

Effect of Type II Diabetes mellitus on Intra ocular pressure in Central India

Kanishk Singh^{1*}, Ankur K. Shrivastava², Nobal Chandrakar³

¹Assistant Professor, Pt. Jawaharlal Nehru Medical College, Raipur, Chhattisgarh, ²Assistant Professor, ³Intern, Dept. of Ophthalmology, AIIMS, Raipur, Chhattisgarh

***Corresponding Author:**

Email: drkanishksingh@gmail.com

Abstract

Aim: Intraocular pressure distribution and its association with Type 2 Diabetes Mellitus.

Material and Methods: A comparative cross-sectional study was done in a tertiary care hospital. Patients of 20-80 years of age were taken up in the study which included 100 diabetic and same number of non-diabetic subjects (controls). Various laboratory tests such as fasting blood sugar level (FBS) and postprandial plasma blood sugar (PPBS), glyated haemoglobin (HbA1C) levels were done. All patients underwent complete ocular examination. Intra-ocular pressure was measured by using by Non-Contact tonometer (NCT, Shin-Nippon, Japan).

Results: It was found that the mean intraocular pressure in diabetic and non-diabetic subjects was 17.61 ± 1.8 and 14.08 ± 1.4 mm of Hg respectively. The intraocular pressure values were higher in the subjects with diabetes in all the age groups. The study also revealed that the mean intraocular pressure was higher in diabetic patients with more than 5 years of duration.

Conclusion: The data obtained from the study suggests the intra-ocular pressure was raised in subjects with diabetes as compared to the controls. Individuals with poor glycemic control were more prone to get elevated intra-ocular pressure.

Keywords: Intraocular pressure, Tonometry, Type 2 diabetes

Introduction

Diabetes mellitus is characterized by hyperglycemia, which is usually due to defects in insulin secretion or insulin action.⁽¹⁾ It is also considered to be a one of the risk factor for the development of open angle glaucoma. Various studies have found that chronic hyperglycemia in diabetes is associated with raised intraocular pressure, hence suggesting a close relationship between diabetes and glaucoma.^(2,3) Glaucoma is identified by raised intraocular pressure along with optic disc cupping and visual field impairment, it can further lead to low vision, optic atrophy, and permanent loss of vision if not dealt in early stage.^(4,5,6) India faces one of the greatest health challenges regarding diabetic patients and there are approximately over 35 million people with diabetes, which will increase to around 80 million by 2030.^(7,8) Diabetes mellitus is an important ocular risk factor. Ophthalmological disorder associated with diabetes are also one of the major concern of blindness in India and worldwide, which commonly include cataract, glaucoma, macular edema, retinal vascular changes and diabetic retinopathy. Hence early diagnosis and management will help to prevent the systemic association as well as severe ophthalmological condition related to diabetes mellitus.

Aim

Intraocular pressure distribution and its association with Type 2 Diabetes Mellitus.

Material and Methods

This is a comparative cross-sectional type of study conducted over a period of six months from May to

September 2015 in a tertiary care eye hospital in central India. It included 100 diabetic and same numbers of non-diabetic subjects. Patients from 20-80 years of age were taken up in the study, informed consent was obtained from each patient. Detail history of diabetes along with other systemic disease was taken. Patients with history of glaucoma, ocular infection or inflammation, any history of ocular surgery and usage of any medications that would affect the IOP were excluded from the study. All the patients were included after confirming the diagnosis of Type 2 Diabetes mellitus by blood sugar levels (FBS, PPBS & HbA1c); diagnosis was done as per standard guidelines of American Diabetic Association.⁽⁹⁾ Fasting blood sugar (FBS) and postprandial blood sugar (PPBS) were measured at baseline and after 1month while HbA1c was measured at baseline. All patients underwent complete ocular examination, which included assessment of visual acuity, colour vision, slit-lamp examination, tonometry and dilated fundus examination. Intra-ocular pressure (IOP) was measured by using by Non-Contact tonometer (NCT, Shin-Nippon, Japan). IOP measurements were done between 9:00-11:00 am. Detailed stereoscopic examination of fundus was done by indirect ophthalmoscope with +20D lens.

The data was analyzed using statistical package SPSS version 12.0. Analysis was performed by Student's *t*-test. The correlation between HbA1c and IOP was analyzed by using the Pearson's correlation coefficient, *p* value of < 0.05 was considered to be significant.

Results

A total of 200 patients were included in the study out of which 100 were diabetics and 100 non-diabetics. The diabetic group included 62 males and 38 females, with mean age of 58.4 ± 7.45 years while non-diabetic group included 60 males and 40 females, with mean age of 56.5 ± 6.56 years.

In this study it was found that the mean intraocular pressures in diabetic patients was 17.61 ± 1.8 mm of Hg and in non-diabetic patients was 14.08 ± 1.4 mm of Hg which was statistically significant with p -value < 0.05 . The mean intraocular pressure of male diabetic patients was 17.43 ± 2.05 mm of Hg and that of females were 17.78 ± 2.18 mm of Hg (Table 1). It was also observed that the mean intraocular pressures in males and females diabetic patients between 41 to 60 years of age

were 18.45 ± 1.24 and 18.71 ± 1.34 mm of Hg respectively, which was found to be maximum in comparison to all the age groups among diabetic individuals. It was noticed that the intraocular pressure values were higher in the subjects with diabetes in all the age groups (Table 2). However the mean intraocular pressure difference within diabetic and non-diabetics patients with gender was not statistically significant.

Table 1

Gender	Diabetics(IOP)	Non Diabetics(IOP)
Males	17.43 mm of Hg	14.11 mm of Hg
Females	17.78 mm of Hg	14.26 mm of Hg

Table 2

Age	Diabetics		Non Diabetics	
	Male (IOP)	Female(IOP)	Male (IOP)	Female(IOP)
20-40	16.75 ± 2.13	17.18 ± 2.83	13.31 ± 1.81	13.04 ± 2.11
41-60	18.45 ± 1.24	18.71 ± 1.34	14.83 ± 1.60	14.64 ± 1.81
61-80	17.10 ± 1.52	17.46 ± 1.20	14.20 ± 1.52	14.51 ± 1.36

The study revealed that the mean intraocular pressure was higher in recently diagnosed diabetic patients and in those of more than 5 years of duration. The mean intraocular pressure was 17.12 ± 1.30 mm of Hg in diabetic patients of less than 1 year of duration, 16.33 ± 2.52 mm of Hg in 1 to 5 years and 17.98 ± 1.92 mm of Hg in more than 5 years of duration (Table 3). When the intraocular pressure was compared to the glycaemic status of the subjects, a significant difference in the intraocular pressure was observed. It was also found that mean intraocular pressure was high in subjects with poor diabetic control (Table 4).

Table 3

Duration of diabetes	IOP in mm of Hg
<1 year (n=24)	17.12 ± 1.30
1-5 year (n=38)	16.33 ± 2.52
>5 year (n=38)	17.98 ± 1.92

Table 4

Diabetic profile	HbA1c% <7%	HbA1c% 7-8%	HbA1c% >8%
Number of patients	n= 38	n= 34	n= 28
Mean IOP (Males)	16.53 ± 2.32 mm of Hg	17.67 ± 2.66	18.11 ± 2.19
Mean IOP Females	16.98 ± 2.44 mm of Hg	17.84 ± 2.64	18.32 ± 2.01
Mean HbA1c%	6.65 ± 0.34	7.44 ± 0.42	8.9 ± 0.87

Discussion

It is a well-known fact that diabetes mellitus can cause micro vascular damage and may affect the auto regulatory action of the blood vessels in the retina and optic nerve. Diabetes has also been found to be associated with elevated intraocular pressure and thus it is a possible risk factor for glaucoma and diabetic retinopathy.⁽¹⁰⁻¹⁴⁾ However a few studies have reported that diabetes was significantly associated with higher intraocular pressure but not in development of glaucoma.⁽¹⁵⁻¹⁸⁾

Our results have also supported the hypothesis that diabetic patients with poor glycaemic control have elevated intraocular pressure than those of non-diabetic individuals. In this study it was found that the mean intraocular pressure of diabetic patients was 17.62 mm of Hg, in which the mean intraocular pressure of male and female diabetic patients were 17.43 ± 2.05 and 17.78 ± 2.18 mm of Hg respectively. Though the mean intraocular pressure difference between males and females were not significant but it was significantly higher than that of non-diabetic subjects. Comparable results were also seen by Anandalakshmi S et al, Khalaj M et al.^(1,4)

The study also revealed that there is no significant association between mean IOP and blood glucose level among different age groups, which is in concordance with the study done by Kawase K et al, Xu L et al and Pimentel LG et al.^(16,19,20) However we observed that the mean intraocular pressure was higher in subjects with poor glycaemic control.

In this study the mean intraocular pressure of diabetic patients with more than five years of duration of diabetes was 17.98 ± 1.92 mm of Hg and was in consistent with the study conducted by Dielemans I et al, which concluded that newly diagnosed diabetes mellitus and high levels of blood glucose are associated with elevated IOP and high-tension glaucoma. The study also found a significant correlation between glycaemic control and intraocular pressure among diabetic patients and a comparable results was also seen by Dielemans I.⁽¹²⁾

Conclusion

The study concluded that the intra-ocular pressure was raised in subjects with diabetes as compared to the controls. Individuals with a poor glycaemic control were more prone to get elevated intra-ocular pressure and there was a significant positive correlation between IOP and HbA1c levels in patients with diabetic retinopathy. Hence the study suggests that the diabetic patients should not only be screened for diabetic retinopathy but intraocular pressure of these subjects with diabetes should also be measured at regular intervals. This would help to detect the development of ocular hypertension or any early glaucomatous changes. Also, the relationship between the two diseases should be studied more, to control and reduce glaucoma cases.

References

- Anandalakshmi S, Petrecia H et al. Intraocular pressure in subjects with type diabetes mellitus. *Journal of Clinical and Diagnostic Research*. 2011; Vol-5(7):1336-1338.
- Matsuoka M, Ogata N et al. Intra-ocular pressure in Japanese diabetic patients. *Clinical Ophthalmology*. 2012; Vol.6:1005-1009.
- Singh M, Heong S. Postural behavior of intraocular pressure in diabetics. *British Journal of Ophthalmology*. 1986; Vol 70:456-459.
- Khalaj M, Fereydooni S, Barikani A. Relationship between diabetes and intraocular pressure. *Acta Medica Iranica*. 2015; Vol. 53(6):363-68.
- Javitt JC, Aiello LP. Cost effectiveness of detecting and treating diabetic retinopathy. *Ann Int Med* 1995;124(2):164-9.
- Nakamura M, Kanamori A, Negi A. Diabetes mellitus as a risk factor for glaucomatous optic neuropathy. *Ophthalmologica* 2005;219(1):1-10.
- Shrikanth S, Susmitha A et al. Comparison of intraocular pressure and body mass index in diabetic and non-diabetic individual. *Indian Journal of Basic & Applied Medical Research*. 2013; Vol.2 (8), P. 939-945.
- Pai S, Pai A et al. A Correlative Study of BMI and IOP in Diabetic and Non diabetic South Indian population. *Thai Journal of physiological Sciences*. 2008; Vol.22:74-78.
- Standards of medical care in diabetes: American Diabetes Association. *Diabetes care*.2011Jan; 34(Suppl 1):S11-S61.
- Chopra V, Varma R, Francis BA, Wu J, Torres M, Azen SP. Los Angeles Latino Eye Study Group. Type 2 diabetes mellitus and the risk of open-angle glaucoma the Los Angeles Latino Eye Study. *Ophthalmology* 2008;115(2):227-232.
- Mitchell P, Smith W, Chey T, Wang JJ, Chang A. Open-angle glaucoma and diabetes. The Blue Mountains Eye Study, Australia. *Ophthalmology* 1997;104(4):712-718.
- Dielemans I, de Jong PT, Stolk R, Vingerling JR, Grobbee DE, Hofman A. Primary open-angle glaucoma, intraocular pressure, and diabetes mellitus in the general elderly population. The Rotterdam Study. *Ophthalmology* 1996;103(8):1271-1275.
- Klein BE, Klein R, Linton KL. Intraocular pressure in an American community. The Beaver Dam Eye Study. *Invest Ophthalmol Vis Sci*. 1992;33(7):2224-2228.
- Klein BE, Klein R, Jensen SC. Open-angle glaucoma and older-onset diabetes. The Beaver Dam Eye Study. *Ophthalmology* 1994;101(7):1173-1177.
- Tan GS, Wong TY, Fong CW, Aung T; Singapore Malay Eye Study. Diabetes, metabolic abnormalities, and glaucoma. *Arch Ophthalmol*. 2009;127(10):1354-1361.
- Kawase K, Tomidokoro A, Araie M, Iwase A, Yamamoto T. Tajimi Study Group; Japan Glaucoma Society. Ocular and systemic factors related to intraocular pressure in Japanese adults: the Tajimi study. *Br J Ophthalmol*. 2008;92(9):1175-1179.
- De Voog DS, Ikram MK, Wolfs RC. Is diabetes mellitus a risk factor for open angle glaucoma, The Rotterdam Study. *Ophthalmology* 2006;113(10):1827-1831.
- Le A, Mukesh BN, McCarty CA, Taylor HR. Risk factors associated with the incidence of open angle glaucoma: the Visual Impairment Project. *Invest Ophthalmol Vis Sci* 2003;44(9):3783-3789.
- Xu L, Wang YX, Jonas JB, Wang YS, Wang S. Ocular hypertension and diabetes mellitus in the Beijing Eye Study. *J Glaucoma*. 2009;18(1):21-25.
- Pimentel L.G, Gracitelli C, Da Silva LS, Souza A.K, Prata T.S. Association between glucose levels and intraocular pressure: Pre and post prandial analysis in diabetic and non-diabetic patients. *Journal of Ophthalmology*. Volume 2015; Article ID 832058,1- 5.