

Comparative Assessment of the Intraocular Pressure (IOP) in Diabetes Mellitus and Non-Diabetics Individuals

Umesh Kumar¹, Nawin Kumar²

¹Senior Resident, Department of Ophthalmology, DMCH, Laheriasarai, Darbhanga, Bihar, India

²Associate Professor, Department of Ophthalmology, DMCH, Laheriasarai, Darbhanga, Bihar, India

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Corresponding author: Dr Nawin Kumar

Conflict of interest: Nil

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 case control study was done in the Department of Ophthalmology, DMCH, Laheriasarai, Darbhanga, Bihar, India for 1 year, all the Patients having diabetes mellitus on treatment and Nondiabetic individuals was included in this study. Two groups were formed which includes Group A constituting diabetes mellitus patients and Group B constitutes Nondiabetic 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.

Results: 130 patients were included in our study. 55 patients had Type 2 diabetes mellitus (all were non-insulin dependent) and 10 patients had Type 1 diabetes mellitus (all were insulin dependent), and 65 patients were non-diabetics subjects. Mean age of non-diabetics was 46.66±10.73 years and that of diabetics 48.25±10.78 years (p value 0.22) statistically not significant. In those 65 diabetic patients 48 were male and 17 were female. Mean age of male subjects was 50.45±10.36 years and that of female was 50.98±10.69 years in diabetic group which was not statistically significant (p value 0.31). Mean intra-ocular pressure higher (19.02±5.63 mmHg) in diabetic patients as compared with (16.35±4.26 mmHg) in non-diabetic, p value < 0.0001 which is statistically significant. Mean intra ocular pressure was (18.91±3.86mmHg) in diabetic patients with duration greater than 10 years as compared with (18.22±4.69mmHg) in diabetic patients with duration less than 10 years, p value <0.31 which is not significant. Mean intra-ocular pressure (19.69±3.63 mmHg) higher in diabetic patients with HbA1c value >6.5% as compared (18.36±3.12 mmHg) with diabetic patients with HbA1c value <6.5%, p value < 0.0005 which is statistically significant.

Conclusion: We concluded that diabetes mellitus is a risk factor for raised IOP. Tight glycemic control prevents the rise in IOP. Patients with poor glycemic control were found to be more prone to raised IOP. Diabetic patients should be regularly screened for IOP so that burden ocular morbidity due to glaucoma can be reduced.

Keywords: IOP, Diabetics, Glaucoma.

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Introduction

The number of diabetics is growing fast and gaining a status of epidemic 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[1,3] Several large randomized clinical trials underscored the relationship between IOP and glaucoma development and progression.[4,6] Therefore, adequate determination of an individual IOP value is of utmost importance in the management of the disease. The IOP can be influenced by different systemic factors such as hypertension[7,9], atherosclerotic diseases[7], body mass index 10, and diabetes.[7,11] For instance, Lee and colleagues studying the relationship between IOP and systemic disorders found that increased mean blood pressure is strongly correlated with risk of increased IOP. Although diabetes is associated with higher IOP values in most population studies, the underlying mechanisms are still unclear[7,11] Recent studies have suggested that changes in corneal biomechanics (increased corneal hysteresis) in diabetic eyes would lead to overestimated IOP measurements.[11] However, it is not known whether variations in glucose levels could lead to IOP changes in diabetic and nondiabetic individuals. As diabetes and glaucoma (or ocular hypertension) coexist in many patients, a better understanding about how variations in glucose levels can affect IOP changes would give additional information to the IOP assessment.

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 microstructure 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

The present study was conducted in the Department of Ophthalmology, DMCH, Laheriasarai, Darbhanga, Bihar, India for 1 year, after taking the approval of the protocol review committee and institutional ethics committee. After taking informed consent detailed history was taken from the patient or the relatives if the patient was not in good condition.

Two groups were formed which includes Group A constituting diabetes mellitus patients and Group B constitutes Nondiabetic 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 undergone 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 pressure 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).

Inclusion Criteria

- Patients with diabetes mellitus.
- Age group 19-60 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

130 patients were included in our study. 55 patients had Type 2 diabetes mellitus (all were non-insulin dependent) and 10 patients had Type 1 diabetes mellitus (all were insulin dependent), and 65 patients were non-diabetics subjects. Mean age of non-diabetics was 46.66 ± 10.73 years and that of diabetics 48.25 ± 10.78 years (p value 0.22) statistically not significant. In those 65 diabetic patients 48 were male and 17 were female. Mean age of male subjects was 50.45 ± 10.36 years and that of female was 50.98 ± 10.69 years in diabetic group which was not statistically significant (p value 0.31).

Table 1. Mean IOP of patients of diabetics and non-diabetics

Patients	n	Mean IOP (mmHg)	SD	p-value
Diabetics	65	19.02	5.63	P<0.0001*
Non-Diabetics	65	16.35	4.26	

Table 1 shows mean intra-ocular pressure higher (19.02 ± 5.63 mmHg) in diabetic patients as compared with (16.35 ± 4.26 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	18.22	4.69	P<0.31
>10 years	18.91	3.86	

Table 2 shows mean intra ocular pressure was (18.91 ± 3.86 mmHg) in diabetic patients with duration greater than 10 years as compared with (18.22 ± 4.69 mmHg) in diabetic patients with duration less than 10 years, p value < 0.31 which is not significant.

Table 3. Mean IOP of patients with HbA1c

HbA1c	Mean IOP	\pm SD	p-value
<6.5	18.36	3.12	<0.0005*
>6.5	19.69	3.63	

Table 3 shows mean intra-ocular pressure (19.69 ± 3.63 mmHg) higher in diabetic patients with HbA1c value $>6.5\%$ as compared (18.36 ± 3.12 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	19.77	3.21	$<0.0001^*$
PDR	14.89	3.02	

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

Although diabetes is associated with higher IOP values in most population studies, the underlying mechanisms are still unclear. Recent studies have suggested that changes in corneal biomechanics (increased corneal hysteresis) in diabetic eyes would lead to overestimated IOP measurements.

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 factors for emergence of glaucoma and is the only amendable risk factor that can be treated.[18]

Our study shows mean intra-ocular pressure higher (19.02 ± 5.63 mmHg) in diabetic patients as compared with (16.35 ± 4.26 mmHg) in non-diabetic, p value < 0.0001 which is statistically significant, 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 co- relation 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 was (18.91 ± 3.86 mmHg) in diabetic patients with duration greater than 10 years as compared with (18.22 ± 4.69 mmHg) in diabetic patients with duration less than 10 years, p value <0.31 which is not significant, p value <0.31 which is not 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 studies 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. $P < 0.001$.

Conclusion

We concluded that diabetes mellitus is a risk factor for raised IOP. Tight glycemic control prevents the rise in IOP. Patients with poor glycemic control were found to be more prone to raised IOP. Diabetic patients should be regularly screened for IOP so that burden ocular morbidity due to glaucoma can be reduced.

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