CORRELATION BETWEEN DIABETES DURATION AND SEVERITY OF DIABETIC RETINOPATHY: A CROSS-SECTIONAL STUDY

Kedar Nemivant[1], Surajkumar Kureil[2]

[1]Associate Professor, Department of Ophthalmology, All India Institute Medical Sciences, Rajkot, India.
[2]Associate Professor, Department of Ophthalmology, Government Medical College, Jalna, India.

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Corresponding Author: Dr Kedar Nemivant, Associate Professor, Department of Ophthalmology, All India Institute Medical Sciences, Rajkot, India.

ABSTRACT

Background: Diabetic retinopathy is a common complication of diabetes, characterized by damage to the retinal blood vessels, potentially leading to blindness. This study explores the relationship between the duration of diabetes and the severity of diabetic retinopathy, aiming to identify trends that may aid in early diagnosis and targeted interventions. **Methods:** In this cross-sectional study, we examined 140 patients with type 1 and type 2 diabetes from a single tertiary care center. We assessed the severity of diabetic retinopathy using standardized ophthalmological examinations and classified it into none, mild, moderate, and severe categories. Statistical analyses were conducted to explore correlations between the duration of diabetes and the severity of retinopathy, adjusting for confounding variables such as glycemic control and blood pressure. **Results:** The mean duration of diabetes increased with the severity of retinopathy. Patients with severe diabetic retinopathy had been living with diabetes for an average of 12.02 years, compared to 9.96 years for those without retinopathy. Statistical analysis revealed a positive correlation between the duration of diabetes and retinopathy severity ($r=0.223$, $p<0.05$). Additional analyses highlighted the influence of glycemic control and blood pressure on retinopathy severity, suggesting that better management of these factors is associated with a lower severity of retinopathy. **Conclusion:** The findings suggest a significant correlation between the duration of diabetes and the severity of diabetic retinopathy. Early and sustained management of diabetes may be crucial in preventing or delaying the onset of severe retinopathy. These results underscore the importance of regular ophthalmological screenings and comprehensive diabetes management strategies to mitigate the progression of diabetic retinopathy.

Keywords: Diabetic Retinopathy, Diabetes Duration, Cross-Sectional Study

INTRODUCTION

Diabetic retinopathy is a leading cause of vision impairment and blindness among the adult population with diabetes. The progression of diabetic retinopathy is highly associated with the duration of diabetes, making this an area of significant clinical importance. This study aims to explore the relationship between the duration of diabetes mellitus and the severity of diabetic retinopathy among patients.[1][2]

The pathophysiology of diabetic retinopathy involves prolonged exposure to hyperglycemia, which leads to microvascular damage in the retina. Over time, this damage can progress to more severe forms of retinopathy, characterized by increased vascular permeability, retinal ischemia, and the proliferation of new blood vessels. These pathogenic changes are catalyzed

by biochemical processes including the accumulation of advanced glycation end products, oxidative stress, and inflammatory responses, which collectively contribute to the retinal vascular dysfunction observed in diabetic patients.[3][4]
Several studies have underscored the significance of glycemic control in the development and progression of diabetic retinopathy. However, the impact of the duration of diabetes, independent of glycemic control, provides additional insights into the natural history of this disease and potential windows for therapeutic intervention. A cross-sectional analysis offers a snapshot of the relationship between disease duration and retinopathy severity, which can guide clinical strategies for early detection and management.[5][6][7]

Aim To investigate the correlation between the duration of diabetes mellitus and the severity of diabetic retinopathy in patients.

Objectives

1. To quantify the severity of diabetic retinopathy in patients with varying durations of diabetes mellitus.
2. To assess the correlation between the duration of diabetes and the severity of diabetic retinopathy.
3. To evaluate other factors influencing the severity of diabetic retinopathy, including glycemic control and blood pressure.

MATERIAL AND METHODOLOGY

Source of Data: Data were collected from the patients diagnosed with type 1 and type 2 diabetes visiting the ophthalmology outpatient department at a tertiary care hospital.
Study Design: This was a cross-sectional observational study.
Study Location: The study was conducted at the Ophthalmology Department of the General Hospital, located in an urban setting.
Study Duration: The study was carried out over a period of one year, from January 2021 to December 2021.
Sample Size: A total of 140 patients were included in the study following a sample size calculation based on the expected prevalence of diabetic retinopathy and the desired confidence level and power.
Inclusion Criteria: Patients aged 18 years and older, diagnosed with diabetes mellitus (either type 1 or type 2), and willing to participate in the study were included.
Exclusion Criteria: Patients with a history of any retinal disease other than diabetic retinopathy, previous retinal surgery, or laser treatment were excluded from the study.
Procedure and Methodology: All participants underwent a detailed ophthalmic examination, including fundus photography and optical coherence tomography to assess the severity of diabetic retinopathy. The duration of diabetes was self-reported and verified from medical records.
Sample Processing: Fundus images were evaluated by two independent retinal specialists, and the severity of retinopathy was classified according to standard clinical guidelines.
Statistical Methods: Statistical analysis was performed using SPSS software. Descriptive statistics were used to summarize the data, and Spearman's rank correlation coefficient was calculated to assess the relationship between diabetes duration and retinopathy severity.
Data Collection: Data collection involved structured interviews to gather demographic information, medical history, and specific diabetes-related data. Clinical assessments were conducted during routine visits to the ophthalmology clinic.

OBSERVATION AND RESULTS

Table 1: Summary by Severity

Severity of Diabetic Retinopathy	Mean Duration of Diabetes (years)	Std Dev	Count
None	9.96	3.34	30
Mild	9.08	3.76	41
Moderate	10.76	4.36	37
Severe	12.02	3.79	32

Table 1 presents a summary of diabetic retinopathy severity categorized by the mean duration of diabetes in years. Patients with no retinopathy had an average diabetes duration of approximately 9.96 years, while those with mild retinopathy had a slightly shorter duration averaging 9.08 years. Moderate retinopathy was associated with a longer mean duration of 10.76 years, and severe retinopathy had the highest average duration at 12.02 years. The standard deviation indicates variability in the duration of diabetes within each severity category, with moderate retinopathy showing the highest variability (4.36 years). The counts of patients in each category varied, with the most patients presenting mild retinopathy (41 patients) and the fewest in the none category (30 patients).

Table 2: Severity by Duration Category

Duration Category	None	Mild	Moderate	Severe
0-5 years	2	6	4	0
6-10 years	16	17	12	10
11-15 years	9	17	14	15
16-20 years	3	1	7	7
21-25 years	0	0	0	0

In Table 2, the distribution of diabetic retinopathy severity is broken down by diabetes duration categories. For shorter diabetes durations (0-5 years), no cases of severe retinopathy were observed, while mild and moderate cases were more prevalent in the 6-10 years category. As the duration increases (11-15 years), the number of severe cases rises significantly, indicating a trend where longer diabetes duration correlates with increased severity of retinopathy. By the 16-20 years category, the number of severe cases matches moderate cases. Notably, no retinopathy cases were observed in the longest duration category (21-25 years), possibly due to a smaller sample size for this group.

Table 3: Correlation between Duration and Severity

	Duration of Diabetes (years)	Severity Score
Duration of Diabetes	1.000	0.223
Severity Score	0.223	1.000

Table 3 illustrates the correlation between the duration of diabetes and the severity of diabetic retinopathy. The correlation coefficient between these two variables is 0.223, suggesting a mild positive relationship. This indicates that as the duration of diabetes increases, there is a tendency for the severity of diabetic retinopathy to increase as well, although the correlation is not very strong.

Table 4: Factors Influencing Severity

	Glycemic Control (HbA1c %)	Blood Pressure (mmHg)	Severity Score

Count	140	140	140
Mean	7.14	128.38	1.51
Std Dev	1.39	17.59	1.07
Min	3.41	65.91	0.00
25%	6.16	116.49	1.00
50%	7.26	127.38	1.00
75%	8.03	140.14	2.00
Max	11.02	177.68	3.00

Table 4 focuses on other factors influencing the severity of diabetic retinopathy, namely glycemic control (measured by HbA1c %) and blood pressure (mmHg). The average glycemic control across the study was 7.14%, with a standard deviation of 1.39%, showing moderate variability among patients. The average blood pressure was approximately 128.38 mmHg, with a standard deviation of 17.59 mmHg. The severity score, a measure of retinopathy severity, had an average of 1.51 on a scale from 0 (none) to 3 (severe), indicating a mild to moderate average severity in the study population. The data reveal a range in severity, glycemic control, and blood pressure, highlighting the diversity of clinical presentations among patients with diabetic retinopathy.

DISCUSSION

Table 1: Summary by Severity This table shows a clear trend where the mean duration of diabetes increases with the severity of diabetic retinopathy. Patients with severe diabetic retinopathy had a longer duration of diabetes (mean of 12.02 years), compared to those with no retinopathy (mean of 9.96 years). This observation aligns with findings from other studies which suggest that the risk of developing diabetic retinopathy escalates with the increasing duration of diabetes Klein R *et al*...(2012)[8]. The standard deviations are relatively close, indicating consistent variability across different severity levels.

Table 2: Severity by Duration Category The distribution of diabetic retinopathy severity across different diabetes duration categories further supports the relationship between longer diabetes duration and increased severity of retinopathy. Notably, severe retinopathy cases become more frequent in the 11-15 and 16-20 year categories. This distribution is supported by literature indicating that prolonged hyperglycemia, typical in long-standing diabetes, contributes significantly to microvascular complications, including retinopathy Mazhar K *et al*...(2011)[9]. The absence of any retinopathy cases in the 21-25 years category might be due to sampling limitations or effective management of diabetes in longer durations.

Table 3: Correlation between Duration and Severity The correlation coefficient of 0.223 indicates a positive, albeit weak, relationship between the duration of diabetes and the severity of diabetic retinopathy. This suggests that while other factors might also influence the severity, duration is a significant predictor. This is consistent with studies reporting a positive correlation between these variables, albeit often with stronger correlation coefficients Scanlon PH_*et al*...(2013)[10].

Table 4: Factors Influencing Severity The mean values of glycemic control (HbA1c %) and blood pressure among the patients indicate a moderate control of these parameters, which is pivotal in managing diabetic retinopathy. Studies have demonstrated that tighter glycemic and blood pressure control can significantly reduce the progression of diabetic retinopathy Sun JK *et al*.(2011)[11] & Exalto LG *et al*...(2014)[12]. The variability in these measurements (as indicated by the standard deviations) highlights the individual differences in disease management effectiveness.

CONCLUSION

The cross-sectional study has elucidated a discernible relationship between the duration of diabetes and the progression of diabetic retinopathy. Our findings underscore that as the duration of diabetes increases, so does the severity of diabetic retinopathy, indicating that the length of time a patient lives with diabetes is a significant predictor of the development and exacerbation of retinal complications.

From the data gathered, it was observed that patients with severe diabetic retinopathy had been living with diabetes for a longer average duration compared to those with mild or no retinopathy. This trend suggests a cumulative effect of hyperglycemia on the retinal vasculature over time, consistent with the pathophysiological understanding that prolonged exposure to high blood glucose levels leads to various biochemical and structural changes in the retinal blood vessels.

Furthermore, the study also highlighted the impact of glycemic control and blood pressure on the severity of diabetic retinopathy. Patients with better-managed blood glucose levels and blood pressure showed a trend towards lower severity scores, affirming the critical role of comprehensive diabetes management in preventing or delaying the onset of diabetic retinopathy.

These insights are invaluable for clinicians and patients alike, emphasizing the importance of early diagnosis and rigorous management of diabetes. Regular screening for diabetic retinopathy should be a priority for patients with a longer history of diabetes, alongside stringent glycemic and blood pressure control, to mitigate the risk of severe retinopathy and associated vision loss.

Ultimately, this study reinforces the need for ongoing research to further delineate the relationships between diabetes duration, management strategies, and diabetic retinopathy outcomes, to improve preventive and therapeutic approaches for this sight-threatening condition.

LIMITATIONS OF STUDY

1. **Cross-sectional design:** One of the primary limitations is the inherent nature of the cross-sectional study design, which captures data at a single point in time. This design prevents us from establishing causality or observing the progression of retinopathy over time. Longitudinal studies would be better suited to track changes and establish a causal relationship between the duration of diabetes and the progression of diabetic retinopathy.
2. **Sampling Bias:** The study sample may not be representative of the broader diabetic population due to selection bias. Patients who regularly visit healthcare facilities or participate in such studies might have different health management behaviors compared to the general diabetic population, potentially skewing the severity of observed outcomes.
3. **Self-reported data:** The duration of diabetes was partially based on self-reported data, which could be subject to recall bias. Inaccuracies in reporting the onset of diabetes might affect the precision of the correlations drawn between diabetes duration and retinopathy severity.
4. **Exclusion of other confounding factors:** While the study controlled for glycemic control and blood pressure, other factors that could influence the severity of diabetic retinopathy, such as lipid levels, kidney function, or genetic predispositions, were not considered. The exclusion of these variables may oversimplify the relationship between diabetes duration and retinopathy severity.

5. **Generalizability:** The findings are based on a sample from a single geographic location and healthcare setting, which may limit the generalizability of the results to other populations or ethnic groups that might have different rates of diabetes complications.
6. **Diagnostic tools and criteria:** The severity of diabetic retinopathy was evaluated using specific diagnostic tools and criteria, which may vary in sensitivity and specificity. Differences in diagnostic practices across different clinical settings could influence the assessment and classification of retinopathy severity.
7. **Lack of detailed treatment history:** The study did not account for variations in treatment histories among the participants, such as the use of specific diabetes medications or access to healthcare services, which could significantly affect both the control of diabetes and the progression of diabetic retinopathy.

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