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Risk factors of Primary Open Angle Glaucoma: A Case Study

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Abstract:
Aim: *Glaucoma is the leading cause of irreversible blindness in the world, of which primary open angle glaucoma (POAG) is the most common form. POAG is most often detected at late stages when severe irreversible damage has already occurred. Early detection and treatment are important to prevent vision loss from glaucoma. My study aimed at finding the association between POAG and various risk factors thought to be associated with POAG.*
Methodology: *Study design was a case control study, using appropriate statistical formula, size of the study population was determined.*
Results: *Majority of cases belonged to 61–70-year age group. There was no significant difference in gender among the cases. Only 37% of cases had elevated intraocular pressure of more than 21 mm Hg before starting treatment. Hypertension and diabetes mellitus had significant positive association with POAG. Myopia and central retinal vein occlusion showed very high odd's ratio, but the percentage of sample population with the risk factor is very low. Other factors did not have significant association with POAG. Central corneal thickness was lower than 520µ in 72% of cases and 68.5% of controls*
Conclusion: *Study results showed that glaucoma screening by intraocular pressure measurement alone will miss more than half of the cases. Central corneal thickness was more than the expected value in about ¾ of cases and controls, which may indicate that the mean value might be lower than expected in this population. Systemic hypertension and diabetes mellitus were the risk factors with significant association. Proper risk factor assessment will require a prospective study with a larger sample size that is representative of general population.*
Key words: *Glaucoma, Hypertension, Diabetes mellitus, Central corneal thickness, Myopia, CVA, CRAO*

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I. Introduction

Glaucoma is a chronic progressive neurodegenerative disease of optic nerve. POAG is the most common form of glaucoma and is the leading cause of irreversible blindness. This disease is typically asymptomatic until advanced field loss occurs. Some of the risk factors are elevated intraocular pressure, advancing age, family history, myopia, and presence of systemic diseases such as diabetes and hypertension. The precise mechanism of increased resistance to aqueous outflow remains unclear. Initial treatment is usually started with topical or oral medications. However, with progressive damage, laser trabeculoplasty may be considered as an adjunctive therapy.

II. Materials and Methods

This is a prospective study carried out on patients with Open angle Glaucoma, who attended Ophthalmology OPD, at Government General Hospital, Guntur from March 2020 to March 2021. A total of 100 cases and 200 controls were selected for this study.

Aim: To determine the risk factors for Primary open angle Glaucoma

Study design: Prospective study

Study location: This was a tertiary care teaching hospital-based study done in Department of Ophthalmology, at Government General Hospital, Guntur, Andhra Pradesh.

Study duration: March 2020 to March 2021.

Methods: Patients were examined in detailed with Snellen's visual acuity chart for best corrected visual acuity, automated refractometry, slit lamp examination for assessment of anterior chamber depth by Van Herick's grading, non-contact tonometry and in patients with raised intraocular pressure confirmed by Goldmann applanation tonometry, gonioscopy, corneal pachymetry, fundus examination, Visual fields assessment by Humphreys visual field analyser, Blood pressure recording and Random blood sugar test.

Inclusion criteria: Patients in whom diagnosis of Primary Open angle Glaucoma was confirmed by

1. Bilateral open angles by gonioscopy
2. Optic disc changes suggestive of glaucoma by slit lamp bio microscopy using 90D lens
3. Glaucomatous visual field defects corresponding with optic disc changes by automated perimetry using Humphrey's visual field analyser.
4. Secondary causes of glaucoma ruled out

Exclusion criteria:

1. Patients in whom the diagnosis of POAG was suspicious and required further follow-up
2. Patients who had unreliable visual fields
3. Visual field not corresponding to optic disc changes

III. Observations and Statistical analysis

A total of 100 cases and 200 controls were selected. Cases were grouped into 10-year age group intervals and age matched controls were chosen in 1:2 ratio.

Table no 1: Age distribution of cases

Age groups	Frequency	Percentage
41-50	15	15.0
51-60	19	19.0
61-70	43	43.0
71-80	20	20.0
81-90	3	3.0
Total	100	100.0

The number of cases increased from 41–50-year group till 61–70-year group. Maximum number of cases (43%) belongs to 61-70 years. There after the number started decreasing.

Table no 2: Gender distribution

Gender	Frequency	Percentage
Male	53	53.0
Female	47	47.0
Total	100	100.0

A slightly higher percentage of cases (53%) were males.

Table no 3: IOP distribution

IOP	Frequency	Percentage
IOP > 21 mm Hg	37	37.0
IOP ≤ 21 mm Hg	63	63.0
Total	100	100.0

Only 37% of cases had IOP recording more than 21 mm Hg before starting treatment. This shows that screening by IOP measurement alone will not be sufficient for Glaucoma.

Table no 4: Distribution of risk factors among cases and controls

Variable	Cases with risk factor in frequency (percentage)	Cases without risk factor in frequency (percentage)	Controls with risk factor in frequency (percentage)	Controls without risk factor in frequency (percentage)
Family	2 (2%)	98 (98%)	1 (1%)	199 (99.5%)
CCT	72 (72%)	28 (28%)	137 (68.5%)	63 (31.5%)
Myopia	2 (2%)	98 (98%)	0 (0%)	200 (100%)
Diabetes	19 (19%)	81 (81%)	25 (12.5%)	175 (87.5%)
Hypertension	16 (16%)	84 (84%)	20 (10%)	180 (90%)
IHD	7 (7%)	93 (93%)	13 (6.5%)	187 (93.5%)
CVA	1 (1%)	99 (99%)	2 (1%)	198 (99%)
CRVO	1 (1%)	99 (99%)	0 (0%)	100 (100%)
Migraine	2 (2%)	98 (98%)	0 (0%)	100 (100%)
Steroids, NDD	0 (0%)	100 (100%)	0 (0%)	100 (100%)

Table no 5: Chi-square test and Odd's ratio for risk factors with their level of significance

Risk factor (Variable)	Chi-square	Odd's	Significance
Family	3.146	6.866	.076
CCT	0.773	1.166	.379
Myopia	3.030	4.304	.082
Diabetes	4.123	1.279	.042
Hyper tension	5.753	1.755	.016
IHD	0.123	0.848	.725
CVA	0.126	0.662	.723
CRVO	4.013	High	.045
Migraine	8.054	High	.005

Odd's ratio was calculated for the rest of the risk factors and the level of significance was taken as 0.05.

IV. Results

From the study positive association between risk factor and POAG was obtained for the following risk factors:
Family history – Odd's ratio of 6.86 showed a positive association, but the level of significance was not attained.
CCT – There was a weak positive association with Odd's ratio of 1.166, but this association was not statistically significant.
Myopia – Myopia also had a positive association with POAG with an Odd's ratio of 4.304, but it was not statistically significant.
Diabetes mellitus – Odd's ratio of 1.279 showed that there was a positive association with the Diabetes mellitus and POAG. Chi-square test and p value indicated that this association is statistically significant.
Systemic hypertension – Hyper tension also had a statistically significant positive association with POAG with Odd's ratio of 1.755.
IHD and CVA – Both had a negative association with POAG, but this was not statistically significant.
CRVO and Migraine – Both had very high Odd's ratio values which were statistically significant.

V. Discussion

Age
Percentage of cases increased from 40 year to 70-year group. After this, it started decreasing. This could be due to lower life expectancy or because the study population was selected from the hospital population. Prevalence of POAG can be calculated only in the steady population is a representative of general population.
Gender
A slightly higher percentage of cases (53%) were males. There was no significant difference in the gender distribution of cases.
Family history
Even though there was a positive association between POAG and Family history with an Odd's ratio of 6.8, the association was not statistically significant.
Intraocular pressure
Only 37% of cases had IOP recording more than 21 mm Hg before starting treatment. This shows that the screening for POAG by IOP alone will miss more than half of the cases.

Central corneal thickness

There was no statistically significant association between CCT and POAG.

Other risk factors

Among the other risk factors, Diabetes mellitus and Systemic hyper tension had statistically significant, weak positive association with POAG. IHD and CVA had no significant association with POAG. Even though CRVO and Migraine had very high Odd's ratio, it cannot be taken into account due to the very low number of sample population who had the risk factor. A much larger study population will be required for the assessment of these factors. The risk of Systemic corticosteroids and Neurodegenerative disease could not be assessed as none of the cases or controls were positive for these factors.

Limitation of the study

The sample population was taken from hospital population, which may not be representative of general population. Larger sample size will be required for better precision. As it is a case control study the temporal association with the disease and the risk factor cannot be established. Whether the risk factor had preceded the onset of disease cannot be known. It requires a longitudinal study to assess the causal relationship.

VI. Conclusion

The study showed a weak, but significant positive association for Diabetes mellitus and Systemic hyper tension with POAG. The study results also suggested that Glaucoma screening by IOP recording alone will miss more than half of the cases. It also suggested that mean CCT of the population studied could be less than 520µ. A long-term study with a larger sample size that represents the general population will be requires for more precise results.

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