

**Original Research Article****Status of Oxidative stress in the Patient of primary open angle glaucoma with type-2 Diabetes mellitus**

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Abstract

Introduction: Primary open-angle glaucoma (POAG) is a chronic and age-related disease that is the leading cause of irreversible visual disability. Primary open-angle glaucoma is known to be associated with diabetes mellitus (DM) type 2 and hypertension. Glaucoma is a progressive optic neuropathy and is the leading cause of blindness in the developing and industrialized countries.

Aim and Objective: Assessment of antioxidant enzyme in Type-2 Diabetes mellitus primary open angle glaucoma patients, diabetes without Primary open-angle glaucoma as compared to normal controls.

Material and Methods: A total of 100 patients, 100 - Type-2 Diabetes mellitus Primary open-angle glaucoma patients from the last one year and 100 normal healthy individuals were chosen as a control group.

Results: The mean values of FBS, were significantly increased ($P < 0.001$) in type -2 Diabetes mellitus Primary open-angle glaucoma, diabetes without Primary open-angle glaucoma cases as compared to normal healthy individuals. significantly decreased levels of antioxidant enzyme activity (SOD, CAT, GPx) levels in Type-2 DM with Primary open angle glaucoma, Diabetes without (POAG) as compared to the controls groups ($p < 0.001$).

Keywords: Primary open-angle glaucoma, FBS and antioxidant enzymes (SOD, CAT, GPx) Type – 2 diabetes mellitus.

Introduction

Glaucoma, characterized by progressive “glaucomatous” optic neuropathy and corresponding visual field loss, is a leading cause

of irreversible blindness worldwide^[1]. Primary open-angle glaucoma (POAG) is a chronic and age-related disease that is the leading cause of irreversible visual disability.²

Oxidative stress appears play a role in progressive neuronal death that is characteristic of glaucomatous optic nerve damage^[3,4]. Oxidative stress generally is induced through formation of multiple reactive oxygen species including hydrogen peroxide and superoxide that can initiate and propagate free radicals⁵.

Antioxidant enzymes (superoxide dismutase, catalase, and glutathione peroxidase) and non-enzymatic antioxidants (vitamins C and E) in aqueous humor of primary open angle glaucoma. Amita Goyal⁶, performed a case-control study which reported a significant increase in superoxide dismutase (SOD) and glutathione peroxidase (GPx) activities, which were found in the aqueous humor of PACG patients compared to cataract patients.

Materials and Methods

The present study was carried out in the Department of Biochemistry and Clinical Central Laboratory in collaboration with the Department of Ophthalmology at index medical college hospital & Research Centre, Indore, Madhya Pradesh. The study was approved by the Institutional Ethical and Research Committee to use human subjects in the research study. Informed consent was taken from patient and control subjects. 100 type 2 diabetic Primary open-angle glaucoma patients, 100 diabetic without Primary open-angle glaucoma of both genders attending the Ophthalmology ward of the Hospital for the last one year have been included in this study as compared to 100 healthy control groups. **Inclusion Criteria-** Normal subject has normal fasting blood glucose level with no history of diabetes. Diagnose Diabetes person having POAG without any other diseases. **In Exclusion Criteria-** Patient with ocular surgery, Patients having Pancreatitis, Infection of inflammation of eye, evidence of renal or hepatic diseases, Autoimmune disorder and carcinomas were excluded from the study

Patients on Type 1 DM, Patients having Pancreatitis. The exception criteria included

Patients with cataract, ocular infection, Taking medication as steroid and had systemic diseases such as diabetes mellitus and hypertension, having the habit of alcohol, congenital glaucoma, and evidence of renal or hepatic diseases were excluded from this study.

Collection of Blood Sample

About 3-5 ml of venous blood was collected in vacutainer using a sterile needle, from the antecubital vein. It was allowed to clot for a few minutes and was subjected to centrifugation for 10 minutes at 3000 rpm to separate the serum and kept at -20°C until analysis was carried out. By this sample estimation of serum fasting blood glucose, and antioxidant enzyme (SOD, CAT, and GPx) were done by the following methods.

Group I- 100 type-2 diabetic patients of both genders with Primary open-angle glaucoma.

Group II- 100 type-2 diabetic without Primary open-angle glaucoma have been evaluated.

Group III- 100 healthy volunteer.

Estimation of Serum Fasting blood glucose & Oxidative Marker was measured by

Method: Glucose Oxidase and Peroxidase (GOD – POD) Method⁷.

Superoxide Dismutase (SOD) Activity:

Method: The SOD Activity in RBC lysate was estimated by method of McCord and Fridovich, 1969⁸.

Glutathione Peroxidase (GPx) Activity:

Method: GPx activity in RBC lysate was measured by method of Pagila and Valentine (1967)⁹.

Principle: During conversion of hydroperoxide radical into non reactive hydroperoxides, Glutathione Peroxidase utilize reduced Glutathione as a cofactor. In this pathway the amount of GSH utilized is a measure of enzyme activity, GSH is converted in oxidized glutathione (GSSG).

Statistical Analysis: Data were compiled and analyzed using by t-tests (student t-test) software package. It was expressed as mean \pm S.D. (standard deviation).

Results

Table No 1:- Showing means age of Cases, Diabetes without (POAG) and Controls

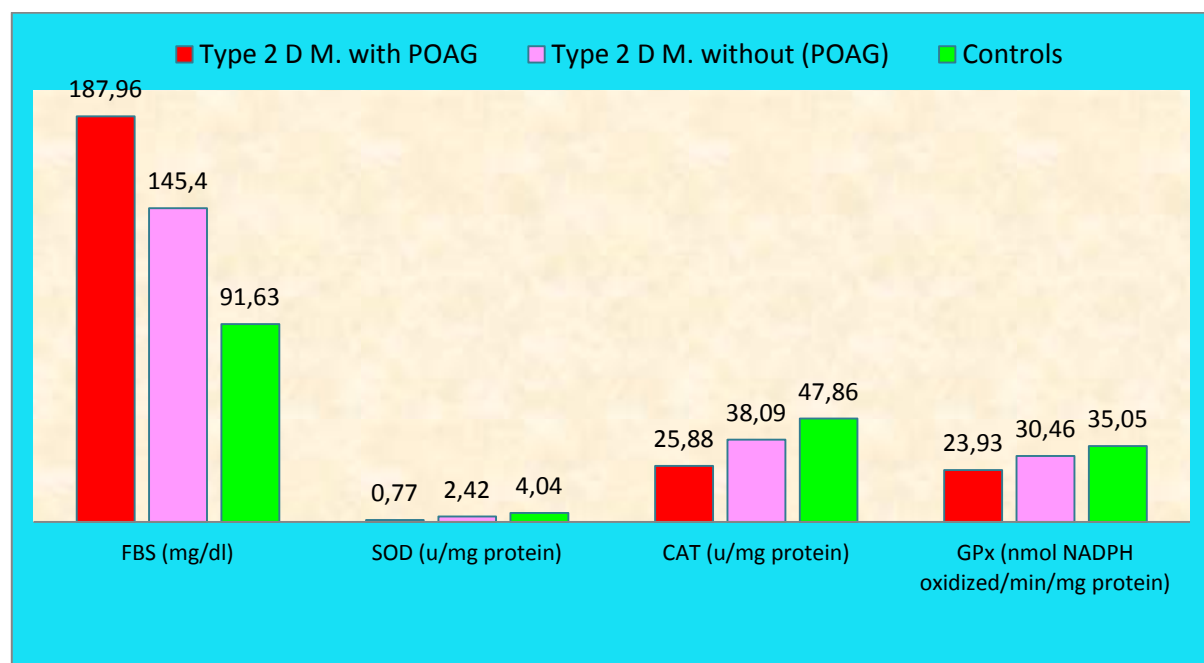
Group	Number of subjects studied	Age (Years) (Mean±SD)	p-value
Controls	n=100	47.61±6.05	P<0.001
Case (POAG)	n=100	59.73 ± 6.56	
Diabetes Without (POAG)	n=100	55.87±8.53	

Table No: 2: Sex-wise distribution of patients T2 DM with POAG, Diabetes without (POAG) and controls

Sex	Diabetes Without (POAG)		Case (POAG)		Controls	
	NO.	%	NO.	%	NO.	%
Male	58	58%	60	60%	68	68%
Female	42	42%	40	40%	32	32%
Total	100	100%	100	100%	100	100%

Table No: 3: Comparison of mean blood glucose Type 2 Diabetes Mellitus with POAG, Type 2 D M. without (POAG) and Controls POAG.

Parameters	Type 2 D M. with POAG	Type 2 D M. without (POAG)	Controls	P value
FBS (mg/dl)	187.96 ±44.92	145.40 ± 24.36	91.63 ± 8.07	P<0.001
SOD (u/mg protein)	0.77±0.13	2.42±0.31	4.04±0.50	P<0.001
CAT (u/mg protein)	25.88±2.72	38.09±6.06	47.86±6.31	P<0.001
GPx(nmol NADPH oxidized/min/mg protein)	23.93±2.46	30.46 ± 3.02	35.05±2.94	P<0.001



P<0.01 Statistical Significant, P<0.001 Highly statistically significant, P<0.0001 extremely statistically significant

Discussion

Primary open angle glaucoma is a major cause of blindness. It has been suggested that metabolic diseases may play a role in the evolution of the disease. Fasting blood glucose levels were significantly high in POAG patients than control

group¹⁰. Metabolic abnormalities in patients with POAG have been the focus of various studies¹¹. Glaucoma, being a non systemic disease, is the most frequent etiology of irreversible blindness worldwide is an ocular pathology. Studies related

to its effects on serum oxidative stress markers are quite limited in the existing literature¹².

Our study reported that Age group mean value of Type – 2 DM. Primary open angle glaucoma, Type – 2 DM without (POAG), 59.73 ± 6.56 , 55.87 ± 8.53 and control 47.61 ± 6.05 statistically significant ($p < 0.001$). Our result correlated well with finding showed by NR. Hazari et al¹⁰, Channabasappa S. et al¹³, Desai A¹⁴.

I have observed that significantly increased levels of Fasting blood glucose levels Type 2 Diabetics with POAG, Diabetes without (POAG), as compared to controls groups ($p < 0.001$). Our study correlated with NR. Hazari et al¹⁰, Channabasappa S. et al¹³, Desai A¹⁴.

Primary open-angle glaucoma (POAG) is the leading cause of blindness in the industrial countries. It is reported that oxidative stress might be an important risk factor in the pathogenesis of POAG¹⁴.

In our study observed that significantly decreased levels of antioxidant enzyme activity (SOD, CAT, GPx) levels in Type-2 DM with Primary open angle glaucoma, Diabetes without (POAG) as compared to the controls groups ($p < 0.001$). Our study correlated with Atti et al., (2012)¹², Li S., (2020)¹⁶.

Another study correlated with significant decrease of antioxidant enzymes: CAT ($P < 0.001$), SOD ($P < 0.05$), and GPX ($P < 0.001$) in glaucoma patients as compared to controls groups. (Majsterek, 2011)¹⁵.

Conclusion

Our study there is a disturbed FBS, and PP levels in Type-2 DM with Primary open angle glaucoma, Type – 2 DM without (POAG), increased as compared to controls. Superoxide Dismutase, Glutathione Peroxidase and catalase levels in Type-2 DM with Primary open angle glaucoma, Type – 2 DM without (POAG), decrease as compared normal healthy person control.

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Abbreviations

T-2 D.M.:- Type-2 Diabetes Mellitus

BSL (F): - Blood Sugar Level (fasting)

BSL (PP): - Blood Sugar Level (Post Prandial)

SOD - Superoxide Dismutase

GPx- Glutathione Peroxidase

CAT – Catalase