

DETERMINATION OF MEAN INTRAOCULAR PRESSURE IN PATIENTS WITH TYPE 2 DIABETES MELLITUS

Dilshad Ali, Asfandyar*, Muhamad Manzoor**, Bilal Murtaza***, Abid Naqvi****, Muhammad Azmat Khan*****

Quetta Institute of Medical Sciences (QIMS) Quetta Pakistan, *Combined Military Hospital Gujranwala Pakistan, **Combined Military Hospital Lahore Pakistan, ***61 Medical Battalion Multan Pakistan, ****Armed Forces Institute of Ophthalmology/National University of Medical Sciences (NUMS) Rawalpindi Pakistan, *****Combined Military Hospital Peshawar Pakistan

ABSTRACT

Objective: To determine mean intraocular pressure (IOP) in patients with type 2 diabetes mellitus.

Study Design: Descriptive cross sectional study.

Place and Duration of Study: The study was conducted at Ophthalmology department of Combined Military Hospital Peshawar, from Mar 2014 to Sep 2014.

Patients and Methods: A total of 182 eyes (91 patients) were included in this study. All patients were subjected to slit lamp examination and dilated fundus examination. HbA1c levels were carried out by standard laboratory procedures. IOP of right and left eye was measured routinely one time (between 1000-1200 hrs) through Goldmann applanation tonometer.

Results: Age of the patients ranged from 40 to 59 years. There were 52% males (48) and 47.3% females (43). Mean values of age, HbA1c and duration of DM were 51.44 ± 5.04 , 7.36 ± 0.54 and 9.16 ± 4.95 , respectively. Mean IOP was 19.43 ± 2.98 in right and 19.52 ± 2.73 in left eyes of type 2 diabetic patients.

Conclusion: The mean intra-ocular pressure appeared to be higher than normal in diabetic population.

Keywords: HbA1c levels, Intraocular pressure, Type 2 Diabetes mellitus.

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

Intraocular pressure (IOP) is defined as fluid pressure inside eye. The value of IOP in general population range from 11-21mm of Hg, however there is no absolute pathological point. IOP more than 21mm of Hg is generally considered as abnormally raised¹. The intraocular pressure is a balance between the production and drainage of aqueous humour. An abnormally high IOP reading indicates that either the eye is producing too much fluid, or that it is not draining properly². Intraocular pressure (IOP) is the strongest known risk factors for the development of glaucoma, which leads to irreversible visual loss. Diabetes mellitus is a multisystem disorder that is characterized by hyperglycemia secondary to deficiency of insulin. The prevalence of diabetes mellitus is growing rapidly worldwide affecting 285 million people

and this is expected to rise further affecting about 438 million by the year 2030³. Developing Countries have more than 70% of all diabetic population and the prevalence of DM was 13.14% in Pakistan in 2008⁴. Large population based studies have shown diabetes to be a risk factor for the development of open angle glaucoma⁵. Various authors have concluded that a significant relation exist between high IOP and diabetes, however the underlying etiology is not clear^{6,7}. Some authors found a higher mean IOP in diabetic patient as compared to healthy individuals². However, some studies could not find an association between diabetes and glaucoma⁸. No data of IOP is available so far in local diabetic population and in different international studies variable results have been published with regards to IOP levels in diabetics. Therefore this study was aimed at analysis of IOP levels in diabetics in our target population. So the rationale of the study was based on the fact that if IOP levels were found to be higher than normal which is would be more than 21

Correspondence: Dr Asfandyar, Eye Department, Combined Military Hospital Gujranwala Pakistan

Email: asfand69@yahoo.com

Received: 14 Jul 2017; revised received: 28 Nov 2017; accepted: 04 Dec 2017

mm of Hg, in local diabetic populace, it would provide a critical support not only for carrying out routine assessment of IOP in diabetics but also in operated cases and will definitely offer a staunch basis and preventive measure for conceivable complications including irreversible visual loss.

MATERIAL AND METHODS

The descriptive cross-sectional study was conducted at Ophthalmology, department of Combined Military Hospital Peshawar from Mar 2014 to Sep 2014. After taking permission from hospital ethical committee, patients fulfilling the inclusion criteria (Individuals between 40-59 years of age irrespective of gender and having HbA1c=or >6.5%) and exclusion Criteria (cases having corneal disease, uveitis, ocular inflam-matory disease, fundus diseases including

and left eye was measured routinely one time (between 1000-1200 Hrs) through goldmann applanation tonometer which is a gold standard for IOP measurement. IOP between 5 and 21 mm of Hg will be considered as normal while more than 21mm of Hg will be considered as higher than normal. All the data was collected and recorded in an especially prepared Per-forma attached as Annex A. Confidentiality of the patient's record was maintained. Data analysis was computer based with the use of SPSS version 10. Mean and standard deviation was calculated for quantitative data like age, HbA1c, duration of DM and IOP. Frequency as percentage for gender and glycemic control.

RESULTS

A total of 182 eyes (91 patients) were included in this study during the study period

Table-I: Mean values of age, HbA1c and duration of diabetes mellitus.

Variables	Mean	Standard deviation
Age	51.44	5.04
HbA1c (%)	7.36	0.54
Duration of diabetes mellitus (DM)	9.16	4.95

Table-II: Distribution of intraocular pressure in patients with type 2 diabetes mellitus

Eyes	Intraocular Pressure		Total
	11-21 (mmHg)	>22 (mmHg)	
Right	67 (73.6%)	24 (26.3%)	91
Left	63 (69.8%)	28 (30.2%)	91
Total	130 (71.4%)	52 (28.5%)	182

diabetic retinopathy, any intraocular surgery e.g cataract, vitrectomy, glaucoma or buckling surgery, primary or secondary glaucoma and those using IOP lowering treatments) were selected through non probability purposive sampling. Sample size was calculated by WHO calculator which appeared to be 182 eyes. Population mean of 20.4, while standard deviation of 3.44 and confidence interval of 95% with precision of 0.05 were utilized to calculate the sample size. Patients were explained about the study and a written consent was taken from the willing patients. All patients were subjected to slit lamp examination and dilated fundus examination. HbA1c levels were carried out by standard laboratory procedures. IOP of right

of six months from 10 Mar 2014 to 09 Sep 2014. Regarding age distribution, 36 patients (39.6%) were between 40-50 years and 55 patients (60.4%) were between 51-59 years of age. Mean age of the patients was 51.44 ± 5.04 . There were 48 males (52.7%) and 43 females (47.3%). Mean values of age, HbA1c and duration of DM are given in table-I, while mean IOP distribution in patients with type 2 diabetes mellitus is depicted in table-II. IOP between 11-21mmHg was observed in 67 right eyes and IOP >22 mmHg was seen in 24 right eyes. Similarly IOP 11-21mmHg was observed in 63 left eyes and IOP >22 mmHg was seen in 28 left eyes. Mean IOP with regard to gender and age presented in tables-III & IV.

DISCUSSION

Diabetes mellitus is a multisystem multifactorial disorder which is associated with insulin deficiency that leads to hyperglycemia. The persistent hyperglycemia in diabetic patients leads to long-term damage, dysfunction, and the failure of multiple organs in the form of retinopathy, neuropathy and nephropathy. Diabetes mellitus is an important risk factor for various ocular manifestations. It has emerged as a major cause of vision loss and visual disability worldwide⁹. Diabetes, besides its other ocular manifestations, also affects the intra-ocular

al compared glucose levels in aqueous humor of diabetic versus non diabetic individuals. He found out that glucose level was significantly higher (3.2 mM vs. 7.8 mM) in diabetic patients¹³. The increased incidence of glaucoma in diabetic patients has been claimed by various authors, however the exact etiology has not been defined so far. One proposed mechanism is that hyperglycemia induce changes in trabecular meshwork which increase the outflow resistance and raise intraocular pressure¹³. The mechanism behind development of glaucomatous optic nerve damage is primarily related to the higher IOP,

Table-III: Mean intraocular pressure complete in patients with type-2 diabetes mellitus.

Gender	Eyes	Intraocular Pressure (IOP) mmHg		
		Mean	SD	p-value
Male	Right	19.43	2.98	0.82
	Left	18.92	2.74	0.22
Female	Right	19.14	2.73	0.89
	Left	19.96	3.14	0.62
n=182				

Table-IV: Mean intraocular pressure complete with regard to age.

Age	Intraocular Pressure (IOP) mmHg	
	Mean	Standard deviation
Right eye (91)		
40-50	17.72	2.73
51-59	20.55	2.61
p-value	0.001	
Left eye (91)		
40-50	18.17	2.22
51-59	20.40	2.69
p-value	0.001	
n=182		

pressure¹⁰. Numerous large population based studies have shown diabetes to be a risk factor for the development of open angle glaucoma (OAG)⁵. However, some studies have found no association between the same¹¹. We in our study also found mean IOP towards higher side and significant percentage of patients with IOP even higher than the normal range (table-II). The relationship between elevated intra-ocular pressure, diabetes, glycated hemoglobin (HbA1c), and insulin resistance has been well documented in several studies¹². Study conducted by Davies et

however this can be direct mechanical damage or indirectly by inducing ischemia of optic nerve head^{14,15}. In addition to altering the vascular tissues, neuronal and metabolic functions of retina is also altered in diabetes mellitus, which make the retinal neurons more prone to glaucomatous damage^{16,17}. It appears logical to consider that a poor glycaemic control in subjects with diabetes mellitus, with a prolonged insult to the retina, would be associated with a higher risk of primary open angle glaucoma. Several longer and larger surveys have concluded that there exists a

significant correlation between poor glycemic control and higher IOP in diabetic patients¹⁸. In addition to the fact that mean IOP of our study group that included diabetic patients was higher, we also found out that the patients with age more than 50 years also had statistically significant higher IOP than their counterparts with age less than 50 years (table-IV, $p=0.001$). Moreover, it was also revealed that the difference of mean IOP between right and left eye as well as between male and female patients was statistically insignificant (table-III). Wu *et al* and Memarzadeh *et al* found a higher IOP among women with diabetes while Kawase *et al* could not conclude any such gender predisposition¹⁹⁻²¹.

CONCLUSION

We can conclude that the intra-ocular pressure appeared to be higher than normal in subjects with diabetes. Therefore, IOP of subjects with diabetes should be measured routinely at regular intervals to detect the development of ocular hypertension at an early stage.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES

1. Kanski JJ, Brad B. Clinical Ophthalmology. A systematic approach. 8th ed. London: Elsevier; 2016.
2. Anandha Lakshmi S, Petricia H, Saravanan A, Ramachandran C. Intra-ocular Pressure in Subjects with Type 2 Diabetes Mellitus. J ClinDiagn Res 2011; 5: 1336-8.
3. Sicree R, Shaw J, Zimmet P. Diabetes and impaired glucose tolerance, 4th ed. International Diabetes Federation. Belgium: International Diabetes Federation; 2009.
4. Zafar J, Bhatti F, Akhtar N, Rasheed U, Bashir R, Humayun S, et al. Prevalence and risk factors for diabetes mellitus in a selected urban population of a city in Punjab. J Pak Med Assoc 2011; 61: 40-7.
5. Wise LA, Rosenberg L, Radin RG, Mattox C, Yang EB, Palmer JR, et al A prospective study of diabetes, lifestyle factors, and glaucoma among African-American women. Ann Epidemiol 2011; 21: 430-39.
6. Xu L, Wang YX, Jonas JB, Wang YS, Wang S. Ocular hypertension and diabetes mellitus in the Beijing Eye Study. J Glaucoma 2009; 18: 21-5.
7. Tan GS, Wong TY, Fong CW, Aung T Singapore Malay Eye Study. Diabetes, metabolic abnormalities, and glaucoma. Arch Ophthalmol 2009; 127: 1354-361.
8. De Voogd S, Ikram MK, Wolfs RC, Jansonijs NM, Witteman JC, Hofman A, et al. Is diabetes mellitus a risk factor for open angle glaucoma? The Rotterdam Study. Ophthalmology 2006; 113(10): 1827-31.
9. Wild S, Roglic G, Green A, Sicree R, King H. The global prevalence of diabetes: estimates for the year 2000 and projections for the year 2030. Diabetes Care 2004; 27: 1047-53.
10. Arora VK, Prasad VN. Intra-ocular pressure and diabetes-A correlative study. Indian J Ophthalmol 1989; 37: 10-12.
11. Tielsch JM, Katz J, Quigley HA, Javitt JC, Sommer A. Diabetes, intraocular pressure and primary open-angle glaucoma in the Baltimore Eye Survey. Ophthalmology 1995; 102: 48-53.
12. Chang YC, Lin JW, Wang LC, Chen HM, Hwang JJ, Chaung LM. Association of intra-ocular pressure with the metabolic syndrome and novel cardiometabolic risk factors. Eye 2010; 24: 1037-43.
13. Davies PD, Duncan G, Pynsent PB, Arber DL, Lucas VA. Aqueous humour glucose concentration in cataract patients and its effect on the lens. Exp Eye Res 1984; 39: 605-9.
14. Leske MC, Connell AM, Wu SY. Risk factors for open-angle glaucoma: The Barbados Eye study. Arch Ophthalmol 1995; 113: 918-24.
15. Flammer J, Orgül S, Costa VP, Orzalesi N, Kriegelstein GK, Serra LM, et al The impact of ocular blood flow in glaucoma. Prog Retin Eye Res 2002; 21(4): 359-93.
16. Nakamura M, Kanamori A, Negi A. Diabetes mellitus as a risk factor for glaucomatous optic neuropathy. Ophthalmologica 2005; 219: 1-10.
17. Kanamori A, Nakamura M, Mukuno H. Diabetes has an additive effect on neural apoptosis in rat retina with chronically elevated intraocular pressure. Curr Eye Res 2004; 28: 47-54.
18. Klein BE, Klein R, Linton KL. Intraocular pressure in an American community. The Beaver Dam Eye Study. Invest Ophthalmol Vis Sci 1992; 33(7): 2224-8.
19. Wu SY, Leske MC. Associations with intraocular pressure in the Barbados Eye Study. Arch Ophthalmol 1997; 115: 1572-6.
20. Memarzadeh F, Ying-Lai M, Azen SP, Varma R. Los Angeles Latino Eye Study Group. Associations with intraocular pressure in Latinos: the Los Angeles Latino Eye Study. Am J Ophthalmol 2008; 146: 69-76.
21. Kawase K, Tomidokoro A, Araie M, Iwase A, Yamamoto T, et al. Tajimi Study Group. Ocular and systemic factors related to intraocular pressure in Japanese adults: the Tajimi study. Br J Ophthalmol 2008; 92: 1175-9.