

## A Study of Determinant and Magnitude of Glaucoma in Diabetic Patients

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### ABSTRACT

**BACKGROUND:** The main purpose of the study is to evaluate the determinants and magnitude of glaucoma in diabetic patients and factors which cause glaucoma among diabetic patients. **METHODS AND MATERIALS:** All the diabetic patients referred to Guru Govindsinh Hospital Jamnagar were examined by slit lamp and indirect ophthalmoscopy. Intraocular pressure measured by schiottz tonometer. Classification and grading of glaucoma done by gonioscopic examination. Patients were also classified according to grading of diabetic retinopathy. **OBSERVATION:** Type II diabetic patients were more prone to develop glaucoma. Among them primary open angle glaucoma and neovascular glaucoma had more common occurrence most often bilaterally. Treatment for that type of complicated glaucoma was very difficult. **CONCLUSION:** It is mandatory to male patients having history of diabetes more than 10 years periodic examination for glaucoma also.

**Key Words:** Glaucoma, Diabetes, Goniscopy, Neovascular glaucoma.

### INTRODUCTION

Glaucoma, a condition of increased pressure within the eyeball, causing gradual loss of sight. Glaucoma originally meant "*clouded*" in Greek. It is the leading cause of blindness in developing world and a major health problem in developed world (2). Commonly known as the "*silent thief of sight*", is making increase to 24 million people in 2020. At present the prevalence of blindness is 1.1 % in India. 4% of India's blind cases are due to glaucoma. By implementing strategies to prevent blindness due to glaucoma

**Definition of Glaucoma:** Glaucoma represents a group of disease defined by a characteristic optic neuropathy that is consistent with excavation and undermining of connective and neural tissue of the optic disc and by eventual development of distinctive pattern of visual dysfunction. The peripheral fibers

from the retina remains peripherally in the optic nerve & central fibers remains Centrally which correlates with the clinical progression of glaucomatous visual field loss in the form of Para-central scotomas which appear early in the disease when the cup enlarges. Optic nerve is supplied by the branches of CRA (central retinal artery) & SPCA (short posterior ciliary artery). The branches of CRA is responsible for flame (splinter) shaped haemorrhage which is seen in glaucoma. All the glaucomatous optic atrophy shares the common feature of retinal ganglion cell damage manifesting as excavation of the optic nerve. The earliest site of optic nerve damage is the lamina cribrosa.

There are two types of ganglion cells, small Parvo cells responsible for color & acuity data & large Magno cells responsible for motion & scotopic function which are damaged earlier in glaucoma leading to loss of motion perception & delayed dark adaptation. These ganglionic cells are susceptible to normal aging which account for the 25% of natural loss of these cells even in normal person, raised IOP, neuro-toxic substance like glutamate, and vascular insufficiency produced by disturbances in endothelial auto-regulation. In NTG patients, the mechanism by which such cell loss occurs

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is apoptosis induced programmed cell death. Patients in POAG are usually asymptomatic until the late stages.

**Diabetes and Glaucoma:**

**Magnitude:** Diabetes is a common disorder characterized by sustained hyperglycemia of varying severity secondary to lack or diminished efficacy of endogenous Insulin. **Types:**

- **Juvenile or type I DM:** It affects individuals between 10-20 years & characterized by total lack of insulin.
- **Maturity onset or type II DM:** It affects individual between 50-70 years & characterized by relative deficiency of insulin or peripheral insulin resistance. It accounts for 90% of patients of DM.

The risk of glaucoma is increased to twice in diabetic patients compared to non diabetic patients. The individuals with DM are 25 times more likely to become legally blind than individuals without DM.

**Pathophysiology of Glaucoma In Diabetics: (15), (16), (17), (18), (19)**

The diabetic patients have higher IOP compared to normal persons. Diabetes affects small blood vessels on the optic nerve and makes them susceptible to raised IOP. There is a selective loss of S (blue-pi-1) cone pathway more than the M (green-pi-4). This selective loss is as a result of combined damage produced by toxic metabolites and hypoxia. The rubeosis iridis which develops in patients with PDR can also contribute to raised IOP creating a different entity called neo-vascular Glaucoma.

**Investigations pointing to the diagnosis of DM are (20), (21) :**

- RBS > 200 mg %,
- FBS > 126 mg %,
- PP2BS > 200 mg %
- HbA1c > 8% (suggesting poor glycemc control)
- Urine sugar.

**Diagnosis of Poag(22), (23):**

Based on:

- Increased IOP
- Open angle of anterior chamber on Gonioscopy
- Disc change
- Field changes
- Retinal nerve fiber layer changes.

The aim of this study is to evaluate the determinants and magnitude of glaucoma in diabetic patients.

**MATERIAL AND METHODS**

**Patient Selection:** An institution based cross section analytic study was carried out on 70 diabetic patients who came to outdoor patient department (OPD) of Ophthalmology Department of M.P Shah Government Medical College and Guru Govind Singh Government Hospital, Jamnagar.

As the main objective of the study was to determine magnitude and determinants of glaucoma in diabetic patients cases were selected for the study based on the following criteria.

**Inclusion Criteria**

All the patients above 18 years are included in this study

All the patients diagnosed to have glaucoma. Materials and Methods 34

• **POAG (OPEN ANGLE)**

1. IOP greater than 24 mmHg.
2. Open angle of anterior chamber.
3. On fundus examination glaucomatous cupping of the optic disc.

That fulfilled the minimum criteria for glaucomatous field defects.

• **NERROW ANGLE**

1. Acute or chronic rise of IOP more than 24 mmHg.
2. Narrow angle of anterior chamber
3. Characteristic visual field defects on perimetry examination.

That fulfilled the minimum criteria for glaucomatous field defects.

• **NEO-VASCULAR GLAUCOMA**

1. Presence of rubeosis irides on iris surface or on angle.
2. IOP greater than 24 mmHg.
3. Fundus changes characterized by presence of proliferative diabetic retinopathy with NVD or NVE.

4. Ischemic CRVO characterized by profuse retinal haemorrhge. Materials and Methods 35

5. Cotton wool spot and NV (neo-vascularization) over posterior pole in which disc may be either edematous or inflamed or may become atrophic.

**Exclusion Criteria**

- 1.All the patients who are not diabetic are excluded from the study.
- 2.All the patients with systemic illness other than diabetes are excluded from the study.

**Methodology**

**Detailed Examination**

- Distant visual acuity was taken on Snellen’s chart,
- Anterior segment examination was done using a slit lamp,
- Subjective refraction was done to achieve maximum corrected visual acuity with the aid of auto-refractometer and Snellen’s chart,

Measurement of intra-ocular pressure was done using Schiottz tonometer, Slit lamp examination was done with the full dilation of the pupil, Fundus examination was done using direct ophthalmoscope and 90 D lens.

Random blood sugar value measured by GLAUCOMETER

**Iop Measurement by Schiottz Tonometer:**

**Perimetry:** It was done using octopus 900 automated perimeter.

**OCTOPUS 900 PERIMETER**

**Gonioscopy:** It was done with single mirror Goldmann's indirect Gonio lens. Interpretation was done using Shaffer's grading system.

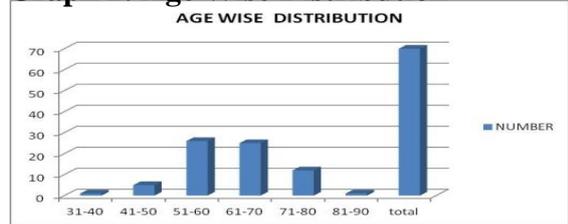
**DISCUSSION**

A total of 140 eyes of diabetic patients were included in the study. Among the 140 eyes included 36 were glaucomatous and the rest were non glaucomatous.

**Table 1: Age Distribution in Diabetic Patients (n=70)**

Age Group(In Years)	Number	%
31-40	1	1.42
41-50	5	7.14
51-60	26	37.14
61-70	25	35.71
71-80	12	17.14
81-90	1	1.42
Total	70	100

**Graph 1: Age Wise Distribution**

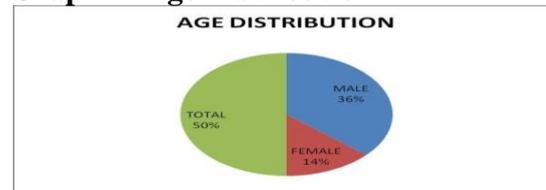


Highest 37.14% prevalence of glaucoma in diabetic patients was found in the age group of 51 prevalence of glaucoma in diabetic patients was found in the age group of 51 to 60 years. Lowest 1.14% prevalence was found in the age group of 81 to 90 and 31 to 40 yrs signifying elderly diabetic individuals are at a higher risk of developing glaucoma.

**Table 2: Sex Distribution in Diabetic Glaucomatou Patients**

SEX	NO OF EYES	%
MALE	102	72.85
FEMALE	38	27.14
TOTAL	140	100

**Graph 2: Age Distribution**

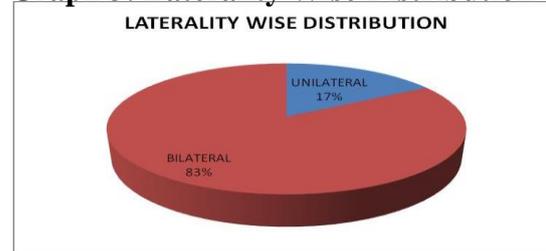


In our study, males are nearly 2.5 times more affected than female.

**Table 3: Laterality of Glaucoma in Diabetics**

	Unilateral	Bilateral
Total	6	30

**Graph 3: Laterality Wise Distribution**

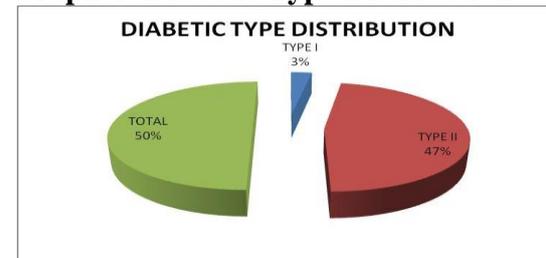


Of the 18 patients included in the study, 15 patients had bilateral disease and only 3 patients had unilateral glaucoma.

**Table 4: Prevalence of Glaucoma in Relation To Types of Diabetes**

TYPE OF DM	NO OF EYES	%
TYPE I	2	5.55
TYPE II	34	94.45
TOTAL	36	100

**Graph 4: Diabetic Type Distribution**

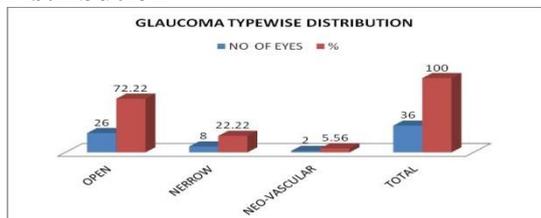


Thus type II DM was found in high prevalence to type I DM in diabetic glaucomatous patients.

**Table 5: Prevalence of Different Types of Glaucoma in Diabetic Glaucomatous Patients**

Type Of Glaucoma	No Of Eyes	%
Open	26	72.22
Nerrow	8	22.22
Neo-Vascular	2	5.56
Total	36	100

**Graph 5: Glaucoma Type Wise Distribution**

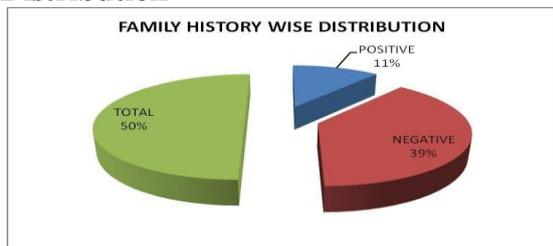


The highest number of patients 72.22% were found to have open angle on Gonioscopy and approximately 5.56 % patients had neo-vascular glaucoma.

**Table 6: Family History of Glaucoma in Diabetic Glaucomatous Patients**

Family History	No of Eyes	%
Positive	8	22.22
Negative	28	77.77
Total	36	100

**Graph 6: Family History Wise Distribution**

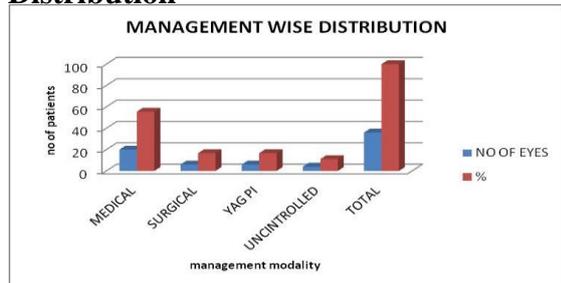


About 22 % of diabetic patients had positive family history of glaucoma in their first degree relative.

**Table 7: Different Types of Management Modality in Different Types of Glaucoma**

Type Of Management	No Of Eyes	%
Medical	20	55.55
Surgical	6	16.66
Yag Pi	6	16.66
Uncintrolled	4	11.11
Total	36	100

**Graph 7: Management Wise Distribution**

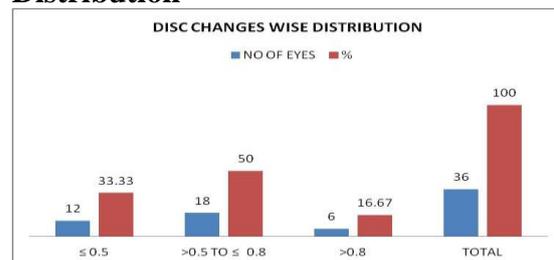


In our study approximately 55.55 % patients were managed medically, 16.66 % patients with YAG PI and 16.66 % patients were managed surgically while remaining 11.11 % of patients had failed to respond to medical and surgical therapy.

**Table 8: Severity of Glaucoma Depending On Disc Changes**

DISC CHANGES	NO OF EYES	%
≤ 0.5	12	33.33
>0.5 TO ≤ 0.8	18	50
>0.8	6	16.67
TOTAL	36	100

**Graph 8: Disc Changes Wise Distribution**

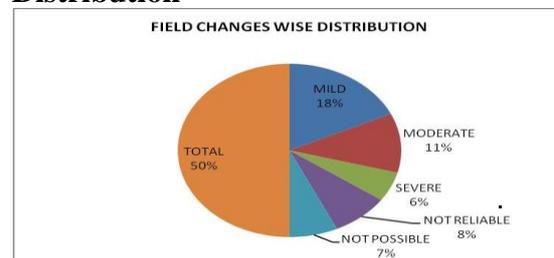


Highest (50 %) of the patients had the cup to disc ratio between 0.5 to 0.8 while 33.33 % of the patients had the mild type of the disc changes and 16.67 % of the patient had the sever disc changes with cup to disc ratio more than 0.8 to glaucomatous optic atrophy.

**Table 9: Severity of Glaucoma Depending on the Field Changes**

Field Changes	No of Eyes	%
Mild	13	36.11
Moderate	8	22.22
Severe	4	11.11
Not Reliable	6	16.66
Not Possible	5	13.88
Total	36	100

**Graph 9: Field Changes Wise Distribution**



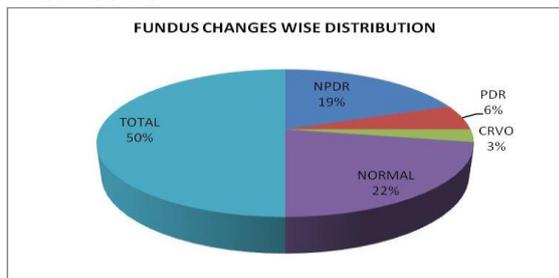
Highest (36.11 %) of the patients had mild changes in their field examination while 22.22 % of the patients had moderate changes in their field and approximately 11.11 % of the patients had severe changes in their field. The field was not reliable in about 16.66 % of the patients and it was not possible in

13.88 % of the patients due to very low vision out of which 11.11 % of the patients had severe glaucomatous disc changes responsible for their low vision.

**Table 10: Prevalence of Diabetic Retinopathy In Glaucomatous Diabetic Patients**

Fundus Changes	No of Eyes	%
Npdr	14	38.88
Pdr	4	11.11
Crvo	2	5.55
Normal	16	44.44
Total	36	100

**Graph 10: Fundus Changes Wise Distribution**



Diabetic retinopathy was present in about 50 % of the patients out of which, non-proliferative changes were found in 38 % patients and proliferative changes in 11 % patients. About 6 % of the patients had the fundus changes of CRVO.

**Table 11: Relation between Severity of Glaucoma and Duration of Diabetes**

Duration of Diabetes	No of Blind Eyes Due To Diabetes	%
≤5 Year	3	30
6-15 Year	5	50
≥ 15 Year	2	20
Total	10	100

**Graph 11: Glaucoma and Duration of Diabetes**

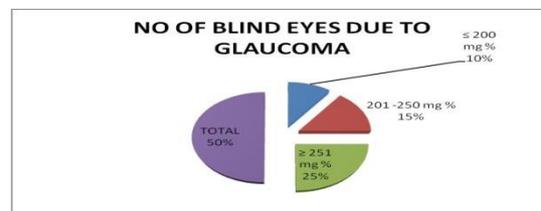


Highest (50 %) of patients developed glaucomatous optic atrophy within 5 to 15 years while lowest (20 %) of the patients developed after 15 years indicating that duration of diabetes has no effects upon severity of glaucoma.

**Table 12: Relation between Random Blood Sug.Ar Level and Severity of Glaucoma**

R.B.S	No Of Blind Eyes Due To Glaucoma	%
≤ 200 Mg %	2	20
201 -250 Mg %	3	30
≥ 251 Mg %	5	50
Total	10	100

**Graph 12: No of Blind Eyes Due to Glaucoma**



Highest (50 %) of patients with glaucomatous optic atrophy had their RBS level more than 251 mg % while lowest (20 %) of patients had their RBS level less than 200mg %, indicating that uncontrolled diabetes with high RBS value increases severity of glaucoma in diabetics.

**CONCLUSION**

The following conclusions are drawn from our studies:

- Elderly diabetics are more susceptible to develop glaucoma especially in 6th to 7th decades.
- Males are more prone to develop glaucoma with diabetes.
- Diabetics with glaucoma usually have the bilateral manifestation.
- Type II diabetes is more commonly associated with glaucoma.
- Primary open angle glaucoma is more common with diabetics.
- Diabetes does not increase the risk of developing glaucoma in patients with positive family history of glaucoma.
- In neovascular glaucoma, most common cause is CRVO followed by diabetic retinopathy.
- In diabetic patients disc changes and field changes correlate as they progress from mild to severe variety.
- Chances of development of diabetic retinopathy in glaucomatous patients are same as in the non-glaucomatous patients.

- Neovascular glaucoma remains refractory to conventional hypotensive therapy.
- Duration of diabetes does not have any effect on causation of glaucoma, however high random blood sugar level increases the severity of glaucoma in diabetic patients. Thus severity of glaucoma can be controlled by proper management and control of diabetes.

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