diabetic Retinopathy • HbA1c

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INTRODUCTION

Diabetes mellitus is a long-term metabolic disorder marked by elevated blood sugar levels, resulting from insufficient insulin production, insulin resistance, or both. As per the International Diabetes Federation, 77 million adults in India, aged 18 and above, are affected by type 2 diabetes.[1]

Diabetic retinopathy (DR) is a microvascular condition caused by the prolonged impact of diabetes mellitus. It can result in damage to the retina that threatens vision and may ultimately lead to blindness.[2] Nonproliferative diabetic retinopathy is characterized by microvascular changes that are usually asymptomatic. It advances quietly through mild, moderate and severe stages without causing vision loss. The cumulative rate of progression from mild nonproliferative retinopathy to vision-threatening complications is approximately 14–16%.[3]

Glycated hemoglobin (HbA1c) indicates long-term blood glucose levels and is used as a marker to assess the average blood glucose concentration over the past 1–2 months. The Hemoglobin A1C (HbA1C) test is a crucial tool in diabetes management because it provides an accurate measure of long-term blood sugar control.[4] By assessing the percentage of glycated hemoglobin, it reflects average blood glucose levels over the past two to three months. Its strong link to the risk of diabetes-related complications, such as nerve damage, kidney issues, eye problems, and heart disease, makes it a valuable indicator.

Maintaining HbA1C levels within the target range can significantly reduce these risks. Regular monitoring helps healthcare providers and patients evaluate treatment effectiveness and make necessary adjustments for better outcomes.

One of the main challenges in linking the severity of hyperglycemia to long-term complications of diabetes is the absence of a reliable and objective method for assessing diabetic control. The use of glycated proteins, serum proteins, and primary hemoglobin has introduced a new approach to evaluating glycemia.[6]

HbA1c has long been recognized as a marker for assessing the long-term control of diabetes mellitus. Several studies have explored the correlation between HbA1c levels and various stages of diabetic retinopathy (DR).[6]

OBJECTIVES

To study the correlation between HbA1c level values and the severity of disease in diabetic patients with diabetic retinopathy and diabetic patients without diabetic retinopathy.

METHODOLOGY

A descriptive observational study was conducted on 47 elderly patients with type 2 diabetes mellitus. The study was conducted from November 2023 to April 2024 at the Outpatient Department of Ophthalmology, Navodaya Medical College Hospital and Research Centre, Raichur. All the male and female patients above 40 years of age and diagnosed with type 2 diabetes mellitus were included in the study. Patients with Type 1 diabetes mellitus, gestational diabetes, patients who were below the age group of 40 years and patients with dense lens opacities were excluded from this study. The study was conducted after Institutional Ethical Committee approval. Informed consent was obtained from all patients, in regional language in the prescribed format and explained about the study purpose and procedures prior to their enrollment in study. 47 patients were enrolled in the study.

Proper history was recorded from each and every patient. Factors like duration of the disease and the medications used by the patients including oral hypoglycemic agents and insulin injections were recorded during history taking. The patients also underwent detailed ophthalmic examination like best corrected visual acuity, slit lamp biomicroscopy and dilated fundus examination. Fundus fluorescence angiography (FFA) and Optical Coherence Tomography (OCT) was done in indicated patients. All patients underwent biochemical tests like HbA1c levels and Random blood sugar levels.

RESULTS

A total of 47 patients were enrolled in the study (Chart 1).

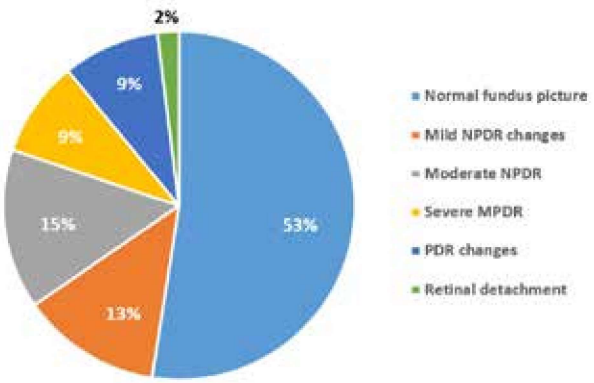

Chart 1: Distribution of patients in the clinical examination

Table 1: Gender Distribution

Male Patients	Female Patients
26 (55.3%)	21 (44.6%)

Table 2: Age Distribution

Age distribution	Patients
41 - 50 yrs	10
51 - 60 yrs	17
61 - 70 yrs	13
71 - 80 yrs	7

The mean age of the patients was 57.72 ± 12.42 years (Table 2) and 44.6% of the patients were females (Table 1).

Table 3: Hypoglycemic agents used

Types of Hypoglycemic Agent Used	No. of Patients
Insulin along with oral hypoglycemics	9 patients (19.2%)
Oral hypoglycaemic agents	38 patients (80.8%)

9 patients were found to be using insulin along with the oral hypoglycemic agents and 38 patients were using only oral hypoglycemic agents (Table 3). Out of 7 patients who were diagnosed with diabetes less than 1 year ago only 2 patients (28.5%) showed signs of diabetic retinopathy with a mean HbA1c value of 10.05 ± 2.07% in affected patients. 28 patients had a history of diabetes for a duration between 1 year to 10 years, only 11 patients (39.2%) showed signs of diabetic retinopathy with a mean HbA1c value of 10.07 ± 2.42%.[7] patients had a history of diabetes for more than 10 years, out of which 6 patients (85.7%) showed signs of diabetic retinopathy with a mean HbA1c value of 10.07 ± 2.88%. (Table 4)

Table 4: Correlation between duration of disease and diabetic retinopathy changes

Duration of disease	No. of patients	Diabetic retinopathy fundus	Mean HbA1c value of affected participants
Less than 1 year	7 patients	2 patients (28.5%)	10.05 ± 2.07%
1 year to 10 years	28 patients	11 patients (39.2%)	10.07 ± 2.42%
More than 10 years	7 patients	6 patients (85.7%)	10.07 ± 2.88%

18 patients out of 27 patients (66.6%) with HbA1c values more than 10% showed signs of diabetic retinopathy with a mean HbA1c value of 12.5 ± 1.8%. 4 patients out of 13 patients (30.7%) with HbA1c values between 6.9% to 10% showed signs of diabetic retinopathy with a mean HbA1c value of 8.7 ± 1.3%. None of 7 patients with HbA1c values less than 6.9% showed signs of diabetic retinopathy. (Table 5)

Table 5: Correlation between HbA1c and diabetic retinopathy changes

HbA1c value range	Total no. of patients	Patients with diabetic retinopathy	Mean HbA1c value of affected participants
Less than 6.9 %	7 patients	None	None
6.9 % to	13 patients	4 patients (30.7%)	8.7 ± 1.3 %
More than 10 %	27 patients	18 patients (66.6%)	12.5 ± 1.8 %

DISCUSSION

A strong correlation was found between the level of HbA1c values and the severity of diabetic retinopathy levels in our study. HbA1c was found to be playing a major role in determining the severity of diabetic retinopathy in the diabetic patients. Controlled HbA1c helped in controlling the progression of the disease. People who were regular on medications were found to be having controlled levels of HbA1c levels.

Bukke SN et al found a statistically significant correlation between HbA1c levels and the severity of diabetic retinopathy, with more severe grades of diabetic retinopathy manifesting in patients with higher levels of HbA1c.[6]

Sharma PK et al in his study stated that HbA1c levels were significantly higher in the NPDR and PDR groups compared to the No DR group. The mean HbA1c value was highest in the PDR group at 9.04 ± 1.89, followed by the NPDR group at 8.40 ± 1.07, and lowest in the No DR group at 6.75 ± 0.51.[8]

Cho et al in his study stated that the occurrence of retinopathy was minimal until the HbA1c levels reached the range of 48–51 mmol/mol (6.5–6.8%). Based on receiver operating characteristic curve analysis, in his study, the optimal HbA1c threshold for detecting any diabetic retinopathy was 49 mmol/mol (6.6%), while moderate to severe retinopathy was best identified at 52 mmol/mol (6.9%).[9]

The HbA1c threshold of 48 mmol/mol (6.5%) recommended by the American Diabetes Association demonstrated similar accuracy in detecting both any retinopathy and moderate to severe cases.[9]

In our study we found that the HbA1c value of 8.7 % of greater significance as larger no. of study population showed diabetic retinopathy changes above this value.

CONCLUSION

A strong correlation was found between diabetic retinopathy and HbA1c. Patients with longer duration of diabetes mellitus, who were regular on medication were found to be having controlled HbA1c levels. Patients with uncontrolled diabetes were found to be having higher HbA1c levels. Long standing diabetes in patients , in general, showed higher incidences of diabetic retinopathy.

Support: Nil

Conflict of interest: Nil

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