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Clinical Profile of Patients with Primary Glaucoma in Tertiary Care Centre

Pranjali Pawar[1], Shweta Bandopadhyay[2] and Dhiraj Balwir[3*]

[1]Former PG student, Department of Opthalmology, Dr. Vasantrao Pawar Medical College, Hospital and Research Centre, Nashik - 422203, Maharashtra, India
[2]Associate Professor, Department of Opthalmology, Dr. Vasantrao Pawar Medical College, Hospital and Research Centre, Nashik - 422203, Maharashtra, India
[3]Professor and Head, Department of Opthalmology, Dr. Vasantrao Pawar Medical College, Hospital and Research Centre, Nashik - 422203, Maharashtra, India; dheeraj_balwir@yahoo.com

Abstract

Aim: To study the clinical profile of patients with primary glaucoma in a tertiary care hospital. **Method:** In a descriptive study of 130 patients, detailed family history, history of systemic illness and previous treatment in past was noted in detailed. Detail ophthalmic examination with visual acuity, anterior segment examination with slit lamp, intraocular pressure measurement with applanation tonometry, fundus examination and perimetry of every patient was done. **Result:** A total of 130 patients were examined the prevalence of glaucoma was 2.92%. The risk factors and their relevance to open angle glaucoma as compared to narrow angle glaucoma, taking recourse to multiple logistic regression. The Odds Ratio (OR) for age was obtained as 0.978 [95% CI: 0.937, 1.021], indicating that the odds are unchanged with the unit change in the age (p=0.304). For gender, with male as reference, OR for females was 1.676 [95% CI: 0.645, 4.355], indicating that the odds in favour of open angle decreases for females as compared to males (p=0.289). Further, the odds of open angle glaucoma with the presence of hypermetropia decreased with OR 0.098 [95% CI: 0.031, 0.311] (p=0.00). The presence of myopia increased the odds in favour of open angle glaucoma 4.785 [95% CI: 1.497, 15.295] times, which was statistically significant (p=0.008). The presence of systemic illness like hypertension and diabetes increased the risk of open angle glaucoma with OR of 1.694 [95% CI: 0.608, 4.719] and 1.017 [95% CI: 0.288, 3.592] respectively. The correlation of pretreatment IOP and visual field defect was statistically significant for PACG and not with POAG the correlation of VCDR and visual field defect was statistically significant for both POAG and PACG.9 eyes were blind in POAG and 17 eyes were blind in PACG. **Conclusion:** Patient with family history of glaucoma; history of DM, HTN, myopia, hypermetropia; and patient above 40 years of age should be screened for glaucoma for early detection and prompt treatment. Awareness of glaucoma is needed in the country as it is one of the leading causes of blindness.

Keywords: Clinical Profile, Primary Glaucoma, Risk Factors, Visual Impairment

1. Introduction

Glaucoma is the second leading cause of world blindness after cataract and accounts for 15% of global blindness[1]. India accounts for a minimum of 12.9% of Primary Open Angle Glaucoma (POAG) blindness and 12.7% of Primary Angle Closure Glaucoma (PACG) blindness in the world[2]. Asians represent 47% of those with glaucoma and 87% of those with Angle Closure Glaucoma (ACG). PACG has been reported to be more prevalent in South East Asian countries than the rest of the world[3]. The Regional Burden of Blindness (RBB) is highest for India (23.5% of global blindness) with at least 5.8 million blind due to glaucoma[4]. Glaucoma is a heterogeneous group of disorders marked by damage to the optic nerve. Primary open angle glaucoma, which is usually detected via elevated Intra-Ocular Pressure (IOP), is the most common diagnosis, while angle closure glaucoma can cause the most sudden and devastating vision loss. Early diagnosis is the key to successful management of glaucoma. Treatment strategies generally require IOP

**Author for correspondence*

lowering drugs, but may include trabeculectomy or other surgery as well as newer, neuroprotective approaches.

To have uniformity in the diagnostic definitions "The International Society of Geographical and Epidemiological Ophthalmology" (ISGEO) proposed criteria for classifying glaucoma in cross sectional, population based research[3].

According to this classification, glaucoma is diagnosed on the grounds of both structural and functional evidence of glaucomatous optic neuropathy. This also allows diagnosis of glaucoma in eyes with severe visual loss where field testing is impractical, and for blind eyes in which the optic disc cannot be visualized owing to media opacities.

The Chennai Glaucoma Study (CGS) was the first Indian study to use the ISGEO classification and they have reported the prevalence and risk factors for POAG and angle closure disease in urban and rural subjects in Southern India[5,6].

Diagnosis of glaucoma is difficult since the disease is represented by heterogeneous group of disorders. ISGEO recommends glaucoma to be diagnosed on the grounds of both structural and functional evidence of glaucomatous optic neuropathy in cross sectional, population based research.

The present study was thereby conducted to study the prevalence, clinical profile, risk factors and associated burden of blindness due to primary glaucoma. Primary glaucoma cases were classified according to ISGEO classification. This was done so that the diagnostic and treatment strategies could be linearized which is the key to successful management of glaucoma.

2. Aims and Objectives

2.1 Aim

Study the clinical profile of patients with primary glaucoma in a tertiary care centre.

2.2 Objectives

1. To study clinical profile of primary glaucoma,
2. To classify primary glaucoma on the basis of ISGEO scheme,
3. To study various risk factors associated with primary glaucoma,
4. To study the burden of visual impairment & blindness due to primary glaucoma, and
5. To suggest recommendations based on findings of study.

3. Materials and Methods

***Study Type*:** Descriptive study
***Study Settings*:** Department of Ophthalmology of a Medical College and Tertiary Health Care Centre.
***Study Duration*:** August 2016 to December 2018
***Study Population*:** Minimal estimated sample size for the foresaid study would be 85 patients but 130 patients were examined
***Sample Size Calculation*:**
Formula – Z2 p*q
L2
Z – Critical value
p – Proportion of the disease
q – (1-p)
L – Available error

3.1 Methodology

The study protocol, consent form and patient information sheet were approved by the institutional ethics committee.

Informed consent from the patient.

Patients can be chosen according to the inclusion and exclusion criteria.

Detail history to be recorded.

General physical examination: including consciousness, orientation, pallor, icterus, cyanosis, clubbing, lymphadenopathy, oedema, PR, BP RR measurement.

Ocular examination including:

- BCVA measured on a Snellen's chart
- Slit lamp evaluation – Slit lamp
- Applanation tonometry – Goldmann's Applantion Tonometer
- Gonioscopy - Gonioscope
- Central corneal thickness reading using an ultrasound pachymeter, a mean of 5 readings.
- Stereoscopic examination of the disc and nerve fibre layer using a +90D lens with the slit lamp.
- Indirect ophthalmoscopy – Indirect ophthalmoscope
- Visual fields with the help of Humphrey's perimetry for glaucomatous changes.
- Single Ophthalmologist will conduct the ocular examination

4. Eligibility Criteria

4.1 Selection of Subjects

Patients of age ≥40 years and of either sex will be selected as subjects. All the outdoor patients presenting to eye department in period August 2016 to December 2018 will be included in the study.

4.2 Inclusion Criteria

1. Patients of age 40 years and above, either sex,
2. Patients with Primary glaucoma as per ISGEO Classification, and
3. Patients with Glaucoma Suspect as per ISGEO Classification.

4.3 Exclusion Criteria

1. Congenital and Juvenile glaucoma,
2. Glaucoma secondary to ocular pathology like uveitis, lens induced, neovascularization, trauma, malignant glaucoma,
3. Unco-operative patients, and
4. Comatose patients.

5. Results

- A total of 4444 cases visited eye OPD during this period out of which 130 cases were identified as having primary glaucoma,
- 111 (85.38%) patients were in the age range of 40-70 yrs, while only 19 (14.61%) patients were above 70 years of age. As regards gender, the percentage of male patients (56.92%) was higher than that of females (43.07%),
- It is shows that out of 71 open angle glaucoma cases, majority i.e., 37 (52.11%) had POAG Category 1, followed by 18 (25.35%) cases with POAG Suspect. There were 14 (19.71%) cases with POAG Category 2 and only 2 (2.81%) patients were diagnosed with POAG Category 3. In narrow angle category, out of 59, 44 (74.57%) cases were diagnosed with PACG, followed by 8 (13.55%) cases with PACS and only 7 (11.86%) cases with PAC,
- 48 (67.60%) were males while 23 (32.39%) were females. The prevalence of POAG was obtained as 1.19% (53/4444) considering categories 1-3. There were 18 (25.35%) POAG suspects in open angle category considering disc/field according to ISGEO scheme,
- Out of 59 narrow angle diagnosed cases, 26 (44.06%) were males while 33 (55.93%) were females. The prevalence of PACG was 0.99% (44/4444) considering only PACG category. In narrow angle category, there were 7 (11.46%) cases of PAC category and 8 (13.55%) cases of PACS category according to ISGEO scheme, and
- Out of 71 diagnosed cases, 66 (92.95%) cases presented with Gradual Progressive Diminution of Vision (GPDOV), while other symptoms were less than 5%. In patients with narrow angle, 46 (77.96%) cases presented with GPDOV, followed by 10 (16.94%) presenting with acute loss of vision and acute red eye each.

Correlation of pretreatment IOP and field defect (mean deviation) which was found to be statistically insignificant in open angle glaucoma (0.9207 with $p<0.05$) and it was statistically significant in angle closure glaucoma (0.00001 with $p<0.05$).

Correlation of VCDR and field defect (mean deviation) which was found to be statistically significant in both primary open angle glaucoma and angle closure glaucoma (0.00001 and 0.01 respectively with $p<0.05$)

- In open angle category, 39 (54.92%) cases had one or more systemic illness. Out of these 39, 29 (74.35%) cases presented with hypertension, while 16 (41.02%) cases had diabetes. In narrow angle category also, out of 25 cases with illness, 14 (56%) presented with hypertension, while 10 (40%) had diabetes,
- The association of systemic illness and diagnostic categories was studied for statistical significance using Fisher exact test. The test resulted into a p-value of 0.04 indicating significant association between the two,
- The proportion of cases with refractive error were marginally more i.e., 46 (64.78%) in narrow angle group as compared to 41 (69.49%) in open angle group. The association of type of refractive error and diagnostic type was evaluated for statistical significance using *Fisher's exact test*. The test resulted into a p-value <0.00001 indicating significant association between two attributes,
- Relevance to open angle glaucoma as compared to narrow angle glaucoma, taking recourse to multiple

logistic regression. The Odds Ratio (OR) for age was obtained as 0.978 [95% CI: 0.937, 1.021], indicating that the odds are unchanged with the unit change in the age (p=0.304). For gender, with male as reference, OR for females was 1.676 [95% CI: 0.645, 4.355], indicating that the odds in favour of open angle decreases for females as compared to males (p=0.289). Further, the odds of open angle glaucoma with the presence of hypermetropia decreased with OR 0.098 [95% CI: 0.031, 0.311] (p=0.00). The presence of myopia increased the odds in favour of open angle glaucoma 4.785 [95% CI: 1.497, 15.295] times, which was statistically significant (p=0.008). The presence of systemic illness like hypertension and diabetes increased the risk of open angle glaucoma with OR of 1.694 [95% CI: 0.608, 4.719] and 1.017 [95% CI: 0.288, 3.592] respectively, and

- Out of 71 cases of open angle category, 9 (6.33%) eyes were blind, 26 (18.30%) were visually impaired. Out of 59 cases of narrow angle category, 17 (14.40%) eyes were blind, 29 (24.57%) were visually impaired. The association of visual outcome and diagnostic category was found statistically significant with p-value of 0.12959 using *Chi-square test*.

6. Discussion

6.1 Prevalence of Glaucoma in India

Glaucoma is a leading cause of blindness. The prevalence of glaucoma varies by region and race. About 60 million people are estimated to be affected by glaucoma out of which 11.2 million cases are estimated to be from the Indian subcontinent[2,7]. It is estimated that there are approximately 11.2 million persons aged 40 years and older with glaucoma in India. Primary open angle glaucoma is estimated to affect 6.48 million persons. The estimated number with primary angle closure glaucoma is 2.54 million. Those with any form of primary angle-closure disease could comprise 27.6 million persons[7].

Most of those with disease are undetected and there exist major challenges in detecting and treating those with disease. Also study by Vijaya *et al.*[8] described that 90% of glaucoma patients are unaware of the disease. Factors responsible for increasing population of glaucoma in developing countries are poor socioeconomic condition, no public awareness, and resources constraint to detect glaucoma. Awareness of glaucoma is very poor in urban as well as rural population of India as compared to western countries.

About one in 40 people are at the risk of suffering from glaucoma. Hence necessity of actively looking at the disease[9] purpose of our study was to classify glaucoma according to ISGEO scheme and to study burden of blindness and visual impairment and also to suggest recommendation with respect to the study.

According to the study conducted in ophthalmology OPD of a tertiary care centre during the period of august 2016 to September 2018. Out of the total 4444 patients visited in OPD 130 patients were diagnosed of having primary glaucoma as per ISGEO classification (Table 1).

Table 1. Distribution of patients according to diagnosis type (N=130)

Diagnosis of patient	Number of patients (%)
Open Angle	71(54.78)
Narrow angle	59(45.22)
Total	**130 (100)**

In our institution prevalence of POAG was 1.59% and that of PACG was1.32% Andhra Pradesh Eye Disease Survey[10], Chennai Glaucoma Study[5,11], West Bengal Glaucoma study[12], Vellore Eye Survey[13] reported prevalence of POAG and PACG. Wide variation in reported prevalence of POAG was between 1.62% and 3.51% and that for PACG was between 0.5% to 4.3%.

6.2 Demographic Profile

In this study out of 130 patients, 35 patients were in the age group of 40-49, 38 patients were in the age group of 50-59, 57 patients were included in the age group of 60 years and above. According to study by Dandona *et al.*[10] suggested.

Prevalence of POAG significantly increases with age. Also Garudadri *et al.*[15] concluded significant association of both POAG and PACG with increasing age[14] but PACG does not follow the same exponential curve as POAG. In patients with age above 40 years and above prevalence increases with age[16].

Considering gender, overall percentage of male patients (58.26%) was higher than that of females (41.74%) in our study. Higher number of male patients was seen in the age group of 60-69 years. Out of 71 patients of open angle category, 49(69.84%) were males while 23 (30.16%)

were females suggesting higher prevalence of open angle glaucoma in male gender.

Consistent with other studies reported on PACG, we reported 33 (55.77%) female patients out of 59 narrow angle patients, resulting in more risk of PACG in female population. Can be because females have shallow anterior chamber depth and smaller eye related to biometric difference in genders[17,18]. In a study done by Garudadri *et al.* (2010)[15] female genders was the risk factor for Primary Angle Closure Glaucoma (PACG). In a cross sectional population based survey in a Nepalese population, Thapa *et al.* (2012)[19] found similar correlation of gender with PACG.

6.3 Demographic Profile according to ISGEO Scheme

In this study the patients were classified as per the ISGEO scheme. In open angle group, diagnosis was classified as Category 1 in which 33 cases (28.46%) which had structural and functional evidence of glaucoma. Category 2 with advanced structural damage and unproved field loss was seen in 14 cases (10.76%) and Category 3 diagnosis was found in two cases (1.53%). Hence majority of POAG cases were diagnosed based on structural and functional evidence. In the Andhra Pradesh Eye Disease Study similar classification was used to diagnose glaucoma and they found 77.8% cases were diagnosed on the basis of structural damage (Category 2). This could result in overestimate of the diagnosis of open-angle of glaucoma.

In this study 18 (25.35%) cases of glaucoma suspect in open angle category where disc or field changes were considered as per ISGEO scheme of classification. The study (VES) reported 10.3% of the population had occludable angles or angle closure Glaucoma[13]. We report 13 cases (25%) of glaucoma suspects in narrow angle category having either occludable angle or angle closure (PACS & PAC). As per ISGEO definitions the prevalence of PACG reported in our study was 0.93% (39/4204) which is comparable to 0.88% reported by CGS based on similar classification scheme[5]. In APEDS study Dandona *et al.*[10] reported 1.08% had manifest PACG and 2.21% had occludable angles without angle closure. Diagnostic differences between VES, APEDS, ACES and CGS were noticed due to different diagnostic criteria for narrow angle glaucoma.

6.4 Symptoms

Majority of patients in open angle category presented to us with gradual painless progressive diminution of vision. These accounted for 66 (92.95%) out of 71 cases. A study done by Gogate *et al.* (2011)[20] in a tertiary eye care centre in Maharashtra which is a cross sectional study suggested that gradual progressive painless loss of vision was the commonest symptom of presentation accounting 87.5% of the total subjects.

Significant visual symptoms are not present in most of the patients with angle closure disease. In APEDS by Dandona *et al.*[10] 83.3% had chronic form of PACG without any symptoms of angle closure attacks. Even in our study it was reported chronic form of narrow angle glaucoma to be more common than the acute form with sudden loss of vision. Gradual progressive diminution of vision was the most common symptom of presentation with 46 cases (77.96%). 10 cases out of 59 presented with acute red eye associated with pain. Patients presenting with sudden onset of a painful, red eye with reduced visual acuity, clinical signs of an acute red eye and reduced vision, should alert doctors to the possibility of acute glaucoma according to Gandhewar *et al.*[21]. Three cases in Open angle category presented with coloured haloes. In such patients there is a possibility of narrow angle mechanism coexistent with open angle glaucoma.

We found Correlation of pretreatment IOP and field defect (mean deviation) which was found to be statistically insignificant in open angle glaucoma (0.9207 with $p<0.05$) and it was statistically significant in angle closure glaucoma (0.00001 with $p<0.05$) Figure 1. A survey done by Gazzard *et al.* (2002)[22] stated that correlation between pretreatment IOP and magnitude of MD for POAG group was weaker and not statistically significant, also a linear regression demonstrated a moderate significant relation between IOP and MD for PACG group. No significant relationship between IOP and visual field Mean Deviation (MD) index in POAG eyes was reported by Migeul *et al.* (1998)[23].

We found Correlation of VCDR and field defect (mean deviation) which was found to be statistically significant in both primary open angle glaucoma and angle closure glaucoma (0.00001 and 0.01 respectively with $p<0.05$) Figure 2. In a study done by Pankaj Soni *et al.* (2017)[24] it was stated that there is a strong correlation between cup disc ratio and mean deviation and pattern standard deviation in patients with POAG. Each optic disc type,

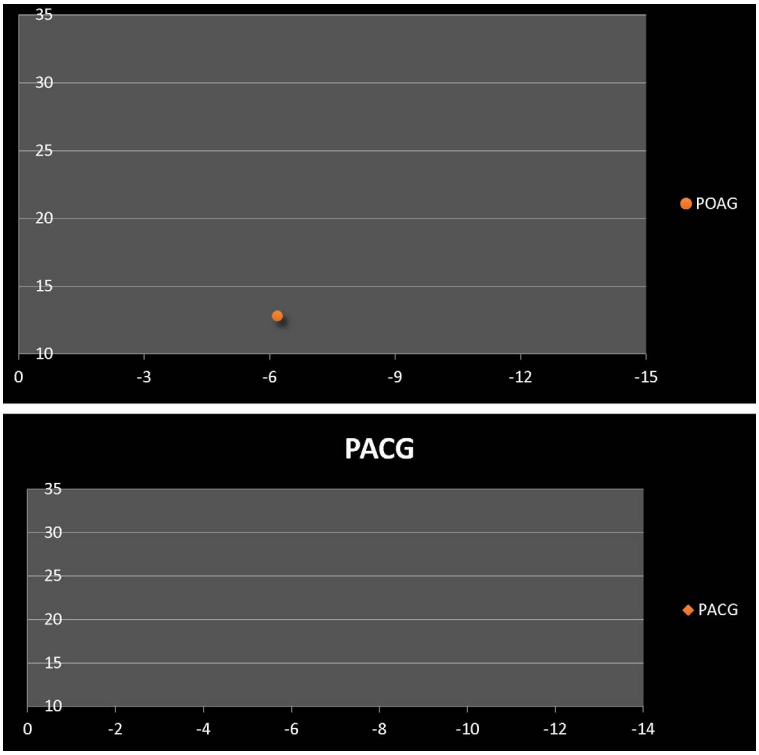

Figure 1. Scatter plot showing the correlation of pretreatment IOP and field defect (higher of two eyes) for patients in two diagnostic groups.

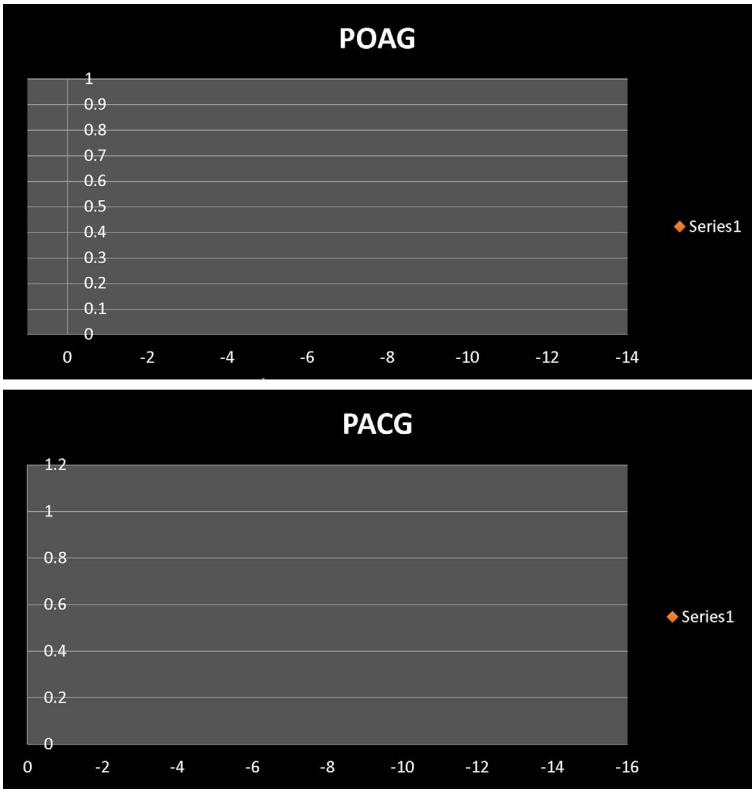

Figure 2. Scatter plot showing the correlation of VCDR and field defect in two diagnostic categories.

except for the FI type, had different HRT-II parameters that were significantly correlated with the MDs in POAG patient was reported by Kazuko Omodaka *et al.* (2010)[25]. Gazzard (2002)[22] stated that VCDR and HCDR were significantly correlated with MD for both diagnosis.

6.5 Risk Factors

6.5.1 Family History

22.4% of POAG have family history of glaucoma according to Rotterdam study[26]. Positive family history has 10 times higher risk of developing glaucoma than the general population.

6.5.2 Refractive Errors

There is a strong association of increasing hypermetropia with angle closure disease but myopia is found to be inconsistent with POAG. Percentage of myopia in this study was predominant in open angle category accounting for 41 cases (57.74%) whereas the percentage of hypermetropia was predominant in narrow angle category accounting for 36 cases (61.01%).

The presence of myopia increased the odds in favour of open angle glaucoma 4.875 [95% CI: 1.497, 15.294] times, which was statistically significant (p=0.008) in our study. Xu *et al.* (2007)[27] did a cross-sectional study on 4319 subjects, in which he found myopia was a risk factor associated with glaucomatous optic neuropathy.

Glaucoma frequency seemed to be higher (P _ 0.075; OR, 2.28; 95% CI, 0.99–5.25) significantly (P_0.001; OR, 7.56; 95% CI, 3.98–14.35) than in the group with emmetropia. Wong *et al.* (2003)[28], in his cross-sectional study found that persons with hypermetropia at baseline were 40% more likely to have a significant IOP increase than those with emmetropia at baseline.

6.5.3 Systemic Diseases

In this study 39(54.92) cases had one or more systemic illness out of 71 open angle cases. Out of these 39 cases: 29(74.35) and 16(41.02) cases presented with hypertension and diabetes respectively. Beaver Dam study[29] and Blue Mountain study[30] reported diabetes mellitus as a risk factor for POAG but no correlation was shown by Baltimore Eye Survey[31]. Positive correlation between hypertension and IOP and association between diagnosis of POAG and hypertension was found by Bonomi *et al.* (2000)[32], also hypertension was more prevalent accounting for 73% of total patients in study done by Salim *et al.* (2010)[33].

10 cases in narrow angle category presented with diabetes accounting for 40%. The presence of diabetes mellitus was associated with an overall rise in mean IOP of both eyes of 0.31 mmHg (95% confidence interval, 0.12-0.50), and with a threefold increased presence of high tension glaucoma (odds ratio, 3.11; 95% confidence interval, 1.12-8.66) and concluded that newly diagnosed diabetes mellitus and high levels of blood glucose are associated with elevated IOP and high tension glaucoma as found by Dielemans *et al.*[34] The prevalence of OAG was 40% higher in participants with type 2 Diabetes Mellitus than in those without reported by Los Angeles Latino Eye Study (LALES) cohort Chopra *et al.* (2008)[35].

6.6 Blindness due to Glaucoma

Glaucoma is the second leading cause of world blindness after cataract and accounts for 15% of global blindness[1]. Nine patients out of 130 cases were reported to have bilateral blind eyes in this study. Out of 71 cases with open angle glaucoma three were bilaterally blind and out of 59 cases in narrow angle category six were reported to be bilaterally blind.

According to APEDS[10], CGS (urban)[5], CGS(rural)[11], WBGS[12] rate of bilateral blindness due to POAG was 11.1%, 1.6%, 1.5%, 3.2% and 5.2% respectively which is comparable to the present study. Therefore, prevalence of blind eyes because of POAG varies from 1.5 to 11.1%. Bilateral blindness due to PACG reported by APEDS[10], CGS (rural)[11], CGS(urban)[5] accounts for 16.6%, 2.9% and 5.9% respectively suggesting that PACG causes two times the proportion of bilateral blindness than for POAG.

In this study we reported that as compared to 17 (14.40%) out of 118 eyes in narrow angle category and 9 (6.33%) out of 142 eyes of open angle category had unilateral blindness. It shows that in Asian countries prevalence of unilateral blindness is more in narrow angle category. In this study we found that as compared to 29 (24.57%) eyes in narrow angle category, 26 (18.30%) eyes were visually impaired in open angle category. Thus the association of visual outcome and diagnostic category was found to be statistically significant with p-value of 0.12959 in this study population.

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