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Original Research Article

Intraocular Pressure (IOP) in Diabetics and Non-Diabetics: A Comparative Assessment

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Abstract

Aim: The aim of the present study was to compare the intra-ocular pressure in diabetes mellitus and non-diabetic individuals. **Methods:** This prospective observational study was done in the Department of Ophthalmology, Anugrah Narayan Magadh Medical College Hospital (ANMMCH), Gaya, Bihar, India for 1 year. All the patients having diabetes mellitus on treatment and non-diabetic individuals were included in this study. Two groups were formed which included Group A constituting diabetes mellitus patients and Group B constituting non-diabetic individuals. Detailed history of diabetes mellitus patient was taken regarding duration of diabetes, treatment, fasting, post prandial blood sugar levels and HbA1c were 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:** 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 49.22±9.12 years and that of diabetics 52.36±9.63 years (p value 0.26) statistically not significant. In those 70 diabetic patients 50 were male and 20 were female. Mean age of male subjects was 54.26±9.38 years and that of female was 53.74±9.36 years in diabetic group which was not statistically significant (p value 0.31). Mean intra-ocular pressure was higher (18.96±2.66 mmHg) in diabetic patients as compared to (15.87±2.69 mmHg) non-diabetics, p value <0.0001 which is statistically significant. Mean intra-ocular pressure was (19.11±2.49mmHg) in diabetic patients with duration greater than 10 years as compared with (18.98±3.23mmHg) in diabetic patients with duration less than 10 years, p value <0.31 which is not significant. Mean intra-ocular pressure (19.96±2.78 mmHg) was higher in diabetic patients with HbA1c value >6.5% as compared (18.87±2.26 mmHg) to diabetic patients with HbA1c value <6.5%, p value < 0.0005 which is statistically significant. **Conclusion:** 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 of ocular morbidity due to glaucoma can be reduced.

Keywords: Intraocular Pressure, Diabetes Mellitus, Non-Diabetics.

Introduction

Intra-ocular 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[1,2]. 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 in developing and also in developed countries. Besides its other ocular manifestations, diabetes also affects intra ocular pressure[3]. The association of diabetes with elevated intraocular pressure and primary open angle glaucoma is controversial. The mechanism that causes higher intra-ocular pressure is not clear, but various etiologies have been postulated such as genetic, autonomic dysfunction, and osmotic diffusion[4]. Many studies have shown diabetes mellitus (DM) in association with intraocular pressure and open angle glaucoma. Others have found no association between diabetes and intra-ocular pressure[5]. Many factors, such as age[6] body mass index (BMI)[7], blood pressure (BP)[5,8], blood glucose[9,10], central corneal thickness (CCT), have been reported to be associated with IOP, but their results were not entirely consistent in all studies, and the potential risk factors in their analysis 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 non-diabetes[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.

Intra-ocular 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 kind of intra-ocular surgery should be done by considering the intra-ocular pressure fluctuation. Sudden increase of intra-ocular pressure can lead to intra-ocular micro barotrauma and cause ischemic effects and mechanical stress to retinal nerve fiber layer. Sudden intra-ocular pressure drop can lead to intra-ocular decompression that generates micro bubbles that potentially cause multiple micro emboli and leading to hypoxia, ischemia and retinal micro structural 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 intra-ocular pressure in diabetes mellitus and non-diabetic individuals.

Material and methods

The present study was conducted in the Department of Ophthalmology, Anugrah Narayan Magadh Medical College Hospital (ANMMCH), Gaya, Bihar, India for 1 year after taking the approval of the protocol review committee and institutional ethics committee.

Inclusion Criteria

- Patients with diabetesmellitus.
- Age group 21-61years.
- 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 ± 6D spherical or cylinder greater than ±3D.
- Pregnant women.

Methodology

Two groups were formed which included Group A constituting diabetes mellitus patients and Group B constituting non-diabetic individuals. Detailed history of diabetes mellitus patient was taken regarding duration of diabetes, treatment, fasting, post prandial blood sugar levels and HbA1c were recorded.

All the patients of Group A and Group B underwent complete ophthalmic examination, which included 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 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).

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 49.22±9.12 years and that of diabetics was 52.36±9.63 years (p value 0.26) statistically not significant. In those 70 diabetic patients 50 were male and 20 were female. Mean age of male subjects was 54.26±9.38 years and that of female was 53.74±9.36 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	70	18.96	2.66	P<0.0001*
Non-Diabetics	70	15.87	2.69	

Table 1 shows mean intra-ocular pressure higher (18.96±2.66 mmHg) in diabetic patients as compared with (15.87±2.69 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	18.98	3.23	P<0.31
>10 years	19.11	2.49	

Table 2 shows mean intra-ocular pressure was (19.11±2.49mmHg) in diabetic patients with duration greater than 10 years as compared with (18.98±3.23mmHg) 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	± SD	p-value
<6.5	18.87	2.26	<0.0005*
>6.5	19.96	2.78	

Table 3 shows mean intra-ocular pressure (19.96±2.78mmHg) higher in diabetic patients with HbA1c value >6.5% as compared (18.87±2.26mmHg) 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	± SD	p-value
NPDR	20.12	2.57	<0.0001*
PDR	14.63	1.96	

Table 4 shows mean intra-ocular 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

Intra-ocular pressure (IOP) is the fluid pressure inside the eye. Tonometry is the method eye care professionals use to determine this. IOP is an important aspect in the evaluation of patients at risk of glaucoma. Most tonometers are calibrated to measure pressure in millimetres of mercury (mmHg). Intra-ocular pressure is determined by the production and drainage of aqueous humour by the ciliary body and its drainage via the trabecular meshwork and uveoscleral outflow. The reason for this is because the vitreous humour in the posterior segment has a relatively fixed volume and thus does not affect intra-ocular pressure regulation.

Intra-ocular pressure constitutes 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 intra-ocular 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 intra-ocular 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 (18.96±2.66 mmHg) in diabetic patients as compared with (15.87±2.69 mmHg) in non-diabetic, p value < 0.0001 which is statistically significant. Study conducted by Jain and Luthra, reported that mean intra-ocular 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 (19.11±2.49mmHg) in diabetic patients with duration greater than 10 years as compared with (18.98±3.23mmHg) in diabetic patients with duration less than 10

years, p value <0.31 which is not significant.

A study conducted by Oshitari T., Fujimoto N et al showed higher intra-ocular 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 intra-ocular 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 Cristiansson (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[24].

Conclusion

This investigation 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 of ocular morbidity due to glaucoma can be reduced.

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