Original Article

Clinical Profile, Subtypes, and Risk Factors among Glaucoma Patients in a Tertiary Hospital in Central India

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Abstract

Background: Glaucoma is a leading cause of irreversible blindness and prevalence of glaucoma varies from region to region. There are many risk factors associated with glaucoma which encompasses the need for comprehensive evaluation of all glaucoma patients.

Material and Methods: Our study was a prospective, observational, hospital-based study conducted in the Eye Department of R.D. Gardi Medical College, Ujjain, India. 200 Glaucoma patients were enrolled for the study. All the patients underwent a detailed and comprehensive glaucoma workup. The associated risk factors were also noted. The results were recorded and analyzed in detail.

Results: In our study, 200 patients were enrolled. There were 88 (44%) males and 112 (56%) females. 67 (33.5%) patients were found to be suffering from primary open angle glaucoma while 105 (52.5%) patients had primary angle closure glaucoma (PACG). 13 (6.5%) patients were found to be having secondary glaucoma. 218 (54.5%) eyes had visual acuity <6/60. 33 (16.5%) patients were found to be suffering from hypertension while 28 (14%) patients were detected to be diabetic. 16 (8%) patients were myopic while 5 (2.5%) patients had a genetic predisposition for glaucoma. Smoking was also found in 12 (6%) patients to be associated risk factor in glaucoma patients.

Conclusion: Chronic PACG was the most common subtype of glaucoma found in our study. Timely detection and proper management of glaucoma patients is recommended to reduce the burden of glaucoma blindness.

Key words: Blindness, Glaucoma, Primary angle closure glaucoma, Primary open angle glaucoma, Secondary glaucoma

INTRODUCTION

Glaucoma is a leading cause of irreversible blindness and managing glaucoma patients is a real challenge for ophthalmologists worldwide. This is more so in developing countries due to lack of patient awareness, frequent late presentation, and noncompliance with treatment. Glaucoma can be defined as a multifactorial optic neuropathy with a characteristic accelerated degeneration of retinal ganglion cells, presenting with classical optic nerve head features and correlating visual field changes, which may or may not be associated with angle abnormality in the presence or absence of any cause for the disease.[1]

Glaucoma, the second leading cause of world blindness accounts for 15% of global blindness.[2,3] The prevalence and subtypes of glaucomas vary with age, sex, geographical location, and race.[4]

Many studies have shown a higher prevalence of angle closure glaucoma in Asian individuals, as compared to Caucasians or black people, in whom open angle glaucoma is found to be more prevalent.[5,6] Male preponderance has been seen in primary open angle glaucoma (POAG), normal tension glaucoma (NTG) and secondary glaucoma whereas ocular hypertension (OHT), primary angle closure

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glaucoma (PACG) and developmental glaucoma have shown a higher prevalence in the female sex.[7] Diabetes, hypertension, cardiovascular diseases, myopia, and smoking are some risk-factors which have been found to be associated with glaucoma. This study was conducted in our institute, which is a tertiary hospital located in Central India, to study the clinical profile, distribution of subtypes of glaucoma and the associated risk factors among the patients coming to the Eye Outpatient Department.

MATERIALS AND METHODS

Our study is a prospective, observational, hospital-based study conducted in the Department of Ophthalmology, R. D. Gardi Medical College, Ujjain, Madhya Pradesh, India, over a period of 1-year from January 2015 to December 2015. Prior approval was obtained from the institutional Ethics Committee. 200 consecutive patients found to be suffering from glaucoma or with a suspicion of glaucoma were enrolled in the study.

A written informed consent was obtained from each patient. A detailed history was taken, with regard to the chief complaint, any family history of glaucoma, history of prolonged steroid medication as well as a history of any prior ocular trauma or ocular surgery. History of any systemic illness like diabetes mellitus, hypertension was also sought.

Each patient was subjected to a comprehensive ophthalmic examination which included a record of the unaided visual acuity as well as the best corrected visual acuity. Slit-lamp examination which included Von Herick's grading of the peripheral anterior chamber depth was performed. Pseudoexfoliation and rubeosis were looked for. Refraction was also done. Gonioscopy was done using the Goldmann single-mirror gonioprism. Intra-ocular pressure (IOP) was measured using the Goldmann applanation tonometer. An IOP of >21 mm of Hg was considered abnormal. Central corneal thickness was recorded to obtain the corrected value of IOP. This was especially helpful in case of glaucoma suspects, patients of NTG and OHT. Fundus examination with special emphasis on the optic disc was done by direct ophthalmoscopy as well as slit-lamp biomicroscopy using the 90 D lens. Automated visual field analysis was done.

Diurnal variation of IOP was done in patients who had borderline pressures on 2 or more separate occasions and/or disc changes suggestive of glaucoma, with open angles. A difference of >8 mm of Hg between maximum and minimum values or a rise in IOP to >30 mm Hg was considered to be significant.

Anterior chamber was classified according to Shaeffer's grading.[8] Grades 3 and 4 angles were considered open, while angles of Grade 2 and less were considered occludable. Disc changes suggestive of glaucoma included asymmetrical cupping, vertical elongation of the cup, focal notching, and thinning of the neuro-retinal rim. Anderson's criteria were followed to define glaucomatous visual field defect on visual field analysis.[9] This was co-related with the disc changes and retinal nerve fiber layer defects.

Exclusion Criterion
Patients who were previously diagnosed cases of glaucoma and already on anti-glaucoma medications, or had undergone any laser procedure or filteration surgery for glaucoma were excluded from the study. Patients suffering from ocular surface disorders were also excluded from the study.

After comprehensive ocular work-up, the patients were grouped under different glaucoma sub-types based on a standard criterion. These glaucoma subtypes are congenital glaucoma, POAG, juvenile open angle glaucoma: Patients of age <40 years with clinical features of POAG, PACG, NTG, secondary glaucoma and glaucoma suspects.

Glaucoma suspects: Included patients with: (1) OHT (2) occludable angles on gonioscopy, but no other symptoms/signs of glaucoma (3) strong family history of glaucoma (4) optic nerve head change suggestive of glaucoma, with normal IOP, open angles, and no glaucomatous visual field changes.

RESULTS

Our study was a hospital-based study in which 400 eyes of 200 patients were studied. Our study included 88 (44%) male patients and 112 (56%) female patients. 164 (82%) of the patients in our study were >50 years of age, and only 5 (2.5%) patients were <40 years of age (Figure 1). This finding suggests that glaucoma usually affects individuals in later decades of life. 137 (68.5%) patients belonged to rural area, whereas 63 (31.5%) patients were from urban area. 117 (58.5%) patients in our study group presented with diminution of vision as main presenting complaint. 31 (15.5%) patients presented with ocular pain, while only 13 (6.5%) patients presented with a headache. 6 (3%) patients presented with colored haloes as their chief complaint (Figure 2). In our study, 67 (33.5%) patients were diagnosed as having POAG while 105 (52.5%) patients were diagnosed to be suffering from PACG. In our study, we had 13 (6.5%) patients of secondary glaucoma, and 9 (4.5%) patients were found to be glaucoma suspects

(Table 1). In our study, there were 42 (62.68%) males out of 67 patients in the POAG group. We also found that 60 (57.14%) out of 105 patients in the PACG group were females. This finding suggests female disposition for the development of PACG (Figure 3). 89 (84.76%) out of 105 patients ($P < 0.05$) of PACG presented with chronic angle closure glaucoma (Table 2). Among the 13 patients of secondary glaucomas, we found a predominance of lens-induced glaucoma (30.76%) and pseudophakic glaucoma (23.07%) (Figure 4).

Hypertension and diabetes have been found to be prominent risk factors associated with glaucoma in various studies. We found 33 (16.5%) patients in our study to be hypertensive. 19 (57.57%) out of these 33 hypertensive patients had PACG while 14 (42.43%) patients had POAG. 28 (14%) patients were found to be suffering from diabetes. 21 (75%) out of 28 diabetics were having POAG whereas 7 (25%) diabetic patients were found to be suffering from PACG. Myopia as an associated risk factor was seen in 16 (8%) patients. 12 (6%) patients were found to be smokers while a history of glaucoma among parents and siblings was found in 5 (2.5%) patients (Figure 5).

Glaucoma profoundly affects the optic nerve and eventually leads to blindness, if not detected on time and managed properly. In our study, we found that 218 (54.5%) eyes had visual acuity less than 6/60, 141 (35.25%) eyes had visual acuity between 6/60 and 6/18 whereas only 41 eyes (10.25%) had visual acuity of more than 6/18. Major factors which led to a delay in seeking treatment were financial constraints, lack of escort, lack of health care infrastructure in rural areas and belief in local village practices for treating diseases. We found that hypertension, diabetes, smoking, and myopia were important risk factors associated with various types of glaucoma and these risk factors should also be evaluated while managing patients suffering from glaucoma.

DISCUSSION

Glaucoma with its various subtypes has remained a challenge to ophthalmologists world over. Even today, glaucoma remains a leading cause of irreversible blindness despite tremendous progress in the investigative modalities which help in early detection of glaucoma, of availability of newer and extremely effective anti-glaucoma medications as well as new and innovative modifications in the surgical and laser treatment of glaucoma. Glaucoma
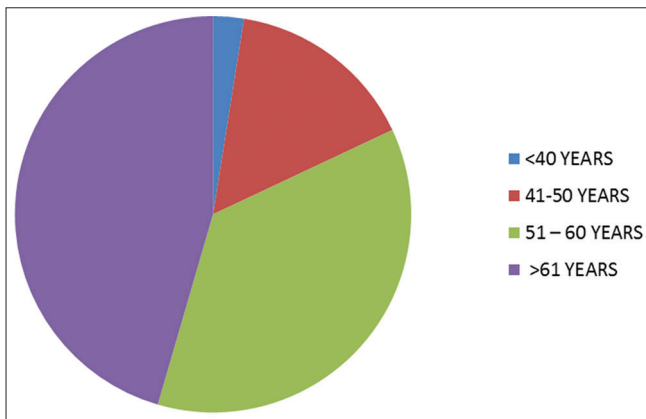

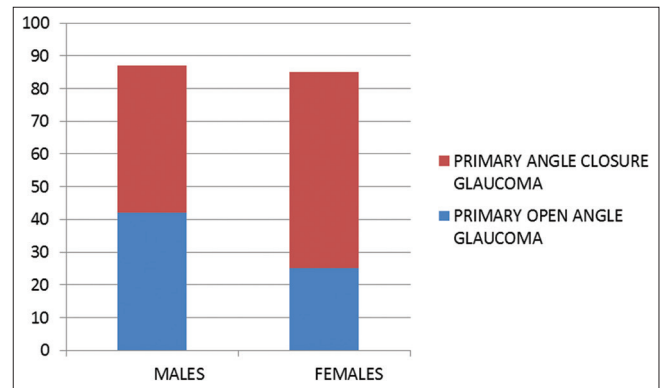**Figure 1: Age distribution in the study group (*n* = 200 patients)**

Figure 2: Distribution of the main presenting complaint in the study group (*n* = 200 patients)

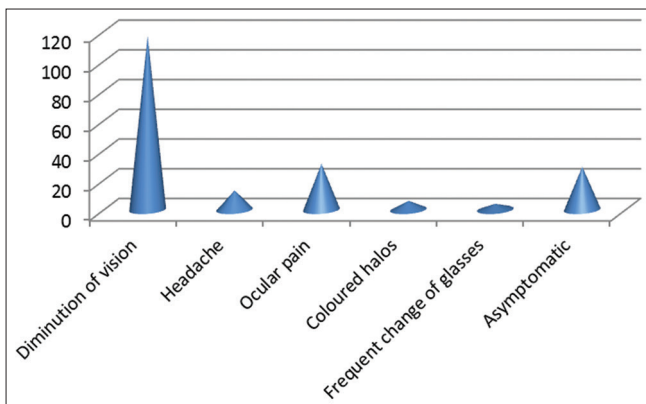**Figure 3: Gender-wise distribution of primary glaucomas in study group (*n* = 172 patients)**
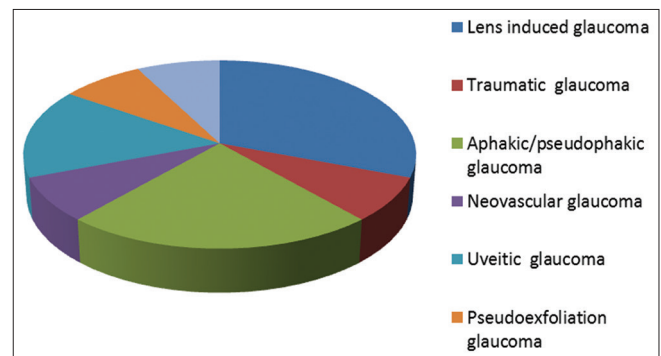

Figure 4: Distribution of secondary glaucoma in the study group (*n* = 13 patients)

Table 1: Distribution of glaucoma sub-types in the study group (*n*=200 patients)

Type of glaucoma	Number of patients (%)
Congenital glaucoma	2 (1)
Juvenile open angle glaucoma	3 (1.5)
Primary open angle glaucoma	67 (33.5)
Primary angle closure glaucoma	105 (52.5)
Normal tension glaucoma	1 (0.5)
Glaucoma suspect	9 (4.5)
Secondary glaucoma	13 (6.5)
Total	200 (100)

Table 2: Distribution of primary angle closure glaucoma in the study group (*n*=105)

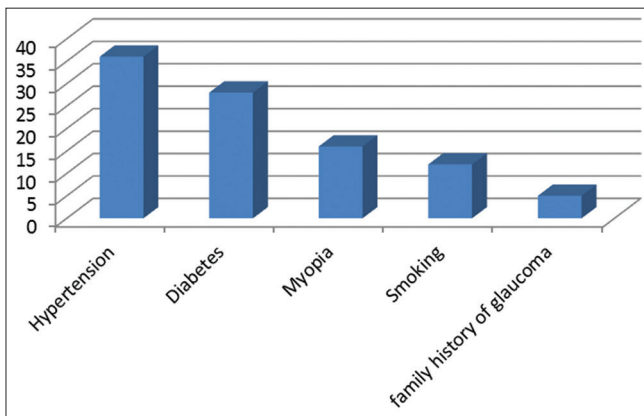| Type of angle closure glaucoma	Number of patients (%)
Acute angle closure glaucoma	13 (12.38)
Intermittent angle closure glaucoma	3 (2.86)
Chronic angle closure glaucoma	89 (84.76)
Total	105 (100)

Figure 5: Distribution of risk factors associated with glaucoma in study group (*n* = 200 patients)

is characterized by myriad clinical manifestations and a large subgroup of patients may be asymptomatic, who are detected during the course of a routine ophthalmological examination. Thus, a clinician needs to have a high index of suspicion for timely detection of glaucoma. Many factors such as the patient's accessibility to medical facilities and compliance to treatment directly affect the overall disease outcome.

Our study included 200 patients, newly diagnosed to be suffering from glaucoma during the study period, or those meeting the criteria for glaucoma suspects. All patients were subjected to a comprehensive glaucoma work-up. 137 (68.5%) patients belonged to rural area whereas 63 (31.5%) patients were residing in urban area. The predominance of rural patients in our study group is probably due to the fact that our institute caters to a large extent to the rural populace in and around Ujjain district as

well as other villages in Malwa region of Madhya Pradesh. Our study included 88 (44%) male patients and 112 (56%) female patients. Results of our study are comparable to the study of Sihota *et al.* who in their study also found a female preponderance amongst glaucoma patients.[10] However, another study by Das *et al.* found a male:female ratio of 1.35:1.[7] This difference in gender distribution can be attributed to regional and ethnic diversity in various study groups. 164 (82%) of the 200 patients in our study were >50 years of age and only 5 (2.5%) patients were <40 years of age. Sharma *et al.* in their study also had the majority of patients >50 years of age.[11] This strongly suggests that glaucoma is primarily a disease of the elderly population. Therefore, it is recommended that all individuals above 40 years of age should undergo ocular screening for glaucoma. This should go a long way in reducing the global burden of glaucoma blindness.

Glaucoma has many presenting features, which vary with the type of glaucoma. In our study, we found that 117 (58.5%) patients presented with diminution of vision as main presenting complaint. 31 (15.5%) patients presented with ocular pain. The result of our study is comparable with the study of Sharma *et al.* who also found that 35.6% patients in their study had decreased vision as the main presenting complaint.[11] Results of both the studies suggest that glaucoma is a leading cause of loss of vision and blindness.

Glaucoma has a wide racial variation. In the Caucasian race, POAG accounts for 75-95% of primary glaucoma.[12] Sihota *et al.* reported that angle-closure glaucoma constituted 45.9% of all adult glaucomas.[10] A study in the Asian population by Martinez *et al.* found PACG in 24.78% patients, while POAG was found in 22.80% patients.[13] In our study, we found that 67 (33.5%) patients were suffering from POAG while 105 (52.5%) patients were diagnosed to be having from PACG. The result of our study correlates with the study of Das *et al.* who in their study found POAG:PACG as 37:63, suggesting PACG to be the most common glaucoma subtype.[7] Results of our study also correlates with study of Al Obeidan *et al.* who in their study found that PACG (46.6%), was most common glaucoma subtype followed by POAG (12.8%) and secondary glaucoma (13%).[14]

In our study, 89 (84.76%) out of 105 patients of PACG presented with chronic angle closure glaucoma (CACG). Das *et al.* found that chronic ACG constituted 64.86% of PACG cases.[7] Sharma *et al.* also found chronic ACG (44%) to be the most common sub-type of PACG.[11] Results of all these studies as well as our study show chronic angle-closure glaucoma to be the most common subtype of angle closure glaucoma.

A number of ocular diseases as well as trauma can lead to secondary glaucoma. In our study, among the 13 patients of secondary glaucoma, we found a predominance of lens-induced glaucoma (30.76%). This was mainly due to a lack of awareness, hesitancy in seeking medical help leading to a cataract backlog among the rural populace of our study group. Congenital glaucoma remains an important cause of blindness in children <5 years. We found 2 (1%) patients to be suffering from congenital glaucoma. Rashid *et al.* also quoted a 1.5% incidence of congenital glaucoma in their study.[15]

Whether diabetes is a significant risk factor for glaucoma is mired in controversy. Two large studies, the Beaver Dam study and Rotterdam study, demonstrated an increased prevalence of POAG among diabetic subjects.[16,17] Another study by Ellis *et al.* failed to conclusively link diabetes mellitus with POAG and OHT.[18] In our study, 28 (14%) patients were found to be suffering from diabetes. 21 (75%) out of 28 diabetics were diagnosed as having POAG whereas 7 diabetic patients were found to be cases of PACG. The higher incidence of glaucoma in diabetic patients could be attributed to the fact that diabetics tend to undergo regular eye check-up and thus have higher chances of detection of asymptomatic glaucoma.

The relationship of systemic blood pressure with glaucoma onset and progression is complex. The Blue Mountain Eye Study, the Erga-Neumarkt Study and the Baltimore Study showed a positive association between systemic hypertension and POAG prevalence.[19-21] On the other hand, the Barbados Eye Study showed that the relative risk of POAG was halved at 4 years in patients of systemic hypertension.[22] We found that 33 (16.5%) patients in our study group were suffering from hypertension. 19 (57.57%) out of 33 hypertensive patients were cases of PACG, while 14 (42.43%) patients were having POAG. It has been postulated that glaucoma occurs, at least to some extent, due to decreased optic nerve head perfusion. Systemic hypertension causes increased blood flow to optic nerve head before small vessel damage occurs.[23] But later on, prolonged systemic hypertension causes microvascular damage and thereby impaired blood flow and subsequent neuronal damage resulting in glaucoma. The result of our study shows that hypertension and diabetes are significant risk factors associated with glaucoma.

Myopia, as an associated risk factor, was seen in 16 (8%) patients in our study. The Blue Mountain Eye Study found that myopic subjects had an increased risk of glaucoma, which was independent of other glaucoma risk factors and IOP.[24] The role of cigarette smoking as a risk factor for POAG remains controversial. Klein *et al.* in their study found that there was no difference in the frequency of glaucoma by cigarette smoking status.[25] However, the meta-analysis results of a study by Bonovas *et al.* suggested that current smokers are at a significantly increased risk of developing POAG.[26] 12 (6%) patients were found to be smokers in our study suggesting smoking to be one of the risk factors associated with glaucoma. Glaucoma is known to have a genetic predisposition. This was also seen in our study as a positive history of glaucoma among parents and siblings was found in 5 (2.5%) patients. However, a study with a larger sample size needs to be undertaken to further evaluate the relative influence of each of these factors on glaucoma causation and progression.

Glaucoma, if not timely detected and treated, leads to profound and permanent loss of vision. Grant *et al.* in their study suggested that there are three potential reasons for glaucoma blindness: One-third patients remain undiagnosed, one-third patients are improperly treated, and remaining one-third of patients show non-compliance to therapy.[26] In our study, we found that 218 (54.5%) eyes had visual acuity <6/60. This high incidence of poor vision at the time of presentation in our study group was mainly due to lack of awareness and lack of medical facilities in far-flung rural areas.

CONCLUSION

Glaucoma is primarily a disease of the elderly, as most patients in our study belonged to the age group of >50 years. Primary angle-closure glaucoma is the most common subtype of glaucoma detected in our study. Glaucoma, if left untreated, leads to irreversible blindness. This finding was corroborated by our study. Hypertension, diabetes, myopia, and smoking were the associated risk factors of glaucoma in our study. Our study recommends timely diagnosis and appropriate management of glaucoma to decrease the burden of glaucoma blindness.

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