

Original research article

A prospective comparative study to evaluate the Intraocular Pressure in Diabetes Mellitus and non-diabetic individuals

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Abstract

Background: 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 factors, which increase the risk of Glaucoma, is a mainstay in the early detection and prevention of blindness due to the disease.

Aim: To compare the Intraocular Pressure in Diabetes Mellitus and non-diabetic individuals.

Material and Methods: This prospective observational study was done in the Department of Ophthalmology, Netaji Subhas Medical College and Hospital, Amhara, Bihta, Patna, Bihar, India. All the patients having Diabetes Mellitus on treatment and non-diabetic individuals were included in this study. Two groups were formed, which includes Group A constituting Diabetes Mellitus patients and Group B constitutes non-diabetic individuals. A detailed history of Diabetes Mellitus patient was taken regarding the duration of diabetes, treatment, fasting, postprandial blood sugar levels and HbA1c was recorded. Intraocular Pressure was compared between Group A and Group B, to correlate Intraocular Pressure concerning the duration of Diabetes Mellitus and different stages of diabetic retinopathy. Diabetic retinopathy changes were classified according to the ETDRS classification.

Results: Among 120 patients, 55 patients had Type 2 Diabetes Mellitus (all were non-insulin-dependent) and 5 patients had Type 1 Diabetes Mellitus (all were insulin-dependent) and 60 patients were Non-diabetics subjects. Mean age of non-diabetics was 55.2±11.4 years and that of diabetics 57.45±10.33 years (p value 0.38) statistically not significant. In those 60 diabetic patients, 45 were male and 15 were female. The mean age of male subjects was 58.19±9.7 years and that of female was 57.37±10.68 years in the diabetic group which was no statistically significant (p-value 0.42). Mean Intraocular Pressure was higher (17.06±2.11mmHg) in diabetic patients as compared with (14.11±2.77mmHg) in non-diabetic, p-value < 0.0001 which is statistically significant. Mean Intraocular Pressure was (17.95±2.36mmHg) in diabetic patients with a duration greater than 10 years as compared with (17.11±3.11mmHg) in diabetic patients with duration less than 10 years, p > 0.05 which is not significant. Mean Intraocular Pressure was (16.06±1.48 mmHg) in diabetic patients with HbA1c less than 6.5 as compared with (17.12±2.82 mmHg) in diabetic patients with HbA1c more than 6.5 years, p < 0.05 which is significant.

Conclusion: The diabetic patients are prone to higher IOP, and especially, the patients with poor glycemic control were more prone to raised IOP. Diabetic patients should be regularly screened for IOP so that burden of ocular morbidity due to glaucoma can be reduced.

Key Words: Glycemic Control and Intraocular Pressure; Diabetes Mellitus and Intraocular Pressure.

Introduction

The number of diabetics is growing fast and gaining the status of the 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.¹⁻⁴ Looking at current scenario identification of factors which lead to diabetes as well as factors that are worsened by diabetes is necessary. Diabetes Mellitus is a major health problem in India, with its incidence increasing every day. diabetes is associated with long-term damage to various organs such as eye, kidney, heart, blood vessels and nerves. Diabetes Mellitus has emerged as a major cause of vision loss and visual disability, not only in developed countries but also in developing countries. Besides its other ocular manifestations, diabetes also affects Intraocular pressure.⁵ The mechanism that causes higher intraocular Pressure is not clear, but various etiologies have been postulated as genetic, autonomic dysfunction, and osmotic diffusion.⁶ Many studies have shown its association with Intraocular Pressure and open-angle glaucoma. Others have found no association between diabetes and intraocular pressure. Chronic Hyperglycemia in diabetes is associated with long-term damage and dysfunction of multiple organs. Various microangiopathic complications associated with diabetes are nephropathy, retinopathy, and neuropathy.⁷ Diabetes is a known risk factor of decreased visual acuity, and diabetic retinopathy is a well-established cause of it.^{8,9} It has been documented that tight control of blood glucose levels reduces the risk of retinopathy.⁹ Diabetes besides affecting the retina is also a risk factor for raised Intraocular Pressure (IOP). Several studies have shown the association of Diabetes Mellitus with glaucoma.^{10,11} Whether tight glycemic control prevents the rise in IOP is the question of debate IOP is affected by various systemic and local factors. The normal range of IOP is between 10 and 20 mm of Hg. The normal IOP is determined by the balance of production of aqueous humor and its drainage through the trabecular meshwork. Any imbalance in production and drainage leads to a rise in IOP.¹² 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 present study aimed to compare the intraocular Pressure in Diabetes Mellitus and non-diabetic individuals.

Material and Methods

This prospective observational study was done in the Department of Ophthalmology, Netaji Subhas Medical College and Hospital, Amhara, Bihta, Patna, Bihar, India . Patients having Diabetes Mellitus (who are previously diagnosed by a physician) on treatment and Non-diabetic individuals were included in this study. Two groups were formed which includes Group A constituting Diabetes Mellitus patients and Group B constitutes Non-diabetic individuals. The detailed history of Diabetes Mellitus patient was taken regarding the duration of diabetes, treatment, fasting, postprandial blood sugar levels and HbA1c will be recorded.

Methodology

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 Intraocular 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. Intraocular Pressure was compared between Group A and Group B, to correlate Intraocular Pressure concerning the 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 18-75 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.

Results

120 patients were included in our study. 55 patients had Type 2 Diabetes Mellitus (all were non-insulin-dependent) and 5 patients had Type 1 Diabetes Mellitus (all were insulin-dependent), and 60 patients were Non-diabetics subjects. Mean age of non-diabetics was 55.2 ± 11.4 years and that of diabetics 57.45 ± 10.33 years (p value 0.38) statistically not significant. In those 60 diabetic patients, 45 were male and 15 were female. The mean age of male subjects was 58.19 ± 9.7 years and that of female was 57.37 ± 10.68 years in the diabetic group which was not statistically significant (p-value 0.42).

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

Patients	n	Mean IOP(mmHg)	SD	p-value
Diabetics	60	17.06	2.11	P<0.0001*
Non Diabetics	60	14.11	2.77	

Table 1 shows mean Intraocular Pressure higher (17.06 ± 2.11 mmHg) in diabetic patients as compared with (14.11 ± 2.77 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	17.11	3.11	P<0.29
>10 years	17.95	2.36	

Table 2 shows mean Intraocular Pressure was (17.95 ± 2.36 mmHg) in diabetic patients with a duration greater than 10 years as compared with (17.11 ± 3.11 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	16.06	1.48	<0.0005*
>6.5	17.12	2.82	

Table 3 shows mean intra-ocular Pressure (17.12 ± 2.82 mmHg) higher in diabetic patients with HbA1c value $>6.5\%$ as compared (16.06 ± 1.48 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	19.1	2.21	$<0.0001^*$
PDR	12.9	1.33	

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

Glaucoma is the world's leading cause of acquired blindness.¹³ 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.¹⁴ The round firm shape of the eyeball is caused by the Intraocular 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 the emergence of glaucoma and is the only amendable risk factor that can be treated.¹⁵

Our study shows mean Intraocular Pressure higher (17.06 ± 2.11 mmHg) in diabetic patients as compared with (14.11 ± 2.77 mmHg) non-diabetic, p-value < 0.0001 which is statistically significant. A study conducted by Jain and Luthra, reported that mean intraocular Pressure in diabetic eyes is slightly higher than in non-diabetic eyes.¹⁶ 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 Intraocular pressure (POAG) as compared to non-diabetic individuals.¹⁰

In our study, it was observed that mean Intraocular Pressure (17.12 ± 2.82 mmHg) is higher in diabetic patients with HbA1c value $>6.5\%$ as compared (16.06 ± 1.48 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 $>6.5\%$.¹⁷ Baisakhiya S, Garg P et al also had a 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.¹⁸ 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. A study conducted by Christiansson (1961) also reported low IOP in proliferative retinopathy compared to non-proliferative retinopathy.¹⁹ 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 non-diabetic group ($P < 0.001$), but there was no significant difference between the diabetic retinopathy groups. $*P < 0.001$.⁵

Conclusion

The diabetic patients are prone to higher IOP, and especially, the patients with poor glycemic control were more prone to raised IOP. Diabetic patients should be regularly screened for IOP so that burden of ocular morbidity due to glaucoma can be reduced.

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