

Original Article

Relationship between HbA1c Levels and Severity of Diabetic Retinopathy

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ABSTRACT

Purpose: To determine the relationship between HbA1c and severity of retinopathy in diabetic patients.

Study Design: Cross sectional study.

Place and Duration of Study: Eye department of DHQ-UTH Gujranwala, from July 2020 to Dec 2020.

Methods: An observational cross-sectional study including 100 patients was conducted at eye department of DHQ-UTH Gujranwala from January 2018 to December 2018. After approval from institutional review board, written informed consent with demographic variables was collected from every patient. Patients of either gender between 40-80 years of age with both types I and type II diabetes were included in this study. Complete ophthalmic examination including Best Corrected Visual Acuity, slit lamp biomicroscopy, Goldmann Applanation tonometry and fundus examination carried out. Diabetic retinopathy was classified from grade 0 to grade 5.

Results: Out of 100 patients, 46 (46%) were males and 54 (54%) were females. Mean age was 60 ± 2.4 years with a range of 40 – 80 years among males and 40 – 70 years among females. Forty patients presented with grade 1 diabetic retinopathy and 4% presented with grade 5. Thirty two patients had good glycemic control while 20% had glycemic control of grade III. Patients with grade 4 diabetic retinopathy had the worst glycemic control of HbA1c level of 11.5.

Conclusion: This study concluded that patients with poor glycemic control had severe diabetic retinopathy as compared to the patients with good diabetic control. There is a direct relation between HbA1c level and severity of diabetic retinopathy.

Key Words: HbA1C, Diabetic retinopathy, Non proliferative diabetic retinopathy, Proliferative diabetic retinopathy, Vitreous hemorrhage.

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INTRODUCTION

Diabetes mellitus is a metabolic syndrome characterized by an absolute or relative lack of insulin. It can damage every organ system of body causing

impaired quality of life and burden to local community and economy.¹ According to global data, 451 million people were suffering from diabetes mellitus in 2017, which is expected to increase to 693 million by 2045.²

Diabetic retinopathy is a very common complication of diabetes mellitus. It is the leading cause of blindness in working age group of 20 – 65 years.³ Diabetic Retinopathy is present in up to 40% of both type I and type II diabetic patients while type I patients are affected more.⁴

Proliferative diabetic retinopathy affects 5 – 10% of diabetic patients. Severity of diabetic retinopathy

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depends upon many factors e.g. duration of diabetes, glycemic control, hypertension, nephropathy, smoking and cataract surgery etc.^{5-8.}

Another important factor which has a strong relationship with progression of diabetic retinopathy is microalbuminuria. Microalbuminuria of higher grades pose a great risk factor for severity of diabetic retinopathy.⁹ In this study we reported relationship of severity of diabetic retinopathy with glycemic control via HbA1c level.

Regarding treatment of proliferative diabetic retinopathy and macular edema, lasers, intraocular steroid and anti vascular endothelial growth factor injection are less destructive to retina than lasers.¹⁰

This study was carried out at a tertiary care hospital to find out a relationship between the control of diabetes and severity of diabetic retinopathy.

METHODS

After approval from institutional review board, written informed consent was taken and demographic data was collected. Patients of either gender between 40 – 80 years of age with both type I and type II diabetes were included in this study. Across-sectional study including 100 patients was conducted at eye department of DHQ-UTH Gujranwala from January 2018 to December 2018. Complete ocular examination including Best corrected visual acuity, slit lamp biomicroscopy, Goldmann Applanation tonometry and ophthalmoscopy was carried out. Diabetic retinopathy was classified from grade 0 to grade 5 as follow;

Grade 0 No Diabetic Changes

Grade 1 Mild to Moderate NPDR

Grade 2 NPDR with CSME

Grade 3 PDR

Grade 4 Advanced DR (RD + VIT HGE)

Grade 5 Nerve palsies, CRVO, CRAO

HbA1c levels were classified in 3 grades as follow;

Grade I 5 – 8

Grade II 8 – 12

Grade III 12 – 15

Data was collected on specially designed proforma and analyzed using SPSS version 20. Frequency and percentages were used for categorical data while mean ± SD was determined for numerical data.

RESULTS

Out of 100 patients, 46% were males and the remaining 54% were females. Mean age was 60 ± 2.4 years. Figure 1 shows a Bar chart with number of patients on y-axis with diabetic retinopathy grades on x-axis. Maximum number of patients presented with grade 1 (40%) while minimum number of patients presented with grade 5 diabetic retinopathy (4%).

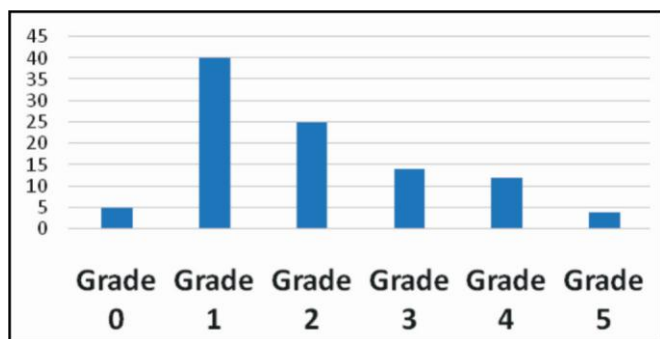


Figure 1: Number of patients with different grades of diabetic retinopathy.

Table 1: HbA1c and severity of diabetic retinopathy.

HbA1c Grading	Total No. of Patients	Diabetic Retinopathy Severity
Grade – I (5 – 8)	32 (32%)	Grade 0 = 5%
		Grade 1 = 13%
		Grade 2 = 6%
		Grade 3 = 3%
		Grade 4 = 5%
Grade – II (8 – 12)	48 (48%)	Grade 5 = 0%
		Grade 0 = 0%
		Grade 1 = 24%
		Grade 2 = 13%
		Grade 3 = 7%
Grade – III (12 – 15)	20 (20%)	Grade 4 = 3%
		Grade 5 = 1%
		Grade 0 = 0%
		Grade 1 = 3%
		Grade 2 = 6%
		Grade 3 = 4%
		Grade 4 = 4%
		Grade 5 = 3%

Patients were also divided according to their glycemic control with 32% having good glycemic control of grade I, 48% with poor glycemic control of grade II and 20% with worst glycemic control of grade III (Table 1).

Correlation between diabetic retinopathy grading and HbA1c levels was also assessed and documented

by line chart, which showed that patients with grade 4 diabetic retinopathy had the worst glycemic control of 11.5 HbA1c level (Figure 2).

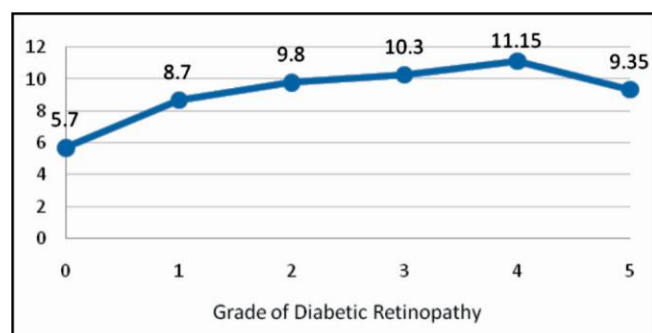


Figure 2: Correlation between diabetic retinopathy grading and HbA1c levels.

DISCUSSION

Diabetic retinopathy is a serious cause of blindness causing a major burden to ophthalmic society. It is very important to determine the risk factors exacerbating the progression of diabetic retinopathy. In this study, we have evaluated the relationship between HbA1c levels and severity of diabetic retinopathy. HbA1c levels depict glycemic control of diabetic patient which is very important factor towards development and progression of diabetic retinopathy.^{11,12}

Maximum number of male patients were between 51 – 55 years of age while in female group, maximum number of patients were in 46 – 50 years of age depicting an earlier age of presentation among females. A similar study was carried out in Indian population and it reported higher prevalence in males (68%) compared to females (32%) and majority of their patients belonged to 61 – 70 years of age.¹³

In our study, most patients presented with grade 1 diabetic retinopathy that is mild to moderate NPDR making up of 40% of total patients. Total patients belonged to NPDR grade were 65% while to PDR grade were only 14%. These values are comparable with findings of Sewak et al. while determining the association of HbA1c levels with severity of diabetic retinopathy.¹⁴

Out of 100 patients, only 5 patients presented with grade 0 (No DR) and grade 1 HbA1c levels with mean value of 5.7% that is slightly lower than the cut-off value determined by a study carried out on 3403 adults in South Korea.¹⁵ Mostly of the patients with NPDR

(grade 1 and grade 2) had HbA1c levels of grade 2 (8 – 12). Majority of the patients with grade 5 diabetic retinopathy had HbA1c levels of grade III (12 – 15). Prasad et al. reported mean HbA1c levels of 9.25 + 1.59 and revealed an increasing trend in the severity of retinopathy with a rise in HbA1c levels.¹⁶ A similar study was carried out in Saudi Arabia and it concluded that patients who had uncontrolled diabetes (high HbA1c levels) had 66.61% chance of developing diabetic retinopathy.¹⁷

Relationship between diabetic retinopathy and HbA1c levels showed that severity of retinopathy increased as HbA1c levels were raised and this is also supported by many other similar studies.¹⁸⁻²¹

A study conducted by Rebecka Andreasson et al in Sweden showed similar results in children with type 1 diabetes. Increase in HbA1c levels corresponded to the severity of diabetic retinopathy.²² In another study conducted in China by Valencia Foo et al, showed that increase in HbA1c levels and systolic BP was directly related to severity of diabetic retinopathy in type 2 diabetes.²³

Limitations of this study are that it was a single center study with limited number of patients. Multi-center study is suggested to further support relationship of HbA1c levels and severity of diabetic retinopathy.

CONCLUSION

Patients with poor glycemic control have severe diabetic retinopathy as compared to patients with good diabetic control. It suggests a direct relationship between HbA1c level and severity of diabetic retinopathy.

Ethical Approval

The study was approved by the Institutional review board/Ethical review board. (Admn.292/GMC)

Conflict of Interest

Authors declared no conflict of interest.

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Authors' Designation and Contribution

Saima Jamshaid; Consultant Ophthalmologist: *Concepts, Literature Search, Data Analysis, Statistical Analysis, Manuscript Preparation.*

Ayesha Hanif; Senior Registrar: *Manuscript Review.*

Irfan Qayyum Malik; Associate Professor: *Design, Manuscript Review.*

Nukhba Zahid; Women Medical Officer: *Data Acquisition.*

Hafiza Sadia Imtiaz; Postgraduate Trainee: *Manuscript Editing.*

