

Original research article

Assessment of the intraocular pressure of diabetics and non-diabetics: a comparative study

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Abstract

Aim: The aim of the present study was to compare the intraocular pressure in diabetes mellitus and non diabetic's individuals.

Methods: This prospective observational study was done the Department of ophthalmology in Jawahar Lal Nehru Medical College and Hospital, Bhagalpur, Bihar, India, for 1 years. This research involved all diabetic and non-diabetic patients with diabetes mellitus who were on care. Patients with diabetes mellitus were divided into Group A, while non-diabetic people were taken into Group B. A comprehensive history of the patient's diabetes mellitus was taken, including the length of the condition, medication, fasting, postprandial blood sugar levels, and HbA1c. Intraocular pressure was compared between Groups A and B to see whether there was a correlation between intraocular pressure and diabetes mellitus duration and different stages of diabetic retinopathy.

Results: 150 patients were included in our study. Mean age of non diabetics was 52.6 ± 11.9 years and that of diabetics 56.19 ± 11.93 years (p value 0.37) statistically not significant. In those 75 diabetic patients 53 were male and 22 were female. Mean age of male subjects was 58.16 ± 11.3 years and that of female was 57.79 ± 11.82 years in diabetic group which was not statistically significant (p value 0.38). The mean intra-ocular pressure higher (17.09 ± 2.59 mmHg) in diabetic patients as compared with (14.03 ± 2.76 mmHg) in non-diabetic, p value < 0.0001 which is statistically significant. The mean intra ocular pressure was (17.18 ± 2.63 mmHg) in diabetic patients with duration greater than 10 years as compared with (17.08 ± 3.37 mmHg) in diabetic patients with duration less than 10 years, p value > 0.05 which is not significant. The mean intra-ocular pressure (18.52 ± 2.87 mmHg) higher in diabetic patients with HbA1c value $> 6.5\%$ as compared (17.17 ± 1.63 mmHg) with diabetic patients with HbA1c value $< 6.5\%$, p value < 0.0005 which is statistically significant.

Conclusion: Diabetes mellitus is a risk factor for IOP. The rise in IOP is prevented by strict glycemic regulation. IOP was shown to be more likely in patients with impaired glycemic function. Diabetic patients should have their IOP tested on a daily basis to reduce the burden of glaucoma-related ocular morbidity.

Keywords: intraocular pressure, diabetes mellitus

Introduction

The intraocular pressure is determined by the balance between the production of aqueous humour and its drainage. Various factors may influence the level of intraocular pressure (IOP) e.g. age, sex, blood pressure, body mass index, diabetes etc.^{1,2} Elevated intraocular pressure is a significant risk factor for the development of primary open angle glaucoma (POAG). Glaucomas the leading cause of blindness in the world.¹ Many factors, such as age,³⁻⁶ body mass index (BMI),⁷ blood pressure (BP),^{5,8} blood glucose,^{9,10} central corneal thickness (CCT),⁴ 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 2045.¹¹ 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 nondiabetes.¹² 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.¹³ 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 in Jawahar Lal Nehru Medical College and Hospital, Bhagalpur, Bihar, India, for 1 year, after taking the approval of the protocol review committee and institutional ethics committee. Since obtaining informed consent, the patient or family is asked to have a brief history. This research involved people with diabetes mellitus (previously diagnosed by a physician) that were on medication and non-diabetic persons. Patients with diabetes mellitus were taken into Group A, while non-diabetic people were taken into Group B. A comprehensive history of the patient's diabetes mellitus was taken, including the length of the condition, medication, fasting, postprandial blood sugar levels, and HbA1c.

Both patients in Groups A and B had a comprehensive ophthalmic test that included best corrected vision acuity, slit lamp anterior segment examination, slit lamp biomicroscopy (+90D)/indirect ophthalmoscopy for posterior segment examination, and Goldmann applanation tonometry to assess intraocular pressure. gonioscopy was performed. For the posterior section test, mydriatics were used to dilate the eyes, and a slit lamp biomicroscopic/indirect ophthalmoscopy examination was performed to detect diabetic retinopathy changes, which were then identified using the ETDRS classification. 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 (Non proliferative and proliferative diabetic retinopathy).

Inclusion Criteria

- Patients with diabetes mellitus.
- Age group 18-67 years.
- Non diabetic individuals

Exclusion Criteria

- Patients having corneal pathology and any other ocular abnormalities like pterygium, entropionj, 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.

Results

150 patients were included in our study. 65 patients had Type 2 diabetes mellitus (all were non insulin dependent) and 10 patients had Type 1 diabetes mellitus (all were insulin dependent), and 75 patients were Non-diabetics subjects. Mean age of non diabetics was 52.6 ± 11.9 years and that of diabetics 56.19 ± 11.93 years (p value 0.37) statistically not significant. In those 75 diabetic patients 53 were male and 22 were female. Mean age of male subjects was 58.16 ± 11.3 years and that of female was 57.79 ± 11.82 years in diabetic group which was no statistically significant (p value 0.38).

Table 1: Mean IOP of patients of diabetics and non diabetics

Patients	n	Mean IOP(mmHg)	SD	p-value
Diabetics	75	17.09	2.59	P<0.0001*
Non Diabetics	75	14.03	2.76	

Table 1 shows mean intra-ocular pressure higher (17.09 ± 2.59 mmHg) in diabetic patients as compared with (14.03 ± 2.76 mmHg) in non-diabetic, p value < 0.0001 which is statistically significant.

Table 2: Mean IOP of patients with Duration of diabetes

Duration of diabetes	Mean IOP(mmHg)	SD	p-value
<10 years	17.08	3.37	P<0.27
>10 years	17.18	2.63	

Table 2 shows mean intra ocular pressure was (17.18 ± 2.63 mmHg) in diabetic patients with duration greater than 10 years as compared with (17.08 ± 3.37 mmHg) in diabetic patients with duration less than 10 years, p value > 0.05 which is not significant.

Table 3: Mean IOP of patients with HbA1c

HbA1c	Mean IOP	\pm SD	p-value
<6.5	17.17	1.63	<0.0005*
>6.5	18.52	2.87	

Table 3 shows mean intra-ocular pressure (18.52 ± 2.87 mmHg) higher in diabetic patients with HbA1c value >6.5% as compared (17.17 ± 1.63 mmHg) with diabetic patients with HbA1c value <6.5%, p value < 0.0005 which is statistically significant.

Table 4: Mean IOP of patients with diabetic Retinopathy

Diabetic Retinopathy	Mean IOP	\pm SD	p-value
NPDR	20.01	2.38	<0.0001*
PDR	14.03	1.72	

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.¹⁴ 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.¹⁵

Glaucoma is the world's leading cause of acquired blindness.¹⁶ 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.¹⁷ 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.¹⁸

Our study shows mean intra-ocular pressure higher (17.09 ± 2.59 mmHg) in diabetic patients as compared with (14.03 ± 2.76 mmHg) 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.¹⁹ Contrary to our study, study conducted by Tielsch JM, Katz J et al Baltimore eye survey could not show any positive correlation between diabetes and elevated intra ocular pressure (POAG) as compared to non diabetic individuals.²⁰

In our study it was observed that mean intra-ocular pressure (18.52 ± 2.87 mmHg) higher in diabetic patients with HbA1c value >6.5% as compared (17.17 ± 1.63 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%.²¹ 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.²² 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.²³ 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 < 0.001.²⁴

Conclusion

Diabetes mellitus is a risk factor for elevated IOP, according to the findings of this report. The growth in IOP is prevented by strict glycemic regulation. IOP was shown to be more likely in patients with impaired glycemic function. Diabetic patients should have their IOP tested on a daily basis to reduce the burden of glaucoma-related ocular morbidity.

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