

Original research article

## Primary Open angle Glaucoma in Diabetic Patients: Prevalence and Risk Factors

Dr. Shambhu Suman<sup>1</sup>, Dr. Ashish Kumar Sharma<sup>2</sup>, Dr. Prakash Kumar<sup>3</sup>,  
Dr. Priya<sup>4</sup>, Dr. Nidhi<sup>5</sup>

<sup>1</sup>Postgraduate resident, Department of Ophthalmology, Narayan Medical College & Hospital, Sasaram, Bihar, India

<sup>2</sup>Associate Professor, Department of Ophthalmology, Narayan Medical College & Hospital, Sasaram, Bihar, India

<sup>3</sup>Professor, Department of Ophthalmology, Narayan Medical College & Hospital, Sasaram, Bihar, India

<sup>4</sup>Assistant Professor, Department of Ophthalmology, Narayan Medical College & Hospital, Sasaram, Bihar, India

<sup>5</sup>Senior Resident, Department of Ophthalmology, Narayan Medical College & Hospital, Sasaram, Bihar, India

Corresponding Author: Dr. Prakash Kumar

### Abstract

**Aim:** Prevalence and risk factors associated with primary open angle glaucoma in diabetic patients in a tertiary care centre.

**Methods:** This Cross sectional study was done in the Department of Ophthalmology, Narayan Medical College & Hospital, Sasaram, Bihar, India. All documented diabetic cases attending Department of Ophthalmology giving consent for work up for the study, IOP > 21 mmHg (by Schiotz tonometry) with visual field defects, IOP > 21 mmHg (by Schiotz tonometry) with optic nerve head changes, Optic nerve head changes with visual field defects and Normal IOP with no visual field defects or optic nerve head changes, with asymmetry of IOP in both eyes of > 5 mmHg were included in this study.

**Results:** The results of the study show clear cut evidence of increased incidence of POAG in diabetic patients, which was 8%. The distribution of age in the study population ranges from 35 to 71 years. The mean age of study participants was 52.69 years and a SD of 10.69 years. There is a significant association between age and POAG. No significant association was found between gender and POAG. No significant association was found between duration of DM and prevalence of POAG. POAG was found to be more in patients with a family history of glaucoma.

**Conclusion:** Patients with diabetes are at increased risk of open-angle glaucoma. Glaucoma family history and retinopathy are the main risk factors for open-angle glaucoma in the early years of diabetes. Gender of patients, duration of diabetes and medication used for control of diabetes were found to be insignificantly related to glaucoma.

**Keywords:** diabetes, open-angle glaucoma, risk factors

## Introduction

Diabetes mellitus represents a significant public health issue which has become increasingly prevalent due to changes and trends in diet, lifestyle, and consequently, the rate of obesity.<sup>1</sup> Since 1980, the worldwide prevalence of diabetes has nearly quadrupled to an estimated 422 million affected persons in 2014.<sup>2</sup> As a result, global health care expenditures for diabetes are expected to total as much as 490 billion United States dollars by the year 2030, comprising an estimated 12% of total health care costs.<sup>3</sup> The burden of diabetes on the health care system is manifest in many different ways. Diabetic patients require more outpatient visits, chronic medications, and are at risk for a number of systemic microvascular complications that result in end organ damage and associated complications: renal disease, cardiovascular disease, amputations, vision loss, and premature death.<sup>3</sup> In particular, vision loss from diabetic retinopathy (DR) represents one of the most devastating complications on quality of life and is the leading cause of blindness in working age and economically active adults.<sup>4-7</sup> An older survey among diabetic patients in the United States reported a prevalence of self-rated visual impairment as high as 24.8%.<sup>8</sup> Current estimates of the prevalence of DR have been estimated as 34.6% among all patients with diabetes (both type 1 and type 2) and as a result, the implications of diabetic eye disease are far-reaching.<sup>9</sup> In addition to retinopathy, diabetes has been associated with a number of other potentially vision-threatening ocular complications including cataract, uveitis, and glaucoma.<sup>10-13</sup> Glaucoma represents the leading cause of worldwide irreversible blindness, as defined by best-corrected central visual acuity of less than 3/60 or a visual field of less than 10° in the better seeing eye.<sup>14</sup> It is characterized by pathognomonic optic nerve changes which result in progressive visual field loss over time.<sup>14</sup> Primary open angle glaucoma (POAG) is the most common form of glaucoma and is associated with a number of risk factors such as family history, African ancestry, and elevated intraocular pressure (IOP).<sup>15</sup> Of these, IOP is the only modifiable and effective target of therapy, and as a result, the mainstay of current glaucoma treatment is IOP reduction through the use of medications, laser, or surgery.

## Material and Methods

This Cross sectional study was done in the Department of Ophthalmology, Narayan Medical College & Hospital, Sasaram, Bihar, India.

All documented diabetic cases attending Department of Ophthalmology giving consent for work up for the study, IOP > 21 mmHg (by Schiottz tonometry) with visual field defects, IOP > 21 mmHg (by Schiottz tonometry) with optic nerve head changes, Optic nerve head changes with visual field defects and Normal IOP with no visual field defects or optic nerve head changes, with asymmetry of IOP in both eyes of > 5 mmHg were included in this study.

Patients were excluded if the media remained hazy, with non-visualization of the disc, If the patient was not co-operative with the visual field parameters, Closed angle on gonioscopy and Drug induced (corticosteroids) were excluded from this study.

Parameters to be studied [If quantitative data mention the units of measurement]:

Refraction using Snellen's chart, Intraocular pressure (IOP) (mmHg) using Schiottz Tonometry, Perimetry (Visual field test) using Humphrey Field Analyser (HFA)

VCDR (Vertical Cup-Disk Ratio) using 90D lens, Gonioscopy, Fasting blood sugar levels (mg/dL) and Post-Prandial blood sugar levels (mg/dL).

## Procedure

After acceptance of the thesis by the ethics committee, an informed consent will be obtained from all diabetic patients coming to the Ophthalmology OPD. A detailed ocular and medical history will be taken. A detailed general physical examination will be performed. Single reading blood pressure will be examined in each patient using a sphygmomanometer. Visual

acuity for distance and near, Best Corrected Visual Acuity (BCVA) and IOP (using Schiotz Tonometer) will be recorded in every case. An elaborate slit lamp examination of the anterior segment will also be performed. Angle of anterior chamber will be assessed by gonio Volk lens. Perimetry will be assessed by Humphrey Visual Field Analyser (HFA) (manufactured by Carl Zeiss, Germany) Detailed fundoscopy including VCDR (Vertical Cup- Disk Ratio) using indirect ophthalmoscopy and slit lamp bio microscopy using 90D/78D Volk lens shall be performed in each case. All cases shall be examined for the presence or absence of glaucoma. Blood sample of not less than 5 ml needs to be collected under asepsis from anterior cubital vein using a sterile disposable syringe.

Laboratory investigations: For assessment of fasting blood sugar values, glucose oxidase/peroxidase method is employed. Serum or plasma, free of haemolysis, may be used, mixed with Reagent that is ready to use, and analysed using automated analyser.

### Statistical methods of analysis

The data will be collected and entered into Microsoft Excel 2013, Significant level decided before starting of study:  $p \leq 0.05$ , Statistical tests to be used for data analysis: Chi square test, Student t test, Correlation and Software(s) to be used for the statistical analysis: SPSS Software Trial Version 21.0

### Results

#### Prevalence of POAG in diabetic population

The results of the study show clear cut evidence of increased incidence of POAG in diabetic patients, which was 8%

**Table 1: Prevalence of POAG in diabetic population**

POAG	Number of patients	%
Absent	92	92
Present	8	8
Total	100	100

The distribution of age in the study population ranges from 35 to 71 years. The mean age of study participants was 52.69 years and a SD of 10.69 years.

**Table 2: The mean age of study participants**

Age characteristics (Years)	Values (N = 100)
Minimum	35
Maximum	71
Mean	52.69
Standard deviation	10.69

**Table 3: Age and gender distribution in the study population**

Age in years	Male=65		Female=35	
	Number of patients	%	Number of patients	%
Below 50	18	27.69	10	28.57
50-60	32	49.23	18	51.43
60-70	14	21.54	6	17.14
Above 70	1	1.54	1	2.86
Total	65	100	35	100

**Table 4: Duration of DM**

Duration	Number of patients	%
<5 years	54	54
5-10 years	42	42
>10 years	4	4
Total	100	100

There is a significant association between age and POAG. No significant association was found between gender and POAG. No significant association was found between duration of DM and prevalence of POAG.

POAG was found to be more in patients with a family history of glaucoma.

### Discussion

Primary open-angle glaucoma is a bilateral chronic progressive disease that is often asymmetrical. The conditions are characterised by optic disc or retinal nerve fibre layer structural abnormality and open anterior chamber in the absence of known causes. The disease affects the adult population and could present with or without corresponding visual loss. Risk factors associated with the condition include higher intraocular pressure, older age, family history and African descent, among others. While traditionally raised IOP thought to be the leading cause for the optic neuropathy. Up to 40% of cases with open-angle glaucoma has normal to low intraocular pressure.<sup>16</sup> Early detection is essential and has a direct impact on the outcomes. Treatment modalities both in early and late disease stages help to prevent progression; the visual impairment caused is considered irreversible.<sup>17</sup> Secondary open-angle glaucoma is predominantly iatrogenic. Causes include corticosteroids eye drops, ocular surgery and laser.

The discussion of an association between Diabetes and POAG is not new. In 1971 Becker stated “Diabetes Mellitus occurs more often in patients with Primary Open Angle Glaucoma than in non-glaucomatous populations.<sup>18</sup> Similarly, Glaucoma is more prevalent in diabetic than in non-diabetic population”. Considerable controversy exists in literature.

While several studies show an association between the two diseases, several others fail to show any significant association. Most of these studies were comparatively small, used differing definitions of glaucoma and were clinical, rather than community based. A prevalence of 3.11 from Rotterdam, 1.84 from Wisconsin and 2.12 from Australia have been reported. Armstrong et al.<sup>19</sup> have reported a prevalence of POAG of 4.1 % in diabetic patients.

A community-based study conducted in Vellore, South India showed a prevalence of POAG of 1.7%.<sup>20</sup> My study shows a clear evidence of an excess of POAG in diabetic population, which is 8%. In this study it is found that there is no significant association between duration of DM and prevalence of POAG ( $p>0.05$ ) while in few other studies showed a significant association between these two.

My study shows there is no significant association between gender and POAG ( $p>0.05$ ) while few other studies show slight male predominance. On the contrary, there are studies also showing female predominance.

The distribution of age in the study population ranges from 35 to 71 years. The mean age of study participants was 52.69 years and a SD of 10.69 years. Study conducted by Kahn HA *et al* in 1980 studied 255 patients, 156 F/99 M, in age 30 to 92 years, showed mean age of 70.9

years, which also had similar outcomes. In this study it is found that there is significant association between diabetic retinopathy and POAG ( $P < 0.05$ ).

POAG was found to be more in patients with a family history of glaucoma which supports the family history as a risk factor Baltimore Eye Study which found that family history was a significant risk factor of POAG and the findings were noted in the literature since 1977.<sup>21,22</sup>

This suggests that at the time of annual screening of all diabetic patients for retinopathy, POAG screening is a very effective proposition provided a clear clinical benefit could be elicited. A screening test should ideally be relatively less expensive, simple, and quick to perform and if possible be capable of being administered by a non-specialist.

### Conclusion

Patients with diabetes are at increased risk of open-angle glaucoma, Glaucoma family history and retinopathy are the main risk factors for open-angle glaucoma in the early years of diabetes. Gender of patients, duration of diabetes and medication used for control of diabetes were found to be insignificantly related to glaucoma.

### Reference

1. Shaw JE, Sicree RA, Zimmet PZ. Global estimates of the prevalence of diabetes for 2010 and 2030. *Diabetes Res Clin Pract.* 2010; 87:4–14. [PubMed: 19896746]
2. NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in diabetes since 1980: a pooled analysis of 751 population-based studies with 4.4 million participants. *Lancet.* 2016; 387:1513–30. [PubMed: 27061677]
3. Zhang P, Zhang X, Brown J, et al. Global healthcare expenditure on diabetes for 2010 and 2030. *Diabetes Res Clin Pract.* 2010; 87:293–301. [PubMed: 20171754]
4. Moss SE, Klein R, Klein BE. The 14-year incidence of visual loss in a diabetic population. *Ophthalmology.* 1998; 105:998–1003. [PubMed: 9627648]
5. Cheung N, Mitchell P, Wong TY. Diabetic retinopathy. *Lancet.* 2010; 376:124–36. [PubMed: 20580421]
6. Klein BE. Overview of epidemiologic studies of diabetic retinopathy. *Ophthalmic Epidemiol.* 2007; 14:179–83. [PubMed: 17896294]
7. Ting DS, Cheung GC, Wong TY. Diabetic retinopathy: global prevalence, major risk factors, screening practices and public health challenges: a review. *Clin Experiment Ophthalmol.* 2016; 44:260–77. [PubMed: 26716602]
8. Saaddine JB, Narayan KM, Engelgau MM, et al. Prevalence of self-rated visual impairment among adults with diabetes. *Am J Public Health.* 1999; 89:1200–5. [PubMed: 10432906]
9. Yau JW, Rogers SL, Kawasaki R, et al. Global prevalence and major risk factors of diabetic retinopathy. *Diabetes Care.* 2012; 35:556–64. [PubMed: 22301125]
10. Stanga PE, Boyd SR, Hamilton AM. Ocular manifestations of diabetes mellitus. *Curr Opin Ophthalmol.* 1999; 10:483–9. [PubMed: 10662255]
11. Zhao D, Cho J, Kim MH, et al. Diabetes, fasting glucose, and the risk of glaucoma: a metaanalysis. *Ophthalmology.* 2015; 122:72–8. This meta-analysis pooled data from previous epidemiologic studies to further support the relationship between diabetes status with glaucoma risk in addition to examining the relationship of diabetic characteristics, specifically diabetes duration and fasting glucose levels, with glaucoma risk as well. [PubMed: 25283061]
12. Zhao D, Cho J, Kim MH, et al. Diabetes, glucose metabolism, and glaucoma: the 2005–2008 National Health and Nutrition Examination Survey. *PLoS One.* 2014; 9:e112460. [PubMed: 25393836]

13. Ko F, Boland MV, Gupta P, et al. Diabetes, triglyceride levels, and other risk factors for glaucoma in the National Health and Nutrition Examination Survey 2005–2008. *Invest Ophthalmol Vis Sci.* 2016; 57:2152–7. [PubMed: 27111561]
14. Tham YC, Li X, Wong TY, et al. Global prevalence of glaucoma and projections of glaucoma burden through 2040: a systematic review and meta-analysis. *Ophthalmology.* 2014; 121:2081–90. [PubMed: 24974815]
15. Boland MV, Quigley HA. Risk factors and open-angle glaucoma: classification and application. *J Glaucoma.* 2007; 16:406–18. [PubMed: 17571004]
16. Prum BE, Rosenberg LF, Gedde SJ, Mansberger SL, Stein JD, Moroi SE, Herndon LW, Lim MC, Williams RD. Primary open-angle glaucoma preferred practice pattern® guidelines. *Ophthalmology.* 2016 Jan 1;123(1):P41-111.
17. Weinreb RN, Khaw PT. Primary open-angle glaucoma. *Lancet.* 2004;363(9422):1711-20
18. Reddy M, Malleswari M, Sai Rani K. Prevalence Of Primary Open Angle Glaucoma in Diabetic Patients. *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*e-ISSN: 2279-0853, p-ISSN: 2279-0861 2017;16(6):147-151. [www.iosrjournals.org](http://www.iosrjournals.org)
19. Armstrong JR, Daily RK, Dobson HL, Girard LJ. The Incidence of Glaucoma in Diabetes Mellitus\*: A Comparison with the Incidence of Glaucoma in the General Population. *American journal of ophthalmology* 1960;50(1):55-63.
20. Ramakrishnan R, Nirmalan PK, Krishnadas R, Thulasiraj RD, Tielsch JM, Katz J, Friedman DS, Robin AL. Glaucoma in a rural population of southern India: the Aravind comprehensive eye survey. *Ophthalmology* 2003;110(8):1484-90.
21. Shin DH, Becker B, Kolker AE. Family History in Primary Open-Angle Glaucoma. *Arch Ophthalmol.* 1977 Apr 1;95(4):598-600.
22. Tielsch JM, Katz J, Singh K, Quigley HA, Gottsch JD, Javitt J, et al. A population-based evaluation of glaucoma screening: the Baltimore Eye Survey. *Am J Epidemiol.* 1991 Nov 15;134(10):1102-10

Received :14-11-2021.      Revised:22-11-2021.      Accepted:26-12-2021