

## Association of Severity of Diabetic Retinopathy with Levels of HbA1c

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### ABSTRACT

**Aim:** To assess the association between the severity of retinopathy and HbA1c status in patients with diabetes mellitus.

**Study design:** A Cross-sectional study.

**Place and duration:** In the department of Ophthalmology, Al Shifa Trust Eye Hospital, Rawalpindi for six-months duration from December 2020 to May 2021.

**Methods:** The study included 120 patients of both sexes with type I and type II diabetes, aged 35-80 years. Full ophthalmology examination was carried out including the slit lamp examination, best visual acuity correction, fundus examination and Goldman applanation tonometry. The diabetic retinopathy is graded from Grade 0-Grade V.

**Results:** Of the 120 cases, 58 (49%) were male and 52 (51%) were female.  $60 \pm 2.4$  years was the mean age of patients with 35-80 years of age range for men and 40-75 years for women. Figure 1 is a bar graph showing the severity of diabetic retinopathy. Grade-I diabetic retinopathy was seen in 45(37.5%) patients and Grade-V was noted in 5%. The good control of glycemia was seen in 38 patients and 20.8% had Grade III glycemic control. The worst glycemic control was seen in patients with Grade-IV diabetic retinopathy having 11.8 of HbA1c.

**Conclusions:** This analysis found that severe diabetic retinopathy was seen in patients with poor control of glycemia in comparison to patients with better diabetes control. There is a direct relationship between the severity of diabetic retinopathy and levels of HbA1c levels.

**Keywords:** Diabetic retinopathy, Vitreous hemorrhage, HbA1C, Proliferative diabetic retinopathy, Non-proliferative diabetic retinopathy.

### INTRODUCTION

Diabetes mellitus is an endocrinological disorder categorised by relative and absolute deficiency of insulin<sup>1-2</sup>. It can harm all organs of the body, worsening the life quality and putting a strain on the economy and local community<sup>3</sup>. Conferring to international statics, 4.51 billion of individuals had DM in 2017 and is predictable to upsurge to 6.93 billion by 2050. The most common problem of diabetes is diabetic retinopathy<sup>4-5</sup>. It is the important source of loss of sight in 20-65 years of working people. About 40% of patients has diabetic retinopathy with type 1 and type 2 diabetes, while subjects with type-I diabetes are more affected. About 5% to 10% of the patients with diabetes have proliferative diabetic retinopathy<sup>6-7</sup>. The diabetic retinopathy severity be contingent on various aspects, including glycemic control, duration of diabetes mellitus, nephropathy, hypertension, cataract surgery and smoking, etc<sup>8</sup>. Additional significant factor strongly associated with the diabetic retinopathy progression is microalbuminuria<sup>9</sup>. High-grade microalbuminuria is a major causing factor for worsening of diabetic retinopathy. In this research, we describe the association between the diabetic retinopathy severity and control of blood sugar levels in relation to HbA1c levels<sup>10</sup>. When it comes to treating macular edema and proliferative diabetic retinopathy, intraocular steroids, lasers and injections of anti-VEGF cause less damage to the retina in comparison to lasers<sup>11</sup>. This study was conducted to assess the association between the severity of retinopathy and HbA1c status in patients with diabetes mellitus.

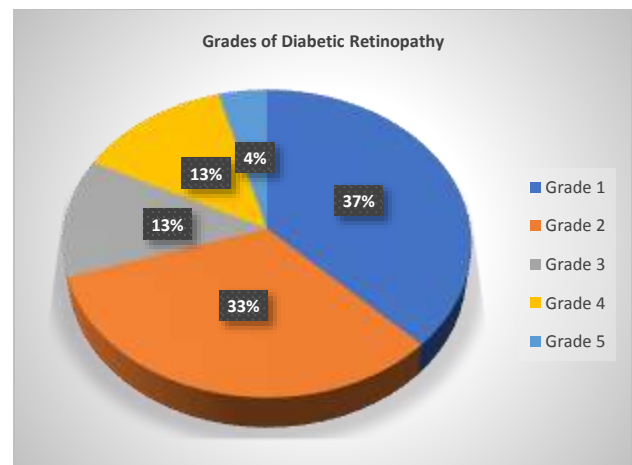
### METHODS

After consent by the institutional review committee, demographic data was gathered after written informed consent. The study included 120 patients of both sexes with type I and type II diabetes, aged 35-80 years. Full ophthalmology examination was carried out including the slit lamp examination, best visual acuity correction, fundus examination and Goldman applanation tonometry. The diabetic retinopathy is graded from Grade 0-Grade V; If no Diabetic Changes, will be labeled as Grade 0, Mild to Moderate NPDR will be labeled as Grade 1, CSME with NPDR as Grade 2, PDR Grade 3, Advanced DR (VIT HE+ RD) will be labeled as Grade 4 and Nerve Palsy, CRAO, CRVO will be labeled

as Grade 5. The levels of HbA1c are categorized into three grades as follows; Grade-I: 5 to 8, Grade-II: 8 to 12, Grade III: 12 to 15. A specially designed proforma was used for data collection and SPSS 22.0 for analysis of data. The percentages and frequencies were cast-off for categorical data and numerical data was considered as the mean  $\pm$  SD.

### RESULTS

Of the 120 cases, 58 (49%) were male and 52 (51%) were female.  $60 \pm 2.4$  years was the mean age of patients with 35-80 years of age range for men and 40-75 years for women. Figure 1 is a bar graph showing the severity of diabetic retinopathy.



Grade-I diabetic retinopathy was seen in 45(37.5%) patients and Grade-V was noted in 5%. The good control of glycemia was seen in 38 patients and 20.8% had Grade III glycemic control. The worst glycemic control was seen in patients with Grade-IV diabetic retinopathy having 11.8 of HbA1c. (Table 1).

Table 1: HbA1c and severity of diabetic retinopathy

HbA1c Grading	Total No. of Patients	Diabetic Retinopathy Severity
Grade – I (5 – 8)	38 (31.7%)	Grade 0 = 4.2% Grade 1 = 12.5% Grade 2 = 7.5% Grade 3 = 2.5% Grade 4 = 6.7% Grade 5 = 0%
Grade – II (8 – 12)	57 (47.5%)	Grade 0 = 0% Grade 1 = 16.7% Grade 2 = 13.3% Grade 3 = 5.8% Grade 4 = 4.2% Grade 5 = 1.7%
Grade – III (12 – 15)	25 (20.8%)	Grade 0 = 0% Grade 1 = 4.2% Grade 2 = 8.3% Grade 3 = 3.3% Grade 4 = 3.3% Grade 5 = 3.3%

The correlation between the HbA1c levels and severity of diabetic retinopathy was evaluated and documented.

## DISCUSSION

One of the grave reasons of blindness is diabetic retinopathy that places a heavy load on the ophthalmic community<sup>12</sup>. It is very vital to identify the risk factors that increase the diabetic retinopathy progression. In this analysis, we assessed the association between diabetic retinopathy severity and HbA1c levels<sup>13-14</sup>. HbA1c levels represent control of glycemic among patients with diabetes mellitus, which is a key feature in the progression and development of diabetic retinopathy. The maximum numeral of male subjects ranges from 51 to 55 years of age, while the maximum numeral of female subjects is from 46 to 50 years, which is the earlier age of admission to women<sup>15</sup>. A comparable analysis was conducted in the Indian people and found an advanced incidence among males (69%) in comparison to females (31%), with the maximum of the patients ranging in age from 61 to 70 years. Most of the patients in our study had diabetic retinopathy of grade 1 with NPDR of mild to moderate severity, accounting for 45% of all cases<sup>16-17</sup>. While the total number of cases with NPDR grade was 65%, only 14% of the patients had PDR. These values are similar to the results of Sewak et al in assessing the relationship of levels of HbA1c with the diabetic retinopathy severity<sup>18</sup>. Only 5 of the 120 subjects had Grade 0 (no DR) and HbA1c levels at Grade 1, with 5.7% of the mean value which is to some extent lesser than the cut-off value governed in 3,403 adults, a study held in South Korea. Most of the 15 NPDR cases (Grade-I and II) had HbA1c at Grade 2 (8-12). Grade III HbA1c (12-15) was seen among patients with Grade-V diabetic retinopathy<sup>19-20</sup>. Prasad et al. recorded mean levels of HbA1c as 9.30 +1.60 and showed a cumulative inclination in the diabetic retinopathy severity as HbA1c levels increased<sup>21-22</sup>. A comparable analysis was conducted in Saudi Arabia and found that subjects with un-controlled diabetes (high HbA1c) have a 67.10% risk of progression towards the diabetic retinopathy<sup>23</sup>. The association between HbA1c levels and diabetic retinopathy shows that the retinopathy severity increases with increasing levels of HbA1c, which is as well reported by various comparable studies<sup>24</sup>. A Rebecca Andreasson et al study in Sweden presented comparable outcomes in type 1 diabetic children<sup>25</sup>. Elevated levels of HbA1c were consistent with the diabetic retinopathy severity. Another Valencia Foo et al study in China exhibited that increases in systolic blood pressure and HbA1c levels are directly interrelated to the diabetic retinopathy severity in type-II diabetic patients.

## CONCLUSION

This analysis found that severe diabetic retinopathy was seen in patients with poor control of glycemia in comparison to patients

with better diabetes control. There is a direct relationship between the severity of diabetic retinopathy and levels of HbA1c levels.

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