

## Original research article

## Determine the intraocular pressure in diabetic and non diabetic individuals: a comparative assessment

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### Abstract

**Background:** Diabetes mellitus is one of the major health issues affecting people across nations. The complications of diabetes mellitus affect vital organs of human body, among which eyes are more susceptible to diabetic complications like primary open angle glaucoma. Increased IOP is one of the complications faced by diabetics.

**Aim:** to compare the intraocular pressure in diabetes mellitus and non diabetic's individuals.

**Material and methods:** This prospective observational study was done the Department of Ophthalmology, Nalanda Medical College and Hospital, Patna, Bihar, India, for 1 year. all the Patients having diabetes mellitus on treatment and Non diabetic individuals was included in this study. Two groups were formed which includes Group A constituting diabetes mellitus patients and Group B constitutes Non diabetic individuals. Detailed history of diabetes mellitus patient was taken regarding duration of diabetes, treatment, fasting, post prandial blood sugar levels and HbA1c was recorded. Intra ocular pressure was compared between Group A and Group B, to correlate intra ocular pressure in relation to duration of diabetes mellitus and different stages of diabetic retinopathy. Diabetic retinopathy changes were classified according to the ETDRS classification.

**Results:** 140 patients were included in our study. 60 patients had Type 2 diabetes mellitus (all were non insulin dependent) and 10 patients had Type 1 diabetes mellitus, and 70 patients were Non-diabetics subjects. Mean age of non diabetics was  $53.7 \pm 12.1$  years and that of diabetics  $58.12 \pm 11.63$  years (p value 0.43) statistically not significant. In those 70 diabetic patients 50 were male and 20 were female. Mean age of male subjects was  $57.96 \pm 10.3$  years and that of female was  $58.09 \pm 11.32$  years in diabetic group which was no statistically significant (p value 0.47). The mean intra-ocular pressure higher ( $16.89 \pm 2.39$ mmHg) in diabetic patients as compared with ( $13.93 \pm 2.86$ mmHg) in non-diabetic, p value  $< 0.0001$  which is statistically significant.

**Conclusion:** This study shows significantly higher intraocular pressures in patients with Type 2 diabetes. This would suggest that diabetics should be monitored regularly for intraocular pressure to detect an early onset of glaucoma in susceptible patients.

**Key Words:** intraocular pressure, diabetes mellitus

### Introduction

Intraocular pressure (IOP) is the fluid pressure inside the eye and an important ophthalmic physiological parameter. High IOP is widely acknowledged as the most important risk factor for glaucoma, and IOP reduction therapy is the only proven effective treatment.<sup>1,2</sup> Thus it is of pragmatic significance to understand the distribution and risk factors of IOP for glaucoma prevention and prognosis. Many factors, such as age,<sup>3-6</sup> body mass index (BMI),<sup>7</sup> blood pressure (BP),<sup>5,8</sup> blood glucose,<sup>9,10</sup> central corneal thickness (CCT),<sup>4</sup> have been reported to

associate with IOP, but their results were not entirely consistent in all studies, and the potential risk factors in their analysis were failed to account due to lack of data. Therefore, population-based studies with larger sample size and detailed information are needed to better understand these issues. To be noted, diabetes has become a global epidemic problem. It has been estimated that there were 451 million (age 18–99 years) people with diabetes in 2017, and these figures were expected to increase to 693 million by 2045.<sup>11</sup> It remains equivocal whether diabetic populations have different distribution or risk factors for IOP, and the association of diabetes with glaucoma has still been controversial, despite the fact that people with diabetes are twice likely to develop glaucoma compared with nondiabetics.<sup>12</sup> Therefore, data on IOP distribution and risk factors in diabetic populations are needed to clarify the relationship between glaucoma and diabetes and plan effective prevention strategies.

Intraocular pressure may become elevated due to anatomical problems, inflammation of the eye, genetic factors, or as a side-effect from medication. Intraocular pressure laws follow fundamentally from physics. Any kinds of intraocular surgery should be done by considering the intraocular pressure fluctuation. Sudden increase of intraocular pressure can lead to intraocular micro barotrauma and cause ischemic effects and mechanical stress to retinal nerve fiber layer. Sudden intraocular pressure drop can lead to intraocular decompression that generates micro bubbles that potentially cause multiple micro emboli and leading to hypoxia, ischemia and retinal micro structure damage.<sup>13</sup> Glaucoma is a disease condition characterized by chronic progressive optic neuropathy and typical visual field changes. Elevated IOP is the major risk factor for glaucoma. The aim of the present study was to compare the intraocular pressure in diabetes mellitus and non diabetic's individuals.

### **Material and methods**

This prospective observational study was done the Department of Ophthalmology, Nalanda Medical College and Hospital, Patna, Bihar, India, for 1 year. after taking the approval of the protocol review committee and institutional ethics committee.

#### **Inclusion Criteria**

- Patients with diabetes mellitus.
- Age group 18-70 years.
- Non diabetic individuals

#### **Exclusion Criteria**

- Patients having corneal pathology and any other ocular abnormalities like pterygium, entropion, trichiasis.
- Patients who have undergone previous ocular surgeries.
- Contact lens wearers.
- Patients on topical and systemic steroids.
- Patients having refractive error greater than  $\pm 6D$  spherical or cylinder greater than  $\pm 3D$ .
- Pregnant women.

After taking informed consent detailed history was taken from the patient or relatives. Patients having diabetes mellitus (who are previously diagnosed by physician) on treatment and Non diabetic individuals were included in this study. Two groups was formed which includes Group A constituting diabetes mellitus patients and Group B constitutes Non diabetic individuals. Detailed history of diabetes mellitus patient was taken regarding duration of diabetes, treatment, fasting, post prandial blood sugar levels and HbA1c will be recorded.

All the patients of Group A and Group B were undergo complete ophthalmic examination, which includes best corrected visual acuity, slit lamp anterior segment examination, slit lamp biomicroscopy (+90D)/ indirect ophthalmoscopy for posterior segment examination, Perkins

applanation tonometry to measure intra ocular pressure. Gonioscopy was done if required. For posterior segment examination pupils was dilated using mydriatics and slit lamp biomicroscopic/ indirect ophthalmoscopy examination was done to find out the diabetic retinopathy changes and classified according to the ETDRS classification. Intra ocular pressures were compared between Group A and Group B, to correlate intra ocular pressure in relation to duration of diabetes mellitus and different stages of diabetic retinopathy. Diabetic retinopathy changes were classified according to the ETDRS classification (Non proliferative and proliferative diabetic retinopathy).

### Results

140 patients were included in our study. 60 patients had Type 2 diabetes mellitus (all were non insulin dependent) and 10 patients had Type 1 diabetes mellitus (all were insulin dependent), and 70 patients were Non-diabetics subjects. Mean age of non diabetics was  $53.7 \pm 12.1$  years and that of diabetics  $58.12 \pm 11.63$  years (p value 0.43) statistically not significant. In those 70 diabetic patients 50 were male and 20 were female. Mean age of male subjects was  $57.96 \pm 10.3$  years and that of female was  $58.09 \pm 11.32$  years in diabetic group which was no statistically significant (p value 0.47).

**Table 1: Mean IPO of patients of diabetics and non diabetics**

Patients	n	Mean IOP(mmHg)	SD	p-value
Diabetics	70	16.89	2.39	P<0.0001*
Non Diabetics	70	13.93	2.86	

Table 1 shows mean intra-ocular pressure higher ( $16.89 \pm 2.39$ mmHg) in diabetic patients as compared with ( $13.93 \pm 2.86$ mmHg) in non-diabetic, p value < 0.0001 which is statistically significant.

**Table 2: Mean IPO of patients with Duration of diabetes**

Duration of diabetes	Mean IOP(mmHg)	SD	p-value
<10 years	16.78	3.22	P<0.22
>10 years	16.98	2.59	

Table 2 shows mean intra ocular pressure was ( $16.98 \pm 2.59$ mmHg) in diabetic patients with duration greater than 10 years as compared with ( $16.78 \pm 3.22$ mmHg) in diabetic patients with duration less than 10 years, p value > 0.05 which is not significant.

**Table 3: Mean IPO of patients with HbA1c**

HbA1c	Mean IOP	± SD	p-value
<6.5	17.07	1.59	<0.0005*
>6.5	18.42	2.91	

Table 3 shows mean intra-ocular pressure ( $18.42 \pm 2.91$  mmHg) higher in diabetic patients with HbA1c value >6.5% as compared ( $17.07 \pm 1.59$  mmHg) with diabetic patients with HbA1c value <6.5%, p value < 0.0005 which is statistically significant.

**Table 4: Mean IPO of patients with diabetic Retinopathy**

Diabetic Retinopathy	Mean IOP	± SD	p-value
NPDR	19.7	2.42	<0.0001*
PDR	13.2	1.69	

Table 4 shows mean intraocular pressure lower in patients who have proliferative diabetic retinopathy than in those patients having non-proliferative diabetic retinopathy, p value <0.0001 which is statistically significant.

### Discussion

Intraocular pressure constitutes as a major risk factor for the emergence of glaucoma, an ophthalmological condition associated with DM.<sup>14</sup> DM and IOP are related in a way that the elevated blood glucose results in the induction of an osmotic gradient which leads to fluid shifts into the intraocular space.<sup>15</sup>

Glaucoma is the world's leading cause of acquired blindness.<sup>16</sup> Glaucoma is an optic neuropathy characterized by progressive degeneration of retinal ganglion cells and their axons, manifested by increasing optic disc cupping and deterioration of visual function.<sup>17</sup> The round firm shape to the eyeball is caused by the intra ocular pressure (IOP) within the eyeball which is caused by the aqueous humour and vitreous body. Importance of IOP is in maintaining the structural and functional integrity of the eye. High intraocular pressure is more often associated with glaucomatous optic nerve damage. IOP is not the only risk factor for optic nerve damage but is one of the modifiable risk factor for emergence of glaucoma and is the only amendable risk factor that can be treated.<sup>18</sup>

Our study shows mean intra-ocular pressure higher (16.89±2.39mmHg) in diabetic patients as compared with (13.93±2.86mmHg) in non-diabetic, p value < 0.0001 which is statistically significant. Study conducted by Jain and Luthra, reported that mean intraocular pressure in diabetic eyes is slightly higher than nondiabetic eyes.<sup>19</sup> Contrary to our study, study conducted by Tielsch JM, Katz J et al Baltimore eye survey could not show any positive co- relation between diabetes and elevated intra ocular pressure(POAG) as compared to non diabetic individuals.<sup>20</sup>

In our study it was observed that mean intra-ocular pressure (18.42±2.91 mmHg) higher in diabetic patients with HbA1c value >6.5% as compared (17.07±1.59 mmHg) with diabetic patients with HbA1c value <6.5%, p value < 0.0005 which is statistically significant.

A study conducted by Oshitari T., Fujimoto N et al showed higher intraocular pressure with chronic hyperglycaemia i.e >6.5%.<sup>21</sup> Baisakhiya S, Garg P et al also had similar finding, mean IOP of diabetic subjects with HBA1C<7% was 16.9±0.43 mm Hg and with HBA1C>8% was 18.62±0.22 mm of Hg (P<0.005) which was significantly higher.<sup>22</sup> In our study the mean intraocular pressure was lower in patients who had proliferative diabetic retinopathy than in those patients having non-proliferative diabetic retinopathy, p value <0.0001 which is statistically significant. Study conducted by Christiansson (1961) also reported low IOP in proliferative retinopathy compared to non-proliferative retinopathy.<sup>23</sup> On the contrary one of the study conducted by Masato Matsuoka, Nahoko Ogata et al showed IOP in each diabetic retinopathy group was significantly higher than that in their nondiabetic group ( $P < 0.001$ ), but there was no significant difference between the diabetic retinopathy groups. \* $P < 0.001$ .<sup>24</sup>

### Conclusion

This study shows significantly higher intraocular pressures in patients with Type 2 diabetes. This would suggest that diabetics should be monitored regularly for intraocular pressure to detect an early onset of glaucoma in susceptible patients.

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