

Association of Intraocular Pressure with HbA1C Levels in Patients with Type 2 Diabetes Mellitus

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Abstract: ***Introduction:** Diabetes mellitus is becoming an epidemic in our country and worldwide. It is an important risk factor for raised intraocular pressure (IOP). Raised IOP is associated with a potentially blinding condition known as glaucoma. Identification of risk factors is a mainstay in the prevention and early detection of glaucoma. **Aim & objectives:** To determine the association of IOP with glycosylated hemoglobin (HbA1c) levels in patients with Type 2 diabetes mellitus & to identify patients of type 2 Diabetes mellitus who are at risk of developing glaucoma. **Materials & methods:** A cross-sectional study was performed on 60 patients with Type 2 Diabetes mellitus. Detailed ocular examination & measurement of IOP by Goldmann's applanation tonometer was done to all patients. The HbA1c levels of these patients were documented. The patients were allocated in 2 groups, based on HbA1c levels <7% in Group 1 & HbA1c levels ≥7% in Group 2. **Results:** Out of 60 patients, there were 39 males (65%) & 21 females (35%). The mean HbA1c level in Group 1 was 6.0 ± 0.4 % & in Group 2 was 8.6 ± 1.1 %. The mean IOP in Group 1 was 12.1 ± 1.2 mmHg & in Group 2 was 16.3 ± 2.2 mmHg. The difference of IOP in both groups was statistically significant (p<0.005). **Conclusion:** Diabetic patients with poor glycemic control revealed higher IOP compared to those with good glycemic control (lower HbA1c levels). Thus, in patients with Type 2 Diabetes mellitus, regular screening for IOP and monitoring of HbA1c levels may be useful in assessing the potential risk of developing glaucoma and reducing ocular comorbidity.*

Keywords: Diabetes Mellitus, intraocular pressure, HbA1c, Glaucoma

1. Introduction

The number of diabetic patients is growing fast and gaining a status of emerging pandemic in India and worldwide. The disease is currently affecting 62 million people in India, and it is predicted that by the year 2030, the number will grow up to 79.4 million.^[1]

Diabetes besides having an effect on the retina is also a risk factor for raised intraocular pressure (IOP). A number of studies have shown the association of diabetes mellitus with glaucoma^[5, 6]. Glaucoma is a disease characterized by chronic progressive optic neuropathy and visual field changes. The normal range of IOP is 10 - 20 mm Hg. The normal IOP is determined by the balance of production of aqueous humor and its drainage through the trabecular meshwork.^[1] Any imbalance in its production or drainage leads to rise in IOP. Raised IOP is a major risk factor for glaucoma.

Diabetes affects the IOP by various suggested mechanisms based on experimental studies one of which is glucose induced upregulation of fibronectin. Increased fibronectin accumulation in the extracellular matrix of trabecular meshwork blocks the aqueous outflow facility. Decreased aqueous drainage leads to rise in IOP.^[1] Raised IOP further leads to progressive damage of optic nerve head and retina. IOP measurement is usually missed in the regular eye screening of diabetic patients. The prevention of blindness due to glaucoma depends on early detection and intervention. Hence, we are conducting this study to

determine the association between diabetes mellitus and IOP and whether poor glycemic control acts as a risk factor for raised IOP.

2. Materials and Methods

It was a cross sectional study conducted on patients with Type 2 Diabetes mellitus attending the outpatient department of Ophthalmology of our hospital. The study period was for 6 months. All Patients of both genders, between 40 to 80 years of age with Type 2 Diabetes mellitus were included in the study after obtaining ethical approval from the institution ethics committee. Patients already diagnosed with glaucoma, using anti glaucoma medications, on oral or topical steroids, history of ocular trauma and patients with any other ocular disease were excluded from the study.

Informed consent and detailed history of the patient was taken. Detailed ocular examination including visual acuity, slit lamp examination, intraocular pressure measurement by Goldmann's applanation tonometer and dilated fundus examination was done to all patients. The HbA1c levels of these patients was documented. The patients were allocated in 2 groups, HbA1c levels <7% in Group 1 and HbA1c levels ≥7% in Group 2. The intraocular pressure was noted in each patient.

3. Results

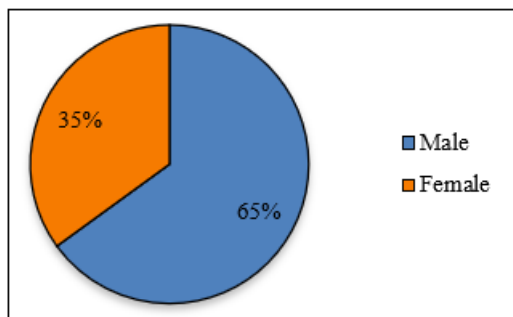


Figure 1: Demographic Details

Table 1: Showing mean IOP and mean HbA1c difference between Group 1 (HbA1c <7%) and Group 2 (HbA1c ≥7%)

IOP: Intraocular pressure

Parameter	HbA1c <7%	HbA1c ≥7%
Mean IOP±SD	12.1± 1.2 mmHg	16.3 ± 2.2 mmHg
Mean HbA1c±SD	6.0 ± 0.4 %	8.6 ± 1.1 %

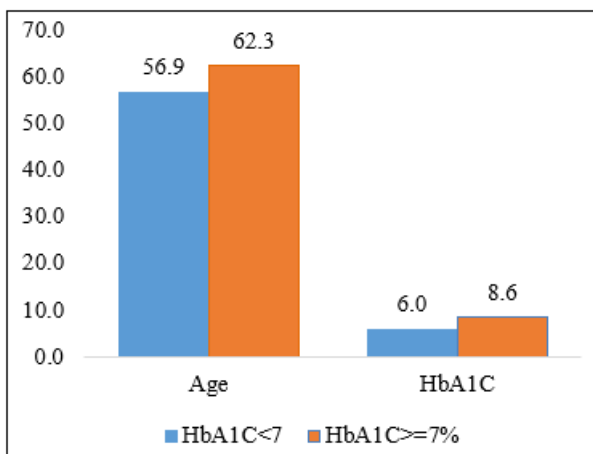


Figure 2: Showing mean age and mean HbA1c difference between Group 1 (HbA1c <7%) and Group 2 (HbA1c ≥7%)

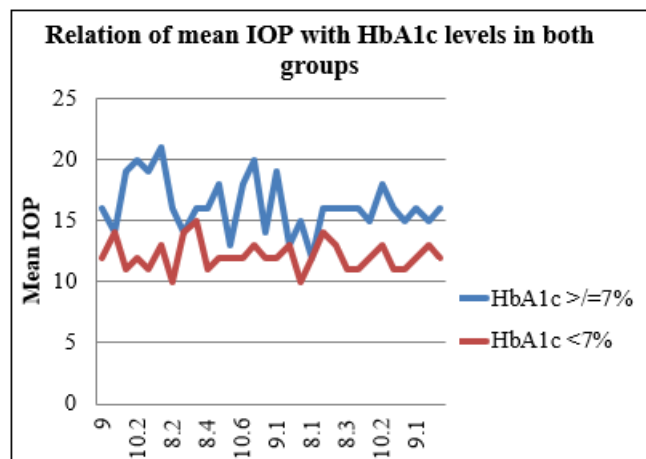


Figure 3: Relationship between mean IOP and HbA1c levels in Category 1 (HbA1c <7 %) and Category 2 (HbA1c ≥7 %) diabetic patients.

Table 2: Table showing HbA1c levels range and the corresponding no. of individuals for both the groups

HbA1c Range (%)	No. of Individuals
5.5 to 5.9	14
6.0 to 6.4	12
6.5 to 6.9	4
7.0 to 7.5	4
7.6 to 8.0	7
8.0 to 10.0	14
>10.0	5
Total = 60	

A total of 60 patients (120 eyes) of Type 2 diabetes mellitus who satisfied the inclusion criteria were included in the study. The age of the patients ranged between 40 - 80 years. Out of these, 39 patients were male and 21 patients were female (Figure 1). The mean IOP of both eyes of each patient and HbA1c levels are detailed in table 1 and Figure 2. It was observed that patients belonging to the category with higher HbA1c levels had higher mean IOP as compared to the patients belonging to the category with lower HbA1c levels (Figure 3). The mean HbA1c in Group 1 was 6.0 ± 0.4 % & in Group 2 was 8.6 ± 1.1 %. The mean IOP in Group 1 was 12.1± 1.2 mmHg & in Group 2 was 16.3 ± 2.2 mmHg. The difference of IOP in both groups was statistically significant (p<0.005). HbA1c levels range and the corresponding no. of individuals for both the groups is shown in Table 2.

4. Discussion

In our study, we observed that the diabetic patients with higher HbA1c levels have higher IOP than patients with lower HbA1c levels. Our findings indicate an association between hyperglycemia and raised IOP and indicate poor glycemic control as a risk factor for glaucoma in diabetic patients.

Baisakhiya et al conducted their study including Group I of 80 normal healthy participants constituting the control group & Group II of 100 diabetic patients. Group II was further subdivided into 3 subgroups according to glycemic control: Group IIA with HbA1c levels <7% indicating good glycemic control, Group IIB with HbA1c levels between 7% and 8% indicating fair glycemic control, and Group IIC with HbA1c levels >8% indicating poor glycemic control. The mean IOP of patients of Group II was higher than Group I. The study suggested that diabetic patients are prone to higher IOP, and especially, the patients with poor glycemic control were more prone to raised IOP. Agrawal et al in their cross sectional study performed on 159 patients with type II diabetes mellitus suggested that hyperglycaemic levels as determined by raised HbA1c levels are associated with higher intraocular pressures in patients with type 2 diabetes mellitus. Samal et al in their study performed on 664 diabetic patients suggested that the intraocular pressure is higher in diabetic patients than normal. Intraocular pressure increased significantly on increasing severity of diabetic retinopathy showing a positive correlation between intraocular pressure and grades of diabetic retinopathy.

The possible suggested mechanisms of raised IOP in diabetic patients, based on experimental studies is glucose induced upregulation of fibronectin. Increased fibronectin

accumulation in the extracellular matrix of trabecular meshwork blocks the aqueous outflow facility. ^[10] Decreased aqueous drainage leads to rise in IOP. Raised IOP, in turn, leads to progressive damage of optic nerve head and retinal ganglion cells due to mechanical compression. ^[11]

Some studies have described that in diabetes, hyperglycemia may increase IOP by interrupting the trabecular meshwork function due to accumulation of extracellular matrix (ECM) components, such as fibronectin and glycosaminoglycans in the aqueous outflow pathway. ^[12] Hyperglycemia may also induce an osmotic gradient that draws excess aqueous humor into the anterior chamber. ^[20] Microvascular damage due to high blood glucose levels can disrupt autoregulation of the retina and optic nerve and decrease optic disc perfusion. Chronic inflammation due to diabetes mellitus can also cause increased oxidative stress in the optic nerve. ^[21]

Therefore, collective evidence from various studies and the results from our study, it is reasonable to consider that poor glycemic control and raise blood glucose levels in diabetes mellitus is a risk factor for raised IOP and glaucoma. It can be considered that there is a significant association between HbA1c levels and intraocular pressure in patients with Type 2 Diabetes mellitus.

5. Conclusion

Diabetic patients with poor glycemic control revealed higher IOP compared to those with good glycemic control (lower HbA1c levels). Since poor glycemic control in Type II diabetic patients may be a risk factor for glaucoma, it is important that blood glucose monitoring should include measurement of HbA1c levels in addition to fasting and post-prandial blood glucose level monitoring. It is advisable that the intraocular pressure of diabetics be measured and recorded on a regular basis. Thus, in patients with Type 2 Diabetes mellitus, regular screening for IOP and monitoring of HbA1c levels may be useful in assessing the potential risk and reducing ocular comorbidity of developing glaucoma.

Financial Disclosure: Nil

Conflict of Interest: Nil

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