

<https://doi.org/10.48047/AFJBS.6.15.2024.9141-9153>



African Journal of Biological Sciences

Journal homepage: <http://www.afjbs.com>



Research Paper

Open Access

Study of Primary Open Angle Glaucoma in Patients with Type2 Diabetes Mellitus in a Tertiary Care Hospital

Nuthan Babu¹, Dr. M S Padmajothi², Srilekha R Matapati³, Dr. Chaitra M.C⁴

1. Former Junior Resident, Department of Ophthalmology, Sri Devaraj Urs Medical College, Tamaka, Kolar.
2. Former Professor, Department of Ophthalmology, Sri Devaraj Urs Medical College, Tamaka, Kolar
3. Junior Resident, Department of Ophthalmology, Sri Devaraj Urs Medical College, Tamaka, Kolar.
4. Associate Professor, Department of Ophthalmology, Sri Devaraj Urs Medical College, Tamaka, Kolar

Corresponding Author: Dr .CHAITRA M.C

Address : Associate Professor, Department of Ophthalmology, Sri Devaraj Urs Medical College, Tamaka, Kolar-563101

Volume 6, Issue 15, Sep 2024

Received: 15 July 2024

Accepted: 25 Aug 2024

Published: 05 Sep 2024

doi: [10.48047/AFJBS.6.15.2024.9141-9153](https://doi.org/10.48047/AFJBS.6.15.2024.9141-9153)

ABSTRACT:

Diabetes mellitus (DM) has emerged as a major cause of blindness and visual disability in developed as well as developing countries. People with diabetes are 40% more likely to suffer from glaucoma, than people without diabetes. Glaucoma and diabetic retinopathy are slowly progressive ocular diseases which cause irreversible visual impairment. This study is undertaken to screen for Primary Open Angle Glaucoma(POAG) in patients with type 2 diabetes mellitus & to correlate between severity of Diabetic Retinopathy with the occurrence of Primary Open Angle Glaucoma(POAG) in patients.

MATERIAL AND METHODS: The study includes 205 patients with type 2 Diabetes Mellitus attending Ophthalmology OPD & inpatients at R. L. Jalappa Hospital& Research centre, Kolar to screen for Primary Open Angle Glaucoma in patients with type 2 diabetes mellitus. Informed written consent form of the participating were taken. A proforma is prepared and data collection is done by noting down the age of the patient, history (including diabetic history), duration of the disease. All the patients are assessed by Visual acuity for distance and near. A thorough anterior segment & Posterior segment examination was done. Gonioscopy was done using Goldmann three mirror lens in cases of primary angle closure glaucomas. Visual field was analyzed by Humphrey Field Analyzer. **RESULTS:** In the present study of 205 type 2 D.M, 6.8%(14) had POAG, 1.94% had Glaucoma Suspect and 0.97% had NTG, among those with POAG, 50% had DR and 50% had No DR. Among POAG 14.28% had Mild NPDR,57.12% had Moderate NPDR,14.28% had severe NPDR14.28% had Diabetic Maculopathy. Total of 37.4% had diabetic retinopathy. Among those with Mild and Moderate Diabetic Retinopathy, 39.3 had DM for 10 years. Among those with Severe NPDR, PDR and Diabetic Maculopathy, 14.3% had DM for 10 years. There was no significant association between severity of Diabetic Retinopathy and Duration of DM.

CONCLUSION: The results of the study show that there were more people with Diabetic Retinopathy and Primary Open Angle Glaucoma in Diabetic patients. Hence it is imperative that all patients who are type 2 diabetics are screened for glaucoma which will help us detect glaucoma at an early stage and thereby enabling early treatment and limiting the progression of glaucoma.

KEY WORDS Diabetic Retinopathy, Primary Open Angle Glaucoma, Diabetes Mellitus, Intra Ocular Pressure.

INTRODUCTION:

The prevalence and incidence of diabetes mellitus with advancing age is increasing; adult diabetics are at a risk of vision threatening retinopathies also. It is estimated that the number of diabetics in India will increase from 19 million to 57 million between 1995 and 2025 (195% increase). One-Fourth of the world's blind population is estimated to be in India, that is about 9-12 million.¹ Glaucoma is a disease in which the optic nerve is damaged, leading to progressive, irreversible vision loss. The presence of the Type 2 Diabetes mellitus and also a longer duration of type 2 diabetes mellitus were independently associated with higher risk, having open angle glaucoma. The risk of visual disability was highest among diabetic patients with glaucoma and in diabetic patients without glaucoma comparatively.²

AIMS AND OBJECTIVES

1. To screen for Primary Open Angle Glaucoma in patients with type 2 Diabetes Mellitus.
2. To co-relate between severity of Diabetic Retinopathy with the occurrence of Primary Open Angle Glaucoma in patients.

MATERIALS AND METHODS.

SOURCE OF DATA This case series study was conducted on all type 2 diabetes mellitus patients attending the OPD of Department of Ophthalmology, R. L. Jalappa Hospital & Research centre, Kolar from July 2017 to July 2018, after obtaining ethical clearance from Institutional Ethical Committee of Sri Devaraj Urs Medical College and written informed consent from the subjects.

INCLUSION CRITERIA : Patients with type 2 diabetes mellitus between 40 -60years of age.

EXCLUSION CRITERIA: Corneal disorders like corneal opacity, degenerations & dystrophies.

METHODOLOGY

Demographic details, duration of diabetes will be recorded followed by assessment of diabetic status by fasting blood sugar (FBS), post prandial blood sugar (PPBS), glycated hemoglobin (Hb1Ac). A proforma was prepared and data collection was done by noting down the age of the patient, history (including diabetic history), duration of the disease. Vision was assessed for all patients for distant and near using snellen's visual chart. A through slitlamp

examination of anterior segment is done. IOP is recorded using Goldmann applanation tonometer. Gonioscopy is done to assess the angle of anterior chamber using Goldmann 3 mirror gonio lens. The patients were graded as follows:

Shaffer's grading system: Grade 4 (angle width of 45- 35), Grade 3 (angle width of 35-20), Grade 2 (angle width of 20), Grade 1 (angle width of <10), Grade 0 (angle width of zero).

Posterior segment examination following pupillary dilatation with Tropicamide 1% eye drop was done by direct ophthalmoscope, indirect ophthalmoscopy and 90D lens examination. Visual field was analysed by Humphrey Field Analyzer. Investigations like fundus photography was done for the required patients. Diabetic retinopathy was determined through fundus examination and graded clinically using the "Early Treatment of Diabetic Retinopathy Study"(ETDRS) classification for DR.

Grade 0: No apparent retinopathy

Grade 1: Mild non-proliferative retinopathy (NPDR) –few micro aneurysms.

Grade 2: Moderate NPDR –micro aneurysms, intra-retinal hemorrhages or venous beading.

Grade 3: Severe NPDR – based on the 4:2:1 rule of the ETDRS, hemorrhages in all 4 quadrants, venous beading in 2 quadrants or intraretinal microvascular abnormalities (IRMA) in 1 quadrant.

Grade 4: Proliferative diabetic retinopathy (PDR) – characterized by neovascularization of the disc, retina, iris & of the angle, vitreous hemorrhage or tractional retinal detachment. Diabetic macular edema was classified as clinically significant macular edema (CSME) or non-CSME.

STATISTICAL ANALYSIS:

Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. Chi-square test or Fischer's exact test (for 2x2 tables only) was used as test of significance for qualitative data. Yates correction was applied where ever chi-square rules were not fulfilled (for 2x2 tables only). Continuous data was represented as mean and standard deviation. Independent t test or Mann Whitney U test was used as test of significance to identify the mean difference between two quantitative variables and qualitative variables respectively. Graphical representation of data: MS Excel and MS word was used to obtain various types of

graphs such as bar diagram, Pie diagram and Scatter plots. p value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests. Statistical software: MS Excel, SPSS version 22 (IBM SPSS Statistics, Somers NY, USA) was used to analyze data. EPI Info (CDC Atlanta), Open Epi, Med calc and Medley's desktop were used to estimate sample size, odds ratio and reference management in the study.

RESULTS:

Mean age of subjects was 52.69 ± 6.605 years. 18.9% were in the age group 40 to 45 years, 23.3% were in the age group 46 to 50 years, 13.6% were in the age group 51 to 55 years and 44.2% were in the age group 55 to 60 years (Table 1).

Table 1: Age distribution of subjects

		Count	%
Age	40 to 45 years	39	18.9%
	46 to 50 years	48	23.3%
	51 to 55 years	28	13.6%
	55 to 60 years	91	44.2%

In the study 46.1% were females and 53.9% were males.

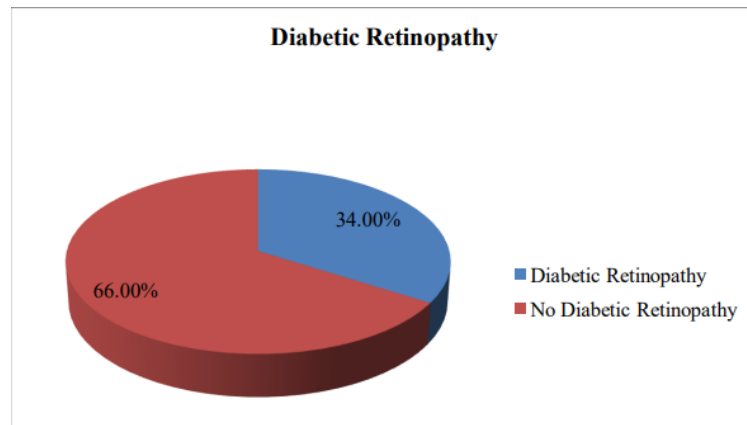
In the study 56.8% were in the age group <5 years, 26.7% were in the age group 6-10 years & 16.5% were >10 years (Table 2)

Table 2: Duration of Type 2 DM distribution of subjects

		Count	%
Duration of Type 2 DM (In Years)	<5 years	117	56.8%
	6 to 10 years	55	26.7%
	>10 years	34	16.5%

In the study 34% had Diabetic retinopathy and 66% had no Diabetic Retinopathy.

Figure 1: Pie diagram showing Diabetic Retinopathy distribution among subjects



In the study 66% had no diabetic retinopathy, 18% had mild NPDR, 9.2% had moderate NPDR, 5.8% had severe NPDR, 2.9% had PDR, 1% had Diabetic Maculopathy and 0.5% had Advanced Diabetic Eye Disease (Table 3).

Table 3: Diabetic Retinopathy among subjects

		Count	%
Final Diagnosis	No DR	129	62.6%
	Mild NPDR	37	18.0%
	Moderate NPDR	19	9.2%
	Severe NPDR	12	5.8%
	PDR	6	2.9%
	Diabetic Maculopathy	2	1.0%
	Advanced Diabetic Eye Disease	1	0.5%

Among those with Diabetic Retinopathy, 31.4% had DM for <5 years, 25.7% had DM for 6 to 10 years and 42.9% had DM for >10 years. Among those without Diabetic Retinopathy, 69.9% had DM for < 5 years, 27.2% had DM for 6 to 10 years and 2.9% had DM for >10 years. There was significant association between Diabetic Retinopathy and Duration of DM.

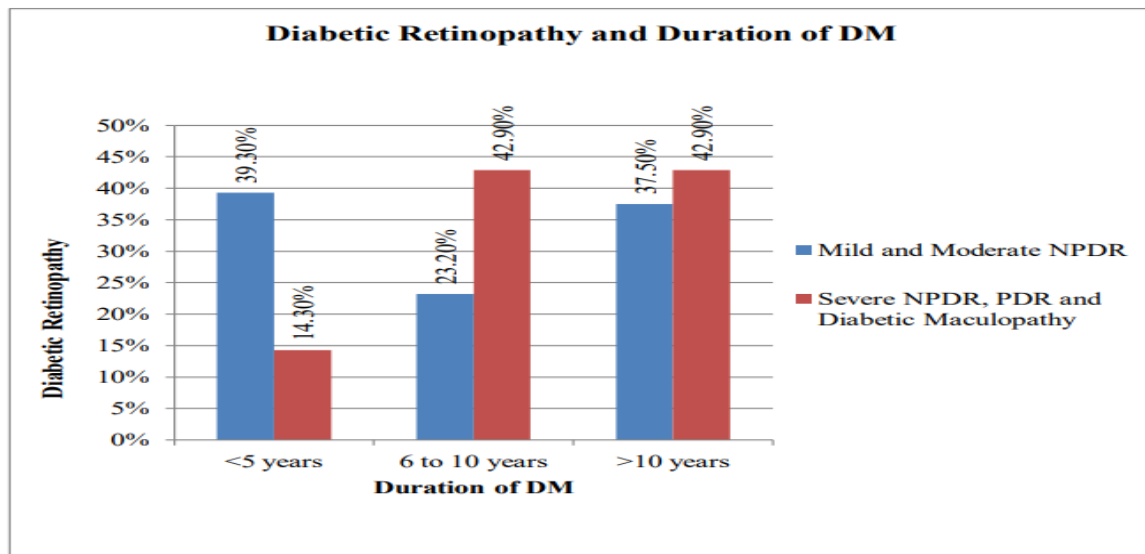
Table 4: Association between Diabetic Retinopathy and Duration of DM

		Diabetic Retinopathy					
		Diabetic Retinopathy		No Diabetic Retinopathy		Total	
		Count	%	Count	%	Count	%
Duration of Type 2 DM (In Years)	<5 years	22	31.4%	95	69.9%	117	56.8%
	6 to 10 years	18	25.7%	37	27.2%	55	26.7%
	>10 years	30	42.9%	4	2.9%	34	16.5%

$\chi^2 = 56.66$, $df = 2$, $p < 0.001^*$

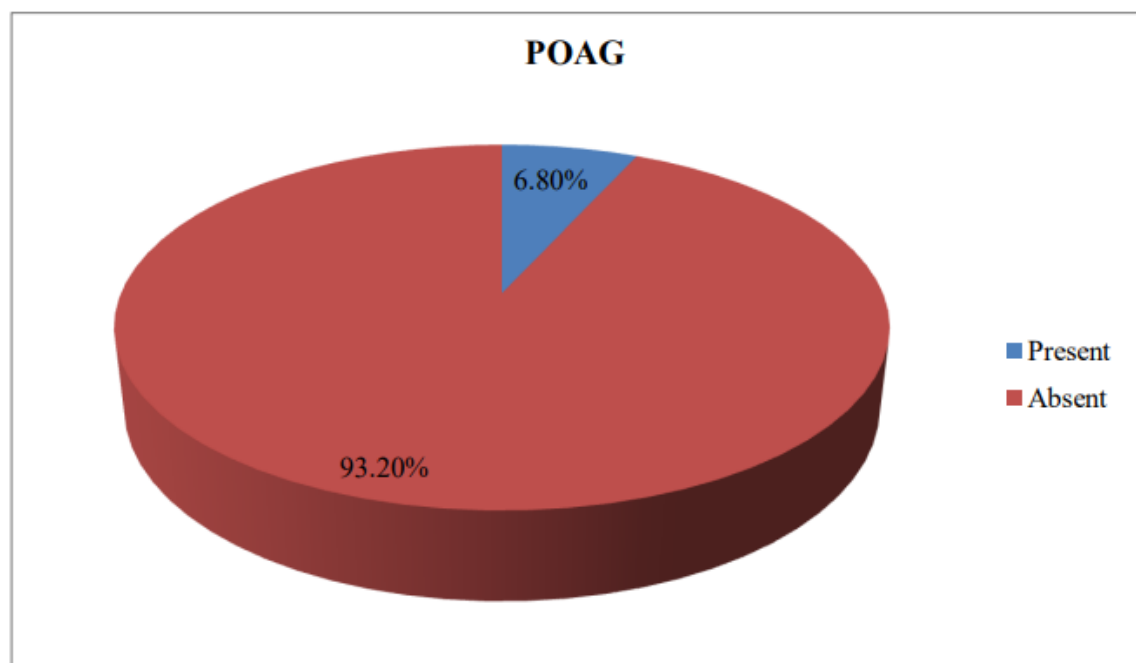
Among those with Mild and Moderate Diabetic Retinopathy, 39.3 had DM for < 5 years, 23.2% had DM for 6 to 10 years and 37.5% had DM for >10 years. Among those with Severe NPDR, PDR and Diabetic Maculopathy, 14.3% had DM for <5 years, 42.9% had DM for 6 to 10 years and 42.9% had DM for >10 years. There was significant association between Diabetic Retinopathy and Duration of DM.

Figure 2: Bar diagram showing Association between Diabetic Retinopathy and Duration of DM.



In the study 6.8% had POAG.

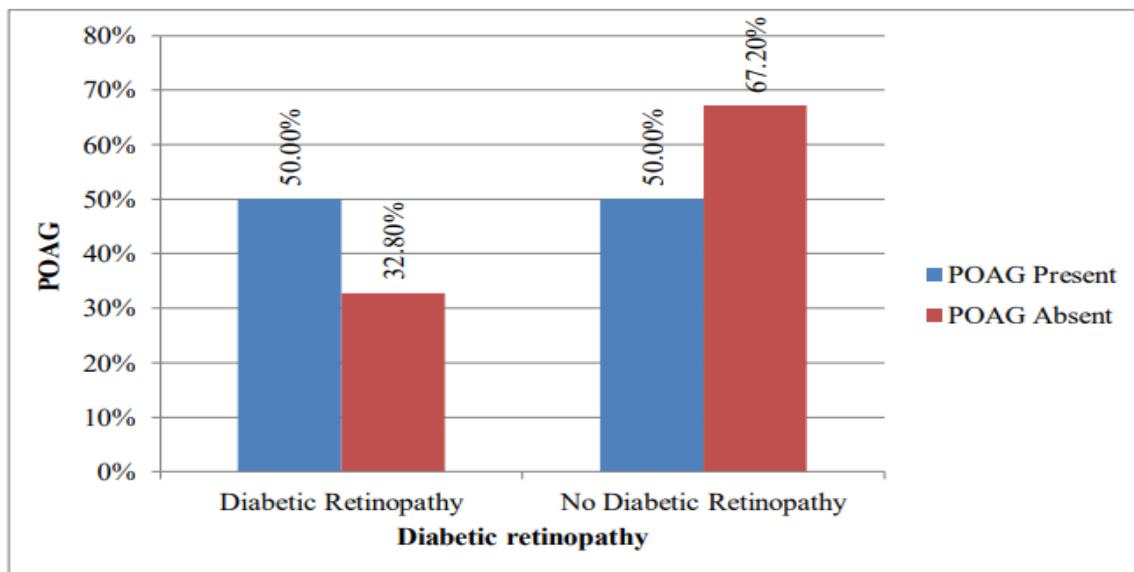
Figure 3: Pie diagram showing POAG distribution among subjects



In the study 6.8% had POAG, 1.94% had Glaucoma Suspect and 0.97% had NTG.

In the study among those with POAG, 50% had DR and 50% had No DR.

Figure 4: Bar diagram showing Association between Diabetic retinopathy and POAG.



The grading of diabetic retinopathy in 7 patients with POAG is 1 patient(14.28%) had mild NPDR, 4 (57.12) had moderate NPDR, 1(14.28) had severe NPDR and 1 (14.28%) had diabetic maculopathy.

Table5 : Severity of diabetic retinopathy in POAG.

DIABETIC RETINOPATHY GRADES	NO OF CASES IN POAG	%
Mild NPDR	1	14.28
Moderate NPDR	4	57.12
Severe NPDR	1	14.28
PDR	-	-
Diabetic Maculopathy	1	14.28
Advanced eye disease	-	-

In the study there was significant difference in mean IOP b/w POAG, Glaucoma Suspect and NTG on both right and left eye.

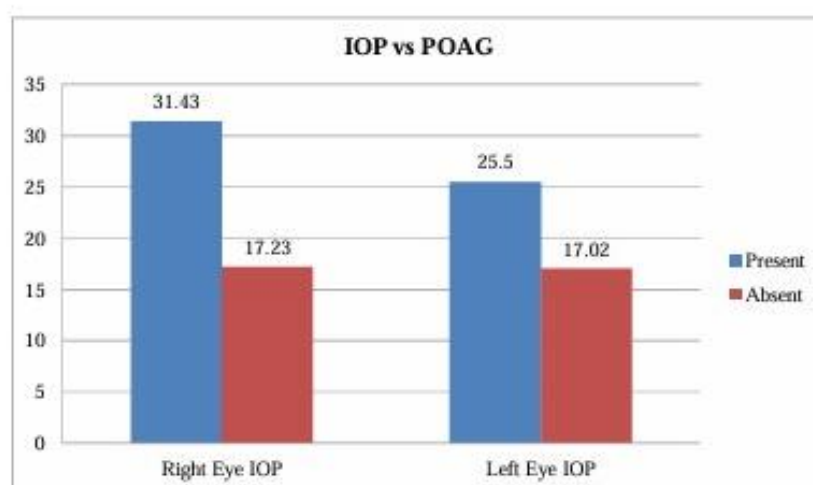
IOP was significantly higher in POAG group on both sides.

Table 6 : IOP comparison with respect to Diagnosis in Right and Left eye

		Right Eye IOP		Left Eye IOP	
		Mean	SD	Mean	SD
Diagnosis	POAG	31.43	5.94	25.50	5.27
	Glaucoma Suspect	16.00	3.27	16.50	3.79
	NTG	21.00	1.41	18.00	2.83
P value b/w three groups		<0.001*		0.009*	

Mean RBS among Diabetic Retinopathy group was 202.34 ± 59.76 mg/dl and among those with No Diabetic Retinopathy, mean RBS was 176.88 ± 43.62 mg/dl. There was no significant difference in mean RBS between two groups.

Among those with POAG, mean IOP in right eye was 31.43 ± 5.94 mmHg and in left eye was 25.50 ± 5.27 mmHg and among those without POAG, mean IOP in right was 17.23 ± 2.86 and in left eye was 17.02 ± 2.54 mmHg. There was significant difference in mean IOP between POAG and no POAG group in both right and left eyes.

Figure5: Bar diagram showing Mean IOP comparison with respect to POAG

DISCUSSION:

The study includes 205 patients of type 2 Diabetes Mellitus attending ophthalmology outpatient department and references from R.L.J. HOSPITAL AND RESEARCH CENTRE, TAMAKA, KOLAR attached to SRI DEVARAJ URS MEDICAL COLLEGE between December 2016 and May 2018 were included in this study to screen for Primary Open Angle Glaucoma in patients with type 2 diabetes mellitus, and to co-relate between severity of Diabetic Retinopathy with the occurrence of Primary Open Angle Glaucoma in patients. Out of 205 type 2 D.M patients, 18.9% were in the age group 40 to 45 years, 23.3% were in the age group 46 to 50 years, 13.6% were in the age group 51 to 55 years and 44.2% were in the age group 55 to 60 years. In our study the mean age of the patients was 52.69 ± 6.605 years. In a study by Mahesh Reddy et al,³ that included 400 diabetic patients, the mean age of the patients was 53.1 ± 8.28 years. This was comparable to our study.

Our study comprised of 95 (46.1%) females and 111(53.9%) males. Out of 95 females and 111 males, 41(43.2%) females and 50(45%) males were above 55 years. Also, in our study there was no significant association between age and gender ($p = 0.325$) . In a study of prevalence of Primary Open Angle Glaucoma in Diabetic Patients by Mahesh reddy et al,³ out of 400 diabetic patients majority of them were males. This was comparable to our study.

Mean RBS among Diabetic Retinopathy group was 202.34 ± 59.76 mg/dl and among those with No Diabetic Retinopathy, mean RBS was 176.88 ± 43.62 mg/dl. There was significant difference in mean RBS between two groups ($p=0.001$).

In a study by Mahesh reddy et al,³ Overall proportion of POAG cases were 4.0% (40 out of 400), NTG were 2.0% (8 out of 400) and 1.0% were OH cases. The Mean Right eye IOP values of Normal were 16.46 ± 2.43 ranging from 12.60 to 22.4. The mean IOP values of NTG were 14.60 ± 0.65 ranging from 14.6 to 14.7. The mean IOP values of POAG were 28.12 ± 3.99 ranging from 23.1 to 31.8. The mean IOP values of OH were 27.2. The difference observed in mean IOP values among the group was statistically significant ($p=0.05$). The POAG patients had statistically significant higher IOP than Normal. The Mean Left eye IOP values of Normal were 17.79 ± 2.55 ranging from 12.60 to 24.4. The mean IOP values of NTG were 16.9 ± 0.57 ranging from 16.5 to 17.3. The mean IOP values of POAG were 26.25 ± 1.56 ranging from 22.4 to 25.1. The mean IOP values of OH were 25.1. The difference observed in mean IOP values among the group was statistically significant

($p=0.05$). The POAG patients had statistically significant higher IOP than Normal. These results were comparable to our study.

Visual field assessment could not be done in 6 eyes due to poor vision (dense cataract). In 380 eyes fields were normal. In 4 eyes (0.97%) there was generalized depression of fields, 1 eye (0.24%) had paracentral scotoma, 12 eyes (3.17 %) had arcuate scotomas, 2 eyes (0.48%) had biarcuate scotomas, 4 eyes (0.97%) had nasal step. Most of the field defects in our study were arcuate scotomas , similar to a study by Jayantha Thakuria et al.⁴

In the present study of 205 patients, 34%(70) patients had diabetic retinopathy. According to Sankara Nethralaya Diabetic Retinopathy Epidemiology and Molecular Genetics Study report 2 in 2009 in the urban Chennai population the prevalence of diabetic retinopathy was found to be 28.2%.⁵ According to a population-based study conducted on a representative population of Chennai city in South India the prevalence of diabetic retinopathy was found to be 17.6%.⁵ According to Los Angeles Latino Eye Study (LALES) the prevalence of diabetic retinopathy was found to be 46.9%.⁶ According to the Liverpool diabetic eye study the prevalence of diabetic retinopathy was found to be 33.6%.⁶ According to the Barbados eye study, the prevalence of diabetic retinopathy was found to be 28.8%.⁷ According to the Blue Mountain Eye study Australia, the prevalence of diabetic retinopathy was found to be 29.0%.⁸ According to the Beaver dam eye study, the prevalence of diabetic retinopathy was found to be 35.1%.⁹ According to the Wisconsin epidemiologic study of diabetic retinopathy the prevalence of diabetic retinopathy was found to be 50.3%.¹⁰ According to the Prevalence of diabetic retinopathy in Tehran province: A population-based study, the prevalence was found to be 37.0%.¹¹

According to our study the prevalence of POAG in Diabetic Patients was found to be 6.8%.

Four large cross-sectional studies found positive associations between diabetes and glaucoma including the Beaver Dam study prevalence of 1.84 %¹⁷⁰, 3.11% from Rotterdam¹², and 2.12% from Blue mountain eye study¹⁶⁹ and Los Angeles Latino Eye study of 1.4% have been reported.⁶

A community based study conducted in Vellore, South India showed a prevalence of POAG of 4.1% in diabetics (2017).¹³

According to one study done by Muhammad Alam et al of Department of Ophthalmology, Bannu Medical College Bannu, Khyber Teaching Hospital Peshawar, Pakistan, the severity of diabetic retinopathy increased with increase in the duration of diabetes. The prevalence of PDR increased from 2.79% (0-10 years of diabetes) to 27.35% (11-20 years of diabetes and to 60.52%(>20 years of diabetes)¹⁴.

CONCLUSION:

India having a high prevalence of Type 2 Diabetics also leads to a large population of people being at risk for Glaucoma. Primary Open Angle glaucoma is typically asymptomatic until significant visual field loss has occurred. It is important to improve the screening, diagnostic and therapeutic approaches to primary open angle glaucoma so that can be applied worldwide. From my study, I come to a conclusion that there is 6.8% proportion of association between primary open angle glaucoma and type2 Diabetes in 205 diabetic patients. Hence it is imperative that all patients who are type 2 diabetics are screened for glaucomas which will help us detect glaucoma at an early stage itself and thereby enabling early treatment and limiting the progression of glaucoma.

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