

# Study correlation of primary open angle glaucoma with blood glucose level, HbA1c and blood pressure

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## Abstract

**Aim:** To study the correlation of Primary open angle glaucoma with Blood glucose level, HbA1c and Blood pressure. **Materials and Methods:** In our study 50 patients of Primary open angle glaucoma were included. Old patients of glaucoma, glaucoma other than POAG, patients having other ocular diseases were excluded. Only newly diagnosed Primary open angle glaucoma patients were included. In Control group 50 individuals, age and sex matched, with no history of glaucoma were included. In all patients blood sugar fasting, postprandial, HbA1c and blood pressure were measured. **Observations and Results:** The levels of blood sugar, HbA1c and blood pressure were higher in primary open angle glaucoma patients as compared to the control group. In group A Mean systolic blood pressure was  $127.46 \pm 10.24$  and diastolic blood pressure was  $82.34 \pm 5.12$ . In group B mean systolic blood pressure was  $115.21 \pm 9.56$  and diastolic blood pressure was  $78.12 \pm 4.36$ . In group A fasting blood glucose level was  $116.21 \pm 11.36$  and pp was  $202.62 \pm 54.28$ . In group B fasting blood glucose level was  $94.12 \pm 10.42$  and pp was  $119.62 \pm 12.24$ . The level of HbA1c was in group A  $7.89 \pm 1.52$  and in group B  $6.21 \pm 0.41$ . **Conclusion:** Our study shows that level of HbA1c, blood sugar and blood pressure were higher in POAG patients. So we concluded that there is an association of POAG with hypertension and diabetes. High Blood sugar, hypertension and high HbA1c should be consider as risk factors for primary open angle glaucoma. The risk factors should be identified as early as possible to diagnose and manage the POAG patients in early stage to prevent permanent loss of vision.

**Key Word:** Primary open angle glaucoma, diabetes mellitus, intraocular pressure, hypertension, HbA1c Abbreviations: POAG: primary open angle glaucoma, BP: blood pressure, PP postprandial

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## INTRODUCTION

Primary open angle glaucoma is a commonly bilateral disease of adult onset<sup>1</sup>. It is characterized by:

- IOP >21 mmHg at some stage.
- Glaucomatous optic nerve damage
- Open angle on gonioscopy
- Visual field loss.

Glaucoma affects up to 2% of those over the age of 40 years globally, and upto 10% over the age of 80years;

50% may be undiagnosed.<sup>2</sup> Glaucoma is the second leading cause of blindness worldwide. The frequency of bilateral blindness amongst persons with glaucoma varies across populations, with substantial bilateral blindness from glaucoma observed in developing countries with poor access to eye care.<sup>3</sup> The prevalence of POAG increases significantly with age<sup>4</sup>. The association between POAG and gender is doubtful. Some studies have suggested that POAG is more common in men<sup>6, 7, 9</sup> while other suggested that there is no difference in male and female<sup>5</sup> and some other studies suggested a higher prevalence in females.<sup>8, 9</sup> Microvascular complication of diabetes can affect vascular auto regulation of optic nerve head and retina. Thus diabetes and primary open angle glaucoma has some association.<sup>16</sup> Primary open angle glaucoma has association with hypertension. Some studies suggest that hypertension leads to altered transport of sodium in the epithelium of distal nephrons and ciliary epithelium.<sup>22</sup> Higher systolic and diastolic blood pressures are associated with increased IOP.<sup>11, 12</sup> According to Blue Mountain Eye Study there is association between iop

elevation and smoking<sup>14</sup> the prevalence of POAG has not been observed to vary between smokers and nonsmokers in other studies.<sup>8,13</sup> Mean iop was raised in patients having high HbA1c.<sup>17</sup>

**MATERIAL AND METHODS**

Study design: An institution based case control study conducted at ophthalmology department of JNUIMSRC. In our study 100 patients were included, who came to our OPD from July 2015 to July 2017. The study was conducted after approval from institutional ethics committee. Sample size and statistics were calculated by statistician. An informed consent was taken by every patient. Group A consists of 50 patients of primary open angle glaucoma of age above 40 years. These patients were diagnosed by IOP monitoring, gonioscopy, fundus examination and visual fields analysis. Group B consists of 50 individuals of age above 40 years with no signs of glaucoma.

**Inclusion criteria**

Newly diagnosed primary open angle glaucoma patients of age above 40 years. In control group individuals age above 40 years, who came for eye checkups and were willing to become part of our study.

**Exclusion criteria**

Patients having history of trauma, ocular surgery, ocular inflammation, ocular infection, other types of glaucoma or patients on antiglaucoma medication and patients having systemic history other than hypertension and diabetes. Detailed history and examination done. Complete ocular examination was performed which includes slit lamp examination, applanation tonometry,

fundus examination, visual acuity, visual fields and gonioscopy. Blood sugar fasting, blood sugar postprandial and HbA1C were measured by standard kits and blood pressure was measured by sphygmomanometer. Systemic history about any systemic disease like diabetes, hypertension, asthma, tuberculosis, drug allergy was taken.

**RESULTS**

Results are expressed as Mean±SD. Data are analysed with the help of Microsoft Excel 2014, using student’s t-test (unpaired). A p-value <0.05 was considered as statistically significant. Table 1 and table 2 shows following results: In our study the mean age in group A was 56.21±16.21 and in group B was 53.32±13.32. In group A 27 were male and 23 were female and in group B 29 were male and 21 were female. In group A 22 patients were rural and 28 were urban while in group B 24 were rural and 26 were urban. In group A 62 % patients were hypertensive while in group B 42% of patients were hypertensive (p 0.0001) .In group A 66% were diabetic and in group B 52% were diabetic (p 0.0001). In group A 18 were smokers and in group B 13 were smokers. In group A level of HbA1c was 7.89±1.52 and in group B 6.21±0.41 (p 0.0001) Mean IOP in group A was 27.24±2.42 and in group B was 15.32±1.32 (p 0.0001) In group A blood sugar fasting was 116.21±11.36 and PP was 202.62±54.28 (p 0.0001) In group B blood sugar fasting was 94.12±10.42 and PP was 119.62±12.24 In group A systolic BP was 127.46±10.24 and diastolic BP was 82.34 ±5.12 (p 0.0001). In group B systolic Bp was 115.21±9.56 and diastolic bp 78.12±4.36.

**Table 1:** Comparison of socio-demographic profile between study and healthy control group

Variables	Group-A (case)	Group-B (control)
<b>Age(yrs)</b>	56.21±16.21(Mean±SD)	53.32±13.32(Mean±SD)
<b>Sex</b>		
Male	27	29
Female	23	21
<b>Residence</b>		
Rural	22	24
Urban	28	26
<b>Smoking habit</b>		
Smoker	18	13
Non-smokers	32	37
<b>Blood pressure</b>		
Hypertensive	31	21
Non-hypertensive	19	29
<b>Diabetes status</b>		
Diabetic	33	26
Non-diabetic	17	24

**Table 2:** Comparative study of Blood sugar, HbA1c, Mean Intraocular pressure, and Blood pressure in case and control group

Variables	Group-A (case)	Group-B (control)	p-value	t-value
<b>Blood sugar:-</b>				
Fasting	116.21±11.36	94.12±10.42	0.0001 significant	10.13
Post-prandial	202.62±54.28	119.62±12.24	0.0001 significant	10.54
<b>HbA1c</b>	7.89±1.52	6.21±0.41	0.0001 significant	7.54
<b>Mean Intraocular pressure</b>	27.24±2.42	15.32±1.32	0.0001 significant	30.5
<b>Blood pressure:-</b>				
Systolic	127.46±10.24	115.21±9.56	0.0001 significant	6.1
Diastolic	82.34±5.12	78.12±4.36	0.0001 significant	4.4

## DISCUSSION

In our study mean age in group A was 56.21±16.21 (years) and in group B was 53.32±13.32 years). Similar results were obtained by Mary K Wirtz, John R samples, Victoria Toumanidou *et al.* they conducted study on Association of POAG risk factors and the Thr 377 Met Myoc mutation in an isolated greek population and concluded that number of glaucoma patients increases with age.<sup>28</sup> In our study males were more than female. Similar result was obtained by Alicja R Rudnicka, Shahrul Mt-isa, *et al.* They conducted study on Variations in primary open angle glaucoma prevalence by age, gender and race: a Bayesian meta analysis and concluded that POAG is more common in males.<sup>29</sup> In our study level of fasting, PP blood glucose and history of diabetes were more in group A then in group B. University of michigan health system did their study on relationship between glaucoma and diabetes and hypertension. They concluded that Diabetes mellitus and Hypertension increase the risk of POAG.<sup>21</sup> Same results were concluded by Graham PA, Epidemiology of simple glaucoma and ocular hypertension.<sup>22</sup> Lins and Becker B, their studies have also suggested a greater frequency of POAG in diabetes as compared to non diabetic patients.<sup>23,24</sup> In our study mean systolic blood pressure, diastolic blood pressure and history of hypertension were more in group A then in group B. Baehw, lee N, lee HS, *et al* conducted their study on systemic hypertension as a risk factor for open angle glaucoma and concluded that there is a modest positive association of systemic hypertension with elevated intraocular pressure.<sup>25</sup> Langman M J, Lancashire R J *et al* conducted their study on systemic hypertension and glaucoma and concluded that there is common mechanism related to altered sodium transport in the epithelium of distal nephrons and cilliary epithelium.<sup>26</sup> Blue mountain study suggests that there is association between primary open angle glaucoma and

hypertension.<sup>27</sup> In our study level of HbA1c was more in group A then in group B. Similar results were obtained by N.R. Hazari, A. R. Hazari. They conducted their study on Relationship of fasting blood glucose and HbA1c with IOP in POAG patients and concluded that HbA1c associated with increased IOP in POAG patients with and without diabetes mellitus.<sup>29</sup> Maggie B. Hymowitz, Donny Chang *et al* conducted their study on Increased IOP and Hyper glycemc level in diabetic patients and concluded that diabetic subjects with elevated HbA1c levels exhibited significant higher IOP compared to those lower HbA1c.<sup>30</sup> In our study smokers were more in group A then in group B. Monica perez-de-Arcelus, Estefania Toledo *et al* conducted their study on smoking and incidence of glaucoma and concluded that current smoking status is associated with higher risk of developing glaucoma.<sup>31</sup> S. Bonavas, K Filioussi, A Tsantes, *et al* conducted their study on Diabetes mellitus as a risk factor for POAG; a meta analysis, and concluded that smokers are at greater risk of developing POAG.<sup>32</sup>

## CONCLUSION

Our study shows that level of HbA1c, blood sugar and blood pressure were higher in POAG patients. So we concluded that there is an association of POAG with hypertension and diabetes. High Blood sugar, hypertension and high HbA1c should be consider as risk factors for primary open angle glaucoma. The risk factors should be identified as early as possible to diagnose and treat the POAG patients in early stage to prevent permanent loss of vision.

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