Original Article

Prevalence and Predictors of Advanced Glaucoma at Presentation

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Abstract

Introduction: Despite advances in newer technologies and methods to diagnose and monitor patients of glaucoma, a meaningful proportion of patients present in an advanced phase of the disease. Our study aimed to assess the prevalence and evaluate the risk factors associated with advanced glaucoma in a hospital-based population.

Materials and Methods: In this case–control and observational study, randomly selected 760 eyes of 394 glaucoma patients were assessed. Patients having advanced glaucoma were grouped as cases and those having mild-to-moderate glaucoma as controls. Risk factors in each case were identified, tabulated, and statistically analyzed.

Results: Out of 760, advanced glaucoma was observed in 261 (34.3%) eyes. Multivariable logistic regression analysis revealed male gender, rural residency, unskilled occupation, diabetes mellitus or hypertension, no eye examination in the past 2 years, negative family history for glaucoma, and illiteracy as independent risk factors for advanced glaucoma at presentation.

Conclusion: High prevalence (34.3%) of advanced stage glaucoma at presentation in our study warrants the necessity to escalate consciousness among public on outcome of silently blinding disease, glaucoma especially in subjects who have identifiable risk factors. Public awareness would substantially halt their further visual deprivation and reduce the socioeconomic burden of the disease on the society.

Key words: Advanced stage, Glaucoma, Public awareness, Risk factors, Socioeconomic burden

INTRODUCTION

Glaucoma is the leading cause of irreversible blindness worldwide.[1] Unfortunately, the visual field loss in glaucoma is gradual, painless, and affects the peripheral field before encroaching on the central field of vision due to which a significant proportion of patients present when the disease has already progressed to advanced stage and are at imminent danger of lifetime blindness. Gessesse and Damji observed 38% of newly diagnosed glaucoma patients in advanced stage.[2] Gogate *et al.* also concluded that lack of education and awareness about glaucoma was major risk factors for late presentation.[3]

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MATERIALS AND METHODS

After taking permission from the Ethical Review Committee, the present study was conducted on 760 eyes of 394 consecutive patients of glaucoma visiting outpatient department on alternate days of Regional Institute of Ophthalmology in North India between January 2017 and December 2019. Eyes with absolute field loss within 5 degree of fixation, mean deviation >-12dB on visual field examination by Humphery field analyser and vertical cup disc ratio ≥ 0.8 on fundus examination were identified as having advanced glaucoma and grouped as cases. Eyes with VCDR$>/=0.5$ or difference of vertical cup disc ratio >0.2 between two eyes with typical glaucomatous field defects (mild-moderate glaucoma) were grouped as controls. Written informed consent was obtained from each patient before enrolment in accordance with declaration of Helsinki.

Detailed examination of all the patients including Snellen visual acuity, applanation tonometry, slit lamp

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Table 1: Risk factors for advanced glaucoma among glaucoma patients

Study Factor	Cases *n*=261 (%)	Controls *n*=499 (%)	*P*-value	Statistical Significance
Mean Age	68.27±8.135 years	60.25±10.534 years	<0.01	Highly Significant
Mean Intra Ocular Pressure	32.86±3.410mmHg	21.68±6.935 mmHg	<0.01	Highly significant
Mean Central Corneal Thickness	512.83±19.605 microns	518.47±17.636 microns	>0.05	Non-significant
Gender				
Males	207 (80.1)	281 (57.6)	<0.01	Highly Significant
Females	54 (19.9)	218 (42.4)		
Residency				
Rural	197 (75.5)	315 (63.1)	<0.05	Significant
Urban	64 (24.5)	184 (36.9)		
Education Level				
Illiterate	218 (83.5)	258 (51.7)	<0.01	Highly significant
Literate	43 (16.5)	241 (48.3)		
Occupation				
Skilled	64 (24.5)	228 (45.7)	<0.01	Highly Significant
Unskilled	197 (75.5)	271 (54.3)		
Family History of Glaucoma				
Negative	205 (78.5)	261 (52.3)	<0.01	Highly significant
Positive	56 (21.5)	238 (47.7)		
History of Systemic Disease				
Negative	65 (28.7)	331 (66.3)	<0.01	Highly Significant
Positive	186 (71.3)	168 (33.7)		
Eye examination in the past 2 years				
No	238 (91.2)	304 (60.9)	<0.01	Highly significant
Yes	23 (8.8)	195 (39.1)		
Economic dependence				
Economically independent	105 (40.2)	191 (38.3)	>0.05	Non significant
Economically dependent	156 (59.8)	308 (61.7)		

Table 2: Multivariate analysis of risk factors

Risk factor	Multivariate analysis	
	P-value	OR (95% CI)
Gender	0.000	0.226 (0.134–0.382)
Residency	0.000	0.414 (0.254–0.676)
Education	0.000	0.406 (0.248–0.663)
Negative Family history	0.000	0.364 (0.226–0.586)
Occupation	0.032	0.602 (0.378–0.957)
History of either diabetes mellitus or hypertension	0.000	4.350 (2.705–6.995)
Eye examination in the past 2 years	0.000	0.110 (0.059–0.207)

Statistic Analysis

Descriptive measures were expressed as percentages and/or means with standard deviations. Correlations were evaluated using univariate and multivariate tests. The statistical analysis was done using IBM SPSS for Windows, Version 19.0; Inc., Chicago, Illinios, USA. For univariate analysis, Pearson Chi-square and student *t*-test were used according to the nature of variables. For multivariate analysis, multivariate logistic regression analysis was used to adjust confounders. The level of statistical significance was set at $P < 0.05$. All variables with $P \leq 0.05$ in univariate logistic regression were considered candidates for multivariate logistic regression models. Odds ratios and 95% confidence intervals were calculated for the same.

RESULTS

Out of 394 patients recruited in the study, 249 (63%) were males and 145 (37%) were females. Two hundred and seventy-four (69.5%) patients were diagnosed as primary open angle glaucoma and 120 (30.5%) as primary angle closure glaucoma. Seven hundred and sixty eyes of 394 glaucoma patients were included in the study. Twenty-eight eyes were excluded due to either history of ocular trauma or surgery or due to hazy cornea, dense cataract, or some pathology in the posterior segment. On the basis of the given criteria, 261 (34.3%) eyes were diagnosed as

examination, gonioscopy with two mirror Goldman Gonio lens, fundus examination using direct and indirect ophthalmoscope, and visual field examination by Humphery field analyser was done. Patients with corneal opacity, secondary glaucoma, cataract, high myopia, or with history of ocular trauma or surgery were excluded from our study.

Data of all the patients including their age, IOP, central corneal thickness, residency-rural or urban background, education status, family history of glaucoma, skilled or unskilled occupation, history of diabetes mellitus or hypertension, history of ophthalmic examination in the past 2 years, economic dependence were recorded and compiled.

advanced glaucoma and grouped as cases and the remaining 499 (65.7%) of mild-to-moderate glaucoma patients as controls.

Univariate analysis of the risk factors associated with advanced glaucoma revealed that the mean age of cases (68.27 ± 8.135 years) was statistically higher than the mean age of controls (60.25 ± 10.534 years). Significant association was observed between male gender and advanced glaucoma ($P < 0.01$). The difference in mean IOP of cases (32.86 ± 3.416 mmHg) and of controls (21.68 ± 6.935 mmHg) was also statistically significant ($P < 0.001$) whereas CCT in both the groups (512.83 ± 19.605 microns of cases and 518.47 ± 17.636 microns of controls) was comparable ($P > 0.05$). The prevalence of advanced glaucoma was significantly more in patients from rural background ($P < 0.05$), with the lower level of education ($P < 0.001$) in unskilled workers ($P < 0.05$) in patients who had no family history of glaucoma ($P < 0.001$) and in those who gave history of no eye examination in the past 2 years ($P < 0.001$). There was also a significant association between diabetes mellitus and/or hypertension with advanced glaucoma ($P < 0.01$) whereas it was not found to be appreciably correlated with economic dependence of the patient ($P > 0.05$).

Multivariate analysis using multivariate logistic regression model revealed male gender ($P = 0.000$), rural residency ($P = 0.000$), illiteracy ($P = 0.001$), negative family history ($P = 0.000$), unskilled occupation ($P = 0.032$), history of either diabetes mellitus or hypertension ($P = 0.000$), and no eye examination in the past 2 years ($P = 0.000$) as notable risk factors for advanced glaucoma [Tables 1 and 2].

DISCUSSION

A small island of vision in the visual field during advanced stage of glaucoma is the major risk factor for lifetime blindness. It is not only agonizing for the patient but also reflects helplessness of the treating doctor. Asymptomatic nature of the disease, lack of awareness among public, and absence of persuasive screening programs in the developing countries contribute to late presentation of the disease. The present study attempts to identify the prevalence of advanced glaucoma at presentation and to elucidate the risk factors associated with it.

In our study, 261 (34.3%) eyes were detected to be having advanced stage glaucoma at presentation. It was in accordance with observations in the literature.[2]

Abdull *et al*. in 2015, exhibiting the data of patients attending glaucoma clinic, revealed that 52% patients at

presentation were blind in Northern Ghana (2005), 29% in Dar in Tanzania (2005), 41% in Ethiopia (2006), 25% in Benin (Nigeria) (2006), 21% in Nigeria (Kano) (2007), 34% in Yaounde (Cameroon) (2008), and 35% blind in Nigeria.[4] Criteria for blindness were presenting visual acuity <3/60 in better eye. The study emphasized on glaucoma blindness prevention strategies which promote early detection, and counseling of the patients to promote acceptance and adherence to treatment.[4]

The late presentation when the visual field defect progresses to involve central vision becomes a risk factor for glaucoma blindness.[5]

Older age (68.27 ± 8.135 years) was associated with advanced glaucoma at presentation as compared to controls (60.25 ± 10.534 years) in our study ($P < 0.05$). In agreement with our observations, Deva *et al*. found that older age (>63 years) was associated with visual field defects at presentation.[6] AW Francis *et al*. also confirmed that patients older than 65 years of age had significantly higher chances of progressing to advanced stage.[7] The probable exposition could be due to associated comorbidities in old age which impair optic nerve perfusion or to their late presentation in a relatively asymptomatic disease.

Similar to studies in the literature, we observed that men are more likely to present with advanced glaucoma ($P < 0.01$) than women.[4,8-11] The likely explanation is that women avail medical and health services earlier than men.[12]

Although patients with a first degree family history of glaucoma are 10 times more likely to have visual field defects at the time of glaucoma diagnosis but negative family history of glaucoma was found to be strongly associated with advanced glaucoma at presentation in our study ($P < 0.01$).[6] Patients with positive family history of glaucoma are more aware about the disease and attend ophthalmologist regularly whereas when there is no family history, people are less likely to know about the disease or its outcomes and they intend to present late when the disease has already progressed to advanced stage. Similar findings have also been reported in the literature.[4,11,13]

No statistical significance was observed between advanced glaucoma at presentation and central corneal thickness (CCT) in our study ($P > 0.05$). A study in 2012 also concluded that thinner CCT did not have more advanced visual field loss.[14]

Higher IOP (32.86 ± 3.410 mmHg) was significantly associated with advanced glaucoma at presentation in our study. Similar findings were confirmed in the literature.[4,9,11]

No eye examination in the past 2 years, lower education level, unskilled occupation, and history of systemic diseases such as diabetes mellitus and/or hypertension were significantly associated with advanced glaucoma at presentation. It was in accordance with other studies.[2,11-13,15-17]

A recent study on advanced glaucoma also identified asymptomatic high IOP, no family history, socially disadvantaged, and no recent sight testing as significant risk factors for glaucoma at diagnosis.[18]

The main limitation of our study was that it was a hospital-based study and sample size was small. Further prospective population-based studies for assessing these variables are required to evaluate more precisely the magnitude of the cause effect relationship more precisely.

CONCLUSION

Despite best of the treatment, patients with advanced glaucoma are at imminent danger of losing their vision. High prevalence (34.3%) of advanced stage glaucoma at presentation in our study warrants the necessity to escalate consciousness among public on outcome of silently blinding disease, glaucoma especially in subjects who have identifiable risk factors. Public awareness would substantially halt their further visual deprivation and thus reduce the socioeconomic burden of the disease on the society.

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