

Research Article

Correlation Between Primary Open Angle Glaucoma and Serum Lipids

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Abstract

Background: Glaucoma is one of the leading causes of blindness worldwide, with Intraocular Pressure (IOP) being the primary risk factor. However, some cases of glaucoma progress even with controlled IOP. This indicates that other risk factors also contribute to its pathogenesis. Our study aims to determine the correlation between Primary Open-Angle Glaucoma (POAG) and serum lipid levels.

Material and Methods: This study was conducted in the Department of Ophthalmology at Government Medical College, Srinagar, including 50 subjects with POAG and 50 control subjects without glaucoma. All participants underwent a comprehensive ophthalmic examination. Fasting lipid profiles, including total cholesterol, Low-Density Lipoprotein (LDL), High-Density Lipoprotein (HDL) and triglycerides, were measured and compared between the two groups.

Results: Significant differences were observed in the lipid profiles between the POAG and control groups. We found a P value of < 0.001 which indicates statistical significance. While HDL levels were higher in the control group, this difference was not statistically significant.

Conclusion: Altered lipid profile parameters are independently associated with POAG. High levels of serum cholesterol, triglycerides and LDL significantly correlate with POAG.

Keywords: Dyslipidemia; Primary Open Angle Glaucoma; Correlation; Intraocular Pressure

Introduction

Primary Open-Angle Glaucoma (POAG) is a chronic and progressive eye disease that stands as the second leading cause of blindness in India. Approximately 112 million individuals aged 40 years and older in India have glaucoma, with an estimated 6.48 million affected by POAG [1].

Most patients remain asymptomatic until the later stages of the disease, highlighting the importance of identifying its risk factors. Raised Intraocular Pressure (IOP) is the primary risk factor for POAG, leading to optic nerve damage either through direct mechanical damage to the retinal nerve fiber layer or ischemic damage due to compression of the blood vessels supplying it [2]. However, other risk factors are also believed to contribute to the disease's causation and progression by modulating IOP or through different mechanisms.

Diabetes Mellitus (DM) Type II and hypertension are known to be associated with POAG and both conditions are linked to high lipid levels. Dyslipidemia and insulin resistance are interrelated, with high lipid levels causing atherosclerotic changes that lead to hypertension. Therefore, there is a possibility that glaucoma is inherently related to serum lipid levels. A study by Lin and colleagues demonstrated that dyslipidemia increases the odds of developing POAG [3]. The aim of this study is to determine the correlation between serum lipid levels and POAG.

Material and Methods

This case-control study was conducted in the Department of Ophthalmology at Government Medical College, Srinagar, from January 2023 to June 2023. The study included fifty patients with Primary Open-Angle Glaucoma (POAG) and fifty healthy volunteers as controls. Written informed consent was obtained from all participants, who were aged 20 years or older.

For the cases, the inclusion criteria consisted of patients who had never been treated for Intraocular Pressure (IOP), those with open anterior chamber angles on gonioscopy, optic disc changes suggestive of glaucoma and visual field defects characteristic of glaucoma. The exclusion criteria for the cases included any history of ocular trauma or surgery, secondary glaucoma and the use of statins.

The controls were selected based on having an IOP of less than 21 mmHg, a normal optic disc, visual field loss uncharacteristic of glaucoma and no presence of pseudoexfoliation material. The exclusion criteria for the controls included myopia and any history of ocular surgery or trauma.

Demographic parameters were recorded for all participants, followed by a comprehensive ophthalmic examination. This examination included visual acuity assessment using Snellen's chart, anterior segment examination, slit lamp examination and assessment of pupillary reactions. Additionally, Van-Herick's grading was used and IOP was measured with a Goldmann applanation tonometer. Gonioscopic examination was conducted to evaluate the angle structures and both fundus examination and visual field defect assessments were performed.

POAG was diagnosed based on raised IOP, optic nerve head changes detected by direct ophthalmoscopy and visual field defects. Blood samples for serum lipid assessment were collected after 12 hours of fasting.

The collected data were entered into Microsoft Excel 2010 and analyzed using SPSS version 23. Categorical variables were summarized as frequencies and percentages, while continuous variables were summarized as means and standard deviations. Logistic regression was employed to calculate the odds ratio, with a P-value of < 0.05 considered statistically significant.

Results

Two hundred subjects, with an equal number in both groups, were included in our study. Table 1 presents the demographic parameters.

Parameter	Cases (n = 50)	Controls (n = 50)
Mean age (years)	56.71±3.4 2	54.36±6.23
Gender (Male: Female)	7:03	6:04
Obesity (BMI* ≥ 25)	10/50 (20%)	4/50 (8%)
Locality	36/50 urban (72%)	32/40 urban (64%)
* BMI- Body Mass Index		

Table 1: Demographic parameters of study population.

The ages of the patients ranged from 40 to 70 years, with a mean age of 56.71±3.4 years for the cases and 54.36±6.23 years for the controls. The majority of both cases and controls were between the ages of 50 and 60 years. The male-to-female ratio was 7:3 in the case group and 6:4 in the control group. Among the cases, 36 out of 50 (72%) were from an urban background, while 32 out of 50 (64%) controls were also from urban areas.

High cholesterol levels (>200 mg/dl) were observed in 28 cases, compared to 8 individuals in the control group. High triglycerides levels (>150 mg/dl) were seen in 24 cases, whereas 6 controls had high triglycerides. Elevated LDL levels (>130 mg/dl) were found in 34 cases and 9 controls. Low HDL levels (<40 mg/dl) were present in 35 cases and 28 controls (Table 2).

Lipid Parameters	Cases (n = 50)	Controls (n = 50)	p- value
High cholesterol (> 200 mg/dl)	28/50 (56%)	8/50 (16%)	< .0001
High triglyceride (> 150 mg/dl)	24/0 (48%)	6/50 (12%)	< .0001
High LDL (> 130 mg/dl)	34/50 (68%)	9/50 (18%)	< .0001
Low HDL (< 40 mg/dl)	35/50 (70%)	28/50(56%)	0.1624

Table 2: Dyslipidemia in cases and controls.

The mean cholesterol level in cases was 219.15 ± 6.79 mg/dl and the mean triglycerides level was 159.15 ± 6.01 mg/dl. The mean LDL level in cases was 147.32 ± 3.14 mg/dl and the mean HDL level was 35.18 ± 6.43 mg/dl. In the control group, the mean total cholesterol level was 176.35 ± 4.13 mg/dl, the mean triglycerides level was 115.10 ± 6.67 mg/dl, the mean LDL level was 111.23 ± 4.43 mg/dl and the mean HDL level was 37.46 ± 4.38 mg/dl (Table 3).

Mean cholesterol, triglycerides and LDL levels were significantly higher in the cases compared to the controls, with a p-value of <0.0001 at a 95% confidence interval. Although the HDL level was lower in the cases than in the controls, this difference was not statistically significant ($p = 0.0631$).

Serum Lipid Parameters	Cases (n = 50)	Controls (n = 50)	p- value
Mean Cholesterol (mg/dl)	219.15 ± 6.79	176.35 ± 4.13	< .0001
Mean Triglycerides (mg/dl)	159.15 ± 6.01	115.10 ± 6.67	< .0001
Mean LDL (mg/dl)	147.32 ± 3.14	111.23 ± 4.43	< .0001
Mean HDL (mg/dl)	35.18 ± 6.43	37.46 ± 4.38	0.0631

Table 3: Serum Lipid Values in Cases and Controls±.

Discussion

Numerous studies have documented various risk factors for the development of Primary Open-Angle Glaucoma (POAG), with a notable association between dyslipidemia and POAG. Oxidative stress, through the peroxidation of lipids, leads to damage to the trabecular meshwork and the endothelial cells of blood vessels that supply the optic nerve head. Additionally, atherosclerotic changes resulting from high cholesterol levels may affect ocular perfusion [4]. Egorow, et al., found that patients with glaucoma exhibited atherogenic hyperlipidemia with lower antioxidative activity [5]. Longer usage of statins (more than 23 months) may significantly reduce the risk of glaucoma [6].

Our study results showed a significant relationship between dyslipidemia and POAG. Kovačević, et al., concluded that patients with higher values of total cholesterol, particularly the atherogenic LDL fraction, may have an increased influence on glaucoma development [4]. In a case-control study conducted by Davari, et al., a positive association was found between POAG and dyslipidemia, with an Odds Ratio (OR) of 7.14 (95% CI: 2.3-22.2) for hypercholesterolemia and an OR of 16.9 (95% CI: 2.1-14.8) for hypertriglyceridemia [7].

A study conducted in 2009 by Pavljasević and Asćerić in Bosnia and Herzegovina tested 50 patients with open-angle glaucoma and 50 healthy individuals concerning their serum lipids [8]. The results of their study were comparable to our findings. Similarly, the Beijing Eye Study, which included about 3,251 individuals over the age of 45, performed complete ophthalmic examinations and measured blood serum lipids [9]. After adjusting for various factors such as age, sex, residence, income level, BMI, cigarette smoking, diastolic blood pressure and blood sugar, the study found that the effect of dyslipidemia on the incidence of ophthalmic diseases was comparable to our results.

Conclusion

In conclusion, our study demonstrates that a deranged lipid profile plays a crucial role in the development of Primary Open-Angle Glaucoma (POAG), even after accounting for confounding factors, thus indicating its independent role in causation. Elevated serum cholesterol, triglycerides and LDL levels significantly correlate with POAG. Therefore, the treatment of dyslipidemia could potentially serve as a preventive strategy for POAG.

Conflicts of Interest

The authors declare no conflict of interest.

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