Clinical and sociodemographic characteristics of patients with glaucoma in Jimma University Specialized Hospital, Ethiopia.

By Addis Tenkir, M.D.

A Thesis to be Submitted to the College of Public Health and Medical Sciences of Jimma University in Partial Fulfillment of the Requirements for the Certificate of Speciality in Ophthalmology.

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Abstract

Background: Evidence is emerging that the prevalence and the proportions of different types of glaucoma vary widely between ethnic groups and geographical areas throughout the world. Until population-based surveys become available in Ethiopia, hospital-based studies are invaluable to show the distribution of the types of glaucoma in certain parts of the country.

Purpose: The main aim of this study was to determine the types of glaucoma prevalent among patients attending the department of ophthalmology of Jimma University Specialized Hospital (JUSH), Jimma, Ethiopia.

Methods: A facility-based cross-sectional study was conducted in JUSH from April 1, 2007 to March 30, 2008. The study population consisted of 335 consecutive patients with glaucoma. Glaucoma was diagnosed by means of strict objective criteria, based on Goldmann applanation tonometry readings, three-mirror gonioscopic examination and binocular biomicroscopic optic disc appearances.

Results: The mean (SD) age of the study patients was 57.0(12.7) years (range, 8-90 years). The male to female ratio was 2.7:1. Primary glaucomas accounted for 52.2% of all cases. The two most common types of glaucoma observed were pseudoexfoliative glaucoma (PXG) (35.2%) and primary open angle glaucoma (POAG) (32.3%). Primary angle closure glaucoma was diagnosed in 18.5% of patients. Less frequently observed types of glaucoma were secondary angle closure glaucomas (9.3%), secondary open angle glaucomas (3.3%) and Juvenile open angle glaucoma (0.9%). Patients with PXG were older than those with POAG in this study ($p<0.0001$), and unilateral disease was more common among patients with PXG as compared to POAG ($p<0.001$). Overall, 56.1% and 23.9% of the study patients were unilaterally and bilaterally blind due to glaucoma, respectively.

Conclusions: The very high proportion of people with blindness due to advanced glaucoma at initial presentation is alarming. Urgent strategies need to be designed to address the problem. The finding that PXG is the commonest type of all glaucomas in the present study is interesting. However, this needs to be substantiated with community-based studies representing all ethnic groups in the area. Patients with POAG in this study are relatively young and tend to have advanced disease. Cohort studies are recommended to verify whether or not POAG has an earlier onset and rapid progression in Ethiopians.

Keywords: Glaucoma, Blindness, Pseudoexfoliation Syndrome, Pseudoexfoliative Glaucoma, Jimma University Specialized Hospital, Ethiopia.

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List of abbreviations

AC anterior chamber

BCVA best corrected visual acuity

CDR cup-to-disc ratio

IOP intraocular pressure

JOAG juvenile open angle glaucoma

JU Jimma University

JUSH Jimma University Specialized Hospital

NVG neovascular glaucoma

OAG open angle glaucoma

OD Oculus Dexter(right eye)

OS Oculus Sinister (left eye)

OU Oculus Uterque (both eyes)

PAS peripheral anterior synechia

PACG primary angle-closure glaucoma

POAG primary open angle glaucoma

PXG pseudoexfoliative glaucoma

PXS pseudoexfoliative syndrome

SACG secondary angle-closure glaucoma

SOAG secondary open angle glaucoma

VCDR vertical cup-to-disc ratio

WHO World Health Organization

Introduction

Glaucoma is the leading cause of irreversible blindness in the world.[1,2] It is also one of the frequent causes of irreversible blindness in Ethiopia.[3]

Glaucoma is not just one disease rather it is a group of diseases that have as a common end-point a characteristic optic neuropathy, which is determined by both structural changes (optic disk appearance) and functional deficit (measured by visual field change).[4]

Historically glaucoma was considered as a disease of 'elevated' intraocular pressure (IOP). However, in the current concept of glaucoma, IOP is no longer part of the definition. There are several systems by which the glaucomas may be classified. The two most commonly used are based on firstly etiology, i.e., the underlying disorder that leads to an alteration on aqueous humor dynamics and secondly mechanism, i.e., the specific alteration in the anterior chamber angle that leads to a rise in IOP. The glaucomas have traditionally been divided on the basis of primary and secondary forms. In primary glaucomas the initial events which lead to outflow obstruction and IOP elevation are thought to be confined to the anterior chamber angle or conventional outflow pathway, with no apparent contribution from other ocular or systemic disorders. These conditions are typically bilateral and probably have a genetic basis. In contrast, other glaucomas have been classified as 'secondary' because of a partial understanding of underlying, predisposing ocular or systemic event(s). These latter glaucomas may be unilateral or bilateral and some may have a genetic basis, while others are acquired. Barkan first recognized the distinction between open-angle and closed-angle forms of glaucoma, which led to the basis for

the mechanistic classification of the glaucomas.[5]

The distribution of the subtypes of glaucoma showed differences among races and ethnic groups. Black populations in the Caribbean,[6] the USA [7,8] and Africa[9,10] have a higher prevalence of POAG than those of European and Asian origin. On the other hand, populations of East Asian origin[11] and Eskimos [12] have a higher frequency of primary angle closure glaucoma (PACG) compared with those of European or African descent. Prevalence of secondary glaucoma varies considerably. The highest rates may reflect particular local circumstances; for example, high frequency of exfoliation syndrome in Norway[13] or trauma in Mamre, South Africa.[14]

Age of onset and severity of primary open angle glaucoma (POAG) appears to be distinct between various ethnic groups. POAG presents later and is less severe at presentation in Caucasians.[15] In blacks, the disease appears to occur earlier, is more advanced at presentation and results in blindness much more often.[16,17]

POAG was reported as the commonest type of glaucoma from a referral hospital in central Ethiopia.[18] However, given the large ethnic diversity in Ethiopia, the pattern of glaucoma may vary in different regions of the country.

To the best of our knowledge, no population-based study has been conducted in Ethiopia to specifically assess the prevalence and proportions of the different groups of glaucoma. Until such data become available, hospital-based studies are invaluable to show the distribution of the subtypes of glaucoma in certain parts of the country.

Literature Review

Glaucoma is one of the diseases which show a difference in prevalence and severity among different races and perhaps in different geographic locations. The first well-designed survey of glaucoma in a defined population was carried out by Hollows and Graham in the Rhondda Valley, South Wales. Since then there have been nearly 30 published surveys on the prevalence of glaucoma with acceptable sampling techniques and definitions.[19]

The predominant form of primary glaucoma in people of African origin is open angle. In a population-based survey, the prevalence of glaucoma was 3.1% in Tanzania,[9] and 2.8% in South Africa.[10] The highest prevalence rates for POAG so far reported anywhere are in the black populations of the Caribbean, particularly St Lucia (10.2%)[6] and Barbados (7%).[7] The populations of these islands were drawn from different parts all down the West African coast. It is interesting that, so far, such extremely high prevalence rates have not been documented in populations in West Africa itself .[19]

In the literature, there are some studies done to assess the distribution of subtypes of glaucoma in hospital-based settings.

A retrospective study in a major eye hospital in India found that the POAG to PACG ratio was 37:63 and the mean age of presentation for POAG and PACG were 60.54 and 55.13 years, respectively. The study also showed that only 9 (1.72%) of 523 cases of POAG and 5 out of 888 cases (0.56%) of PACG presented after age 81 years.[20] The authors assumed that this difference could reflect the lower life expectancy of

Indians or it could indicate that glaucoma probably occurs almost a decade earlier in Indians as compared to Caucasians for whom the average age of presentation of POAG is 69.1 years.[15] Asymmetric glaucoma was documented in 13.02% cases of POAG, 19.14% cases of PACG and 17.24% of JOAG in the Indian study in contrast to 10% of asymmetric POAG in the Blue Mountains Eye Study.[21] In a Wilmer Eye Clinic (USA) study[15], advanced glaucoma at presentation was seen in 18.5% of Caucasian patients and 33.3% of black patients. In the Indian study advanced glaucoma was found in 44.39% of POAG and 48.65% of PACG cases, and along with blindness in 8.6% of POAG and 14.3% of PACG cases at presentation.[20]

A cross-sectional study of 190 patients treated in Glaucoma service, Priest hospital, Thailand showed that open angle glaucoma comprised 50% of all glaucoma, PACG accounted for 23%, and all subtypes of secondary glaucoma comprised 16%.[22]

A clinic-based chart review analysis study in Saudi Arabia showed prevalence of primary open-angle glaucoma 30.5%, primary angle-closure 24.7%, neovascular 7.6%, surgically induced 6.5% and exfoliative 5.2%. One-third of patients were unilaterally legally blind, whereas 11.3% were bilaterally blind.[23]

Among 1732 Japanese American clinic population, 112 had glaucoma (6.4%). Of these, 17% had high-tension glaucoma (HTG) and 70% had normal-tension glaucoma (NTG).[24] A population based study in Japan also showed that NTG is the most common subtype in Japan.[25]

The most common form of glaucoma among 198 consecutive Ghanaian glaucoma patients was primary open-angle glaucoma (44.2%). Open-angle glaucoma suspects

also comprised a large percentage of the group (30.5%). Chronic angle-closure glaucoma was diagnosed in 6.6% of the patients.[26]

In a retrospective study conducted in Menelik II Hospital, Addis Abeba, the following results were reported: POAG was the most frequent type documented in 40% of glaucoma patients, followed by secondary glaucomas in 38%, PACG in 18%, NTG in 2%, and congenital glaucoma 2% of all glaucoma patients. Forty-one percent of the glaucoma patients were blind either in one or both eyes. PACG was found to be potentially a blinding type of glaucoma, in which 53% of the patients suffered from blindness.[27]

Significance of the study

Examining differences in the distribution of disease between populations and using these differences to generate and test hypotheses are key concepts in epidemiology. Evidence is emerging that the prevalence and the proportions of different types of glaucoma vary widely between ethnic groups and geographical areas throughout the world. Considerable data have been collected among white subjects and increasingly in those of East Asian origin. However, studies of the distribution of glaucoma in subjects of African derivation have focused mostly on island populations in the Caribbean and the genetically heterogeneous populations of the United States. In Africa, very few population-based studies of glaucoma have been conducted. The results of such studies cannot be extrapolated to other parts of Africa because of large variations among these populations. Apart from a single hospital-based study, neither population-based study nor another clinic-based study has been done in Ethiopia. Though hospital based data are of limited value in assessing the prevalence of disease among the population, they can serve as baseline for future population-based studies.

Objectives

General objective

To determine the sociodemographic and clinical characteristics of patients with glaucoma in the department of ophthalmology of Jimma University Specialized Hospital (JUSH).

Specific objectives

- To determine the types of glaucoma prevalent in JUSH.
- To identify sociodemographic characteristics of each type of glaucoma in JUSH.
- To identify clinical features of each type of glaucoma in JUSH.
- To determine the magnitude of blindness among patients with glaucoma in JUSH.

Methods and Materials

Study Design: A hospital-based, cross-sectional study.

Study area and period: A one-year survey from April 1, 2007 to March 30, 2008 in the department of ophthalmology of Jimma University Specialized Hospital (JUSH) was conducted.

Jimma University is located in Jimma town. The 180-year old Jimma town is located 335 kilometers southwest of Addis Ababa in Jimma Zone, one of the eleven zones in Oromia Regional State. JUSH is the only public hospital in the town.

The department of ophthalmology of Jimma University is a tertiary eye care center training ophthalmic residents and cataract surgeon-students in addition to providing eye care services to the southwestern and western parts of Ethiopia.

Source population: All patients presenting to JUSH for eye care during the study period.

Study subjects: All patients with glaucoma presenting to JUSH during the study period constituted the study participants. Cases with presumed congenital glaucoma were excluded from this study owing to the fact that facilities for examination under anesthesia were not available in the hospital during the study period, and such patients were being referred to the other tertiary eye care center located in Addis Abeba, Menelik II hospital.

Sample size: since all patients with glaucoma except congenital glaucoma who presented during the study period were the study subjects, no sampling calculation was used. We declined to undertake any sampling procedure for two main reasons.

Firstly, from a previous situational analysis study (unpublished data), we found that the number of new glaucoma patients seen at the eye unit was about forty per month and we presumed that we wouldn't survey more than 500 patients in a year period of time; which, we believed, would not be beyond our capacity in terms of personnel, time and money resources. Secondly, it was our observation that many patients from the rural areas of this part of the country did not present for eye or other health care during plow and harvest seasons. Therefore, in order to avoid any selection bias, we decided to include all glaucoma patients seen in a one-year period as our study subjects.

Data collection: demographic and clinical data were collected and recorded on a structured questionnaire. The questionnaire contains such variables as age, sex, ethnicity, religion, marital status, educational level, occupation and area of residence. The chief complaints and duration of the symptoms were also recorded. A complete ophthalmic history was obtained and a standard comprehensive ophthalmic examination was performed for each patient.

Visual acuity was measured using a standard Snellen visual acuity chart, with distance correction if normally worn. A tumbling E-chart was used for illiterate participants. Pin-hole acuity was checked if the presenting acuity was less than 6/12. Subjective refraction using a trial frame was measured in subjects in whom the visual acuity ranged from 6/18 to 6/60 and improved by 2 lines or more with the pin-hole. All patients underwent conventional slit-lamp biomicroscopy assessment. Goldmann applanation tonometry was performed after instillation of tetracaine 0.5% eye drops and fluorescein paper strips. Three measurements were obtained at the midpoint of

the pulse for each eye. Only readings where minimal force was necessary to widen the palpebral aperature sufficiently were recorded as valid. The tonometer was calibrated daily. An intraocular pressure of more than 21 mmHg was considered abnormal, which is generally accepted as the +2SD from the mean of IOP distribution in the population.[27] Gonioscopy was performed using Goldmann goniolens. Angles were graded according to the Shaffer classification, which is based on the angular width of the angle recess. Grade 1 represents a geometric angle of 10°; Grade 2, 20°; Grade 3, 25° to 35; and Grade 4, 35° to 45°. Slit-like angle represents angle less than 10°, and Grade 0 implies that the iris is against the trabecular meshwork. Grade 2 or less chamber angle in at least three quadrants was considered as a closed-angle.[28] In addition, the degree and color of trabecular meshwork pigmentation as well as the presence of Sampaolesi line, exfoliative material in the angle recess, new vessels, synechiae or other anomalies were noted. If the anterior chamber was judged to be not occludable, the pupils were dilated with 1% tropicamide eye drop. The optic disc was assessed stereoscopically using a Volk +90-diopter lens (Volk Optical Inc, Mentor, Ohio). In the case of cup to disc ratio, the largest value from the 11-to-1 o'clock and 5-to-7 o'clock positions were recorded while for the neuroretinal rim the narrowest width between 11 to 1 o'clock or 5 to 7 o'clock were recorded.

Glaucomatous optic neuropathy in this study was defined as one or more of the following optic disc changes: (1) vertical cup to disc ratio (VCDR) of 0.7 or more or (2) a difference in the VCDR of 0.2 or more between the two eyes or (3) the narrowest remaining neuroretinal rim of 0.1 disc diameters or less. Any of the above optic disc changes in addition to a characteristic visual field defect was considered as the

highest level of evidence for cross-sectional studies in a scheme proposed by the Working Group for Defining Glaucoma of the International Society of Geographical and Epidemiological Ophthalmology. This was based on the consensus that in many populations, the 97.5th percentile for vertical CDR lies at 0.7. Similarly, the 97.5th percentile of the distribution of the differences in the vertical CDRs between the two eyes is approximately 0.2.[4] Patients were diagnosed as having glaucoma if they had a diagnosis of glaucoma in either eye. The ophthalmic evaluation in all subjects was performed by one examiner (A.T.). Reproducibility of measurements and gradings were monitored by a senior ophthalmologist throughout the study.

Statistical analysis: Data were checked for completeness and double-entered into a computer. Analyses were performed with SPSS 16.0 (SPSS Inc, Chicago**,** Illinois) software. Statistical associations were checked between groups using x^2-test or Fisher-exact test as appropriate. The Student's t- test was used for comparing differences in the mean of the continuous variable 'age'. A two-tailed 'P' value of less than 0.05 was considered statistically significant in all analyses.

Dissemination plan: the findings of this study will be presented to concerned academicians and policy makers and it will be sent for possible publication on a peer-reviewed medical journal.

Operational definitions

The following criteria were used for the diagnosis of glaucomatous optic neuropathy and different types of glaucoma:

1. Glaucomatous optic neuropathy was defined as one or more of the following optic disc changes: (1) vertical cup to disc ratio (VCDR) of 0.7 or more or (2) a difference in the VCDR of 0.2 or more between the two eyes or (3) the narrowest remaining neuroretinal rim of 0.1 disc diameters or less.
2. POAG was defined as a glaucomatous optic neuropathy with open anterior chamber angles on gonioscopy and elevated intraocular pressure in which there was no ocular or systemic identifiable cause for the elevated IOP.
3. JOAG was diagnosed in patients younger than 30 years of age with clinical picture similar to POAG, without evidence of congenital glaucoma such as buphthalmos and breaks in the Descemet membrane.
4. PACG was defined as a glaucomatous optic neuropathy with elevated IOP and closed anterior chamber angle in which there was no identifiable ocular or systemic cause for the elevated IOP. It was classified as acute PACG and chronic PACG. Acute PACG was defined as a condition in which there was a functional block between the pupillary part of the iris and anterior lens surface with shallow anterior chamber depth in association with acute onset of pain, redness and reduced vision. Chronic PACG was diagnosed in patients with PACG in whom the acute symptoms of angle closure were lacking.

5. Pseudoexfoliative glaucoma was defined as open angle glaucoma associated with pseudoexfoliative material on the peripheral part of the anterior capsule of the crystalline lens; and Sampaolesi line [one or more waves of pigment accumulated on the posterior face of the cornea anterior to Schwalbe's line in the lower area of the chamber angle between 4 and 8 o'clock], hyperpigmented trabecular meshwork and pseudoexfoliative material in the angle recess on gonioscopy.
6. Secondary glaucoma (other than pseudoexfoliative glaucoma) was diagnosed in a patient with increased IOP and changes suggestive of glaucomatous optic neuropathy in the presence of any ocular (other than pseudoexfoliation syndrome) or systemic problems predisposing to glaucoma. It was further classified as open angle and angle-closure secondary glaucoma based on gonioscopic findings. Secondary open angle glaucoma (SOAG) includes aphakic glaucoma and angle recession glaucoma; and secondary angle closure glaucoma (SACG) includes phacomorphic glaucoma, uveitic angle closure glaucoma and neovascular glaucoma (NVG). In phacomorphic glaucoma, assessment of the optic disc was not possible because of media opacity, and therefore the diagnosis of glaucoma was based on high IOP (at least 30 mmHg (99.5th percentile of normal[4]) and visual acuity less than 3/60 in addition to the slit lamp biomicroscopic finding of hypermature and/or intumescent cataract. Uveitic glaucoma was diagnosed in eyes with glaucomatous optic nerve damage and active or history of anterior segment inflammation and damage. If active inflammation was not present, the diagnosis of uveitis was

made if there was evidence of previous inflammation e.g., posterior synechiae, keratic precipitates in the absence of previous laser or incisional ocular surgery. Neovascular glaucoma was diagnosed in eyes with glaucomatous optic neuropathy with the presence of neovascular proliferation on the iris and/or in the anterior chamber angle. Traumatic angle recession glaucoma was diagnosed in eyes with glaucomatous optic nerve damage and widening of the ciliary body band and scleral spur on gonioscopy in the presence of history or clinical findings consistent with ocular trauma.

Other operational definitions:

1. Asymmetric glaucoma was defined as a glaucomatous optic neuropathy where there was more than 0.3 VCDR difference between the two eyes.
2. Eyes with CDR of more than 0.80 (the 99.5th percentile of vertical CDR varies between 0.7 and 0.85[4]) and/or best corrected visual acuity (BCVA) of 3/60 or less due to glaucomatous optic neuropathy were classified as having advanced glaucoma. If a patient had the above features in one eye only, s/he was classified as having unilaterally advanced glaucoma and if these changes were present in both eyes the patient was classified as having bilaterally advanced glaucoma.
3. A patient with BCVA of 3/60 or less in the worse eye was defined as having unilateral blindness.
4. A patient with BCVA of 3/60 or less in the better-seeing eye was defined as having bilateral blindness.

5. A patient was defined as having unilateral low vision if the BCVA was better than 3/60 but less than 6/12 in the worse eye.
6. A patient was defined as having bilateral low vision if the BCVA was better than 3/60 but less than 6/12 in the better-seeing eye.
7. A patient was defined as having normal visual acuity if the BCVA was better than 6/18 in the worse eye.

Limitations of the study

1. Visual field tests using the standard perimetric procedures were not performed because of lack of the appropriate equipment.
2. Glaucoma suspects were excluded from this survey because this study was meant for determining the types of glaucoma in a cross-sectional design.
3. Cases with presumed congenital glaucoma were also excluded owing to the fact that facilities for examination under anesthesia were not available in the hospital during the study period.

Ethical considerations

Ethical clearance was granted by the Ethical Review Board of the Collage of Public Health and Medical Sciences of Jimma University. Free and informed verbal consent was obtained from each participant or parent or guardian of a patient 18 years of age or younger.

Results

A total of 335 consecutive patients with glaucoma were seen between April 1, 2007 and March 30, 2008 in the department of ophthalmology of Jimma University Specialized Hospital (JUSH). The mean (SD) age of the study patients was 57.0 (12.7) years (range, 8-90 years) and median age was 60 years. Most of them were males (72.8%), married (88.9%), Oromo (54.0%), Muslim (55.5%), illiterates (67.5%) and farmers (49.6%). Majority of them came from farther than 50 kilo meters from the hospital (55.8%) and didn't pay for their health care costs as these expenses were covered by the government (72.8%) (Table 1).

Table 1. Sociodemographic characteristics of patients with glaucoma in Jimma University Specialized Hospital (JUSH), 2009 (n=335).

Characteristics	no (%)
Sex	
Male	244(72.8)
Female	91(27.2)
Age (Years)	
<20	5(1.5)
20-29	1(0.3)
30-39	14(4.2)
40-49	52(15.5)
50-59	89(26.6)
60-69	117(34.9)
70-79	46(13.7)
≥80	11(3.3)
Marital status	
Married	298(88.9)
Single	22(6.6)
Divorced	4(1.2)
Widow	11(3.3)
Ethnicity	
Oromo	181(54.0)
Amhara	63(18.8)
Keficho	21(6.3)
Dawro	16(4.8)
Yem	11(3.3)
Gurage	12(3.6)
Others[†]	31(9.3)
Religion	
Muslim	186(55.5)
Christian	147(43.9)
Others[‡]	2(0.6)
Educational level	
Illiterate	226(67.5)
Read & Write only	38(11.3)
1-4 grade completed	22(6.6)

5-8 grade completed	30(8.9)
9-12 grade completed	15(4.5)
Collage education	4(1.2)
Occupation	
Farmer	166(49.6)
None	55(16.4)
Housewife	41(12.2)
Govt employee	35(10.4)
Merchant	22(6.6)
Others[§]	16(4.8)
Distance of residence from hospital (km)	
<10	30(9.0)
10-20	50(14.9)
21-50	68(20.3)
51-100	73(21.8)
101-200	44(13.1)
>200	70(20.9)
Health care cost	
Government	244(72.8)
Self	91(27.2)

[†]Anuak (10), Nuer (9), Silti (4), Tigre (4), Shakicho (2), Wolayta (2)
[‡]traditional religion (1), no religion (1)
[§]daily laborer (8), pensioner (5), Imam/Priest (3)

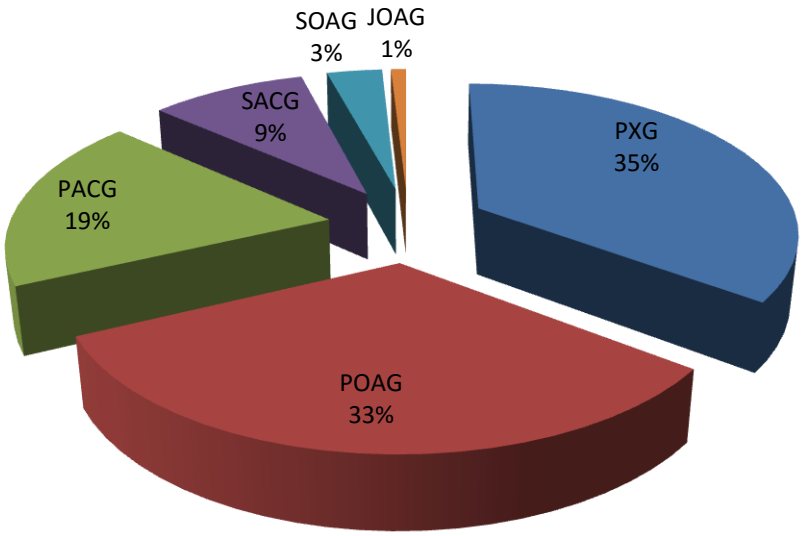
Primary glaucomas accounted for 52.2% of all cases, while the remaining 47.8% were secondary glaucomas. The two most common types of glaucoma observed were pseudoexfoliative glaucoma (PXG) (35.2%) and primary open angle glaucoma (POAG) (32.8%). Primary angle closure glaucoma (PACG) accounts for 18.5% of all the glaucomas. Less frequently observed types of glaucoma were secondary angle closure glaucomas (9.3%), secondary open angle glaucomas (3.3%) and Juvenile open angle glaucoma (0.9%). The POAG to PACG ratio was 110:62 (Table 2). The percentage of glaucoma in children (age <16 years) was 0.6% (n=2). The age and sex distribution of the glaucoma types is presented in Table 2, Figure 1, 2 and 3.

Table 2. Age and gender distribution of patients with various glaucoma types in JUSH, 2009.

	POAG (n=110)	PXG (n=118)	JOAG (n=3)	PACG (n=62)	SOAG (n=11)	SACG (n=31)	Total (N=335)
Age range							**no(%)**
<20 yrs	-	-	3	-	0	2	**5(1.5)**
20-29 yrs	-	-	0	1	0	0	**1(0.3)**

30-39 yrs	7	-	-	4	1	2	**14(4.2)**
40-49 yrs	18	8	-	21	1	4	**52(15.5)**
50-59 yrs	27	31	-	19	4	8	**89(26.6)**
60-69 yrs	40	54	-	12	3	8	**117(34.9)**
70-79 yrs	15	21	-	5	0	5	**46(13.7)**
≥80 yrs	3	4	-	0	2	2	**11(3.3)**
Mean age (SD)	57.1 (12.0)	61.3 (9.6)	15.3 (5.5)	51.1 (10.4)	58.1 (14.5)	55.1 (17.2)	**57.0 (12.7)**
Sex							
Male	76	100	2	36	7	23	**244**
Female	34	18	1	26	4	8	**91**
M:F ratio	2.2:1	5.6:1	2:1	1.4:1	1.8:1	2.9:1	**2.7:1**

Figure 1. Glaucoma types in JUSH, 2009 (n=335)



PACG: acute PACG (31), chronic PACG (31).

SACG: phacomorphic (22), uveitic (5), NVG (4).

SOAG: Uveitic glaucoma (3), aphakic glaucoma (3), Traumatic angle recession (2), NVG (3).

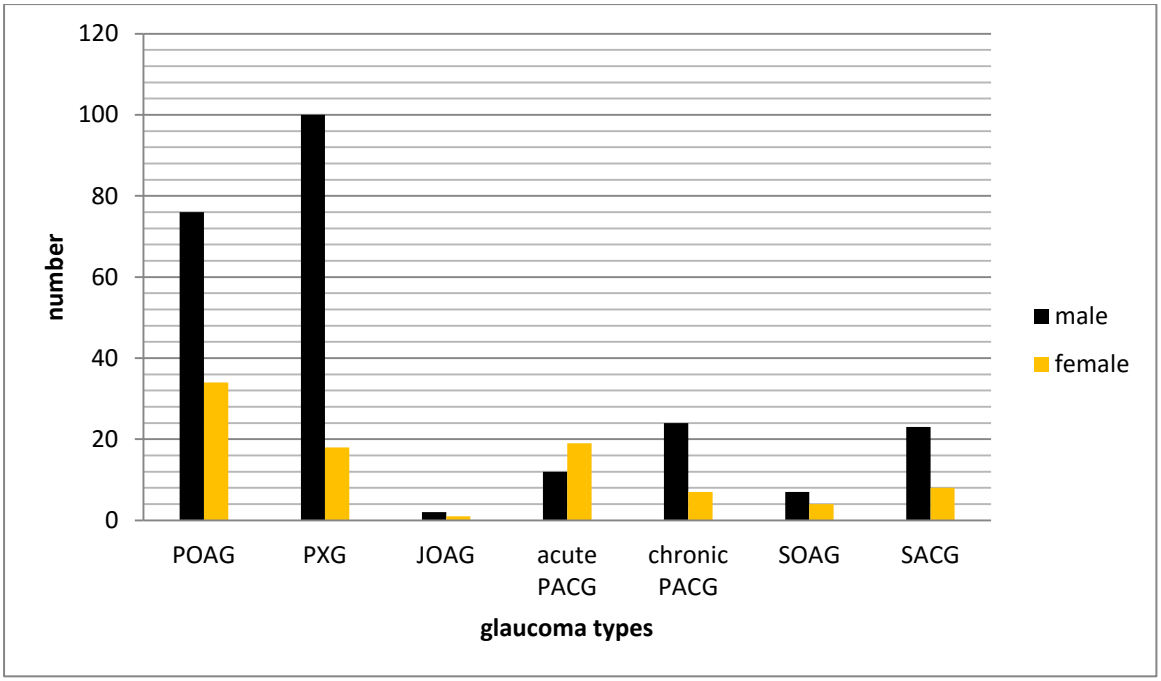


Figure 2. Gender distribution of patients with various glaucoma types in JUSH, 2009(n=335).

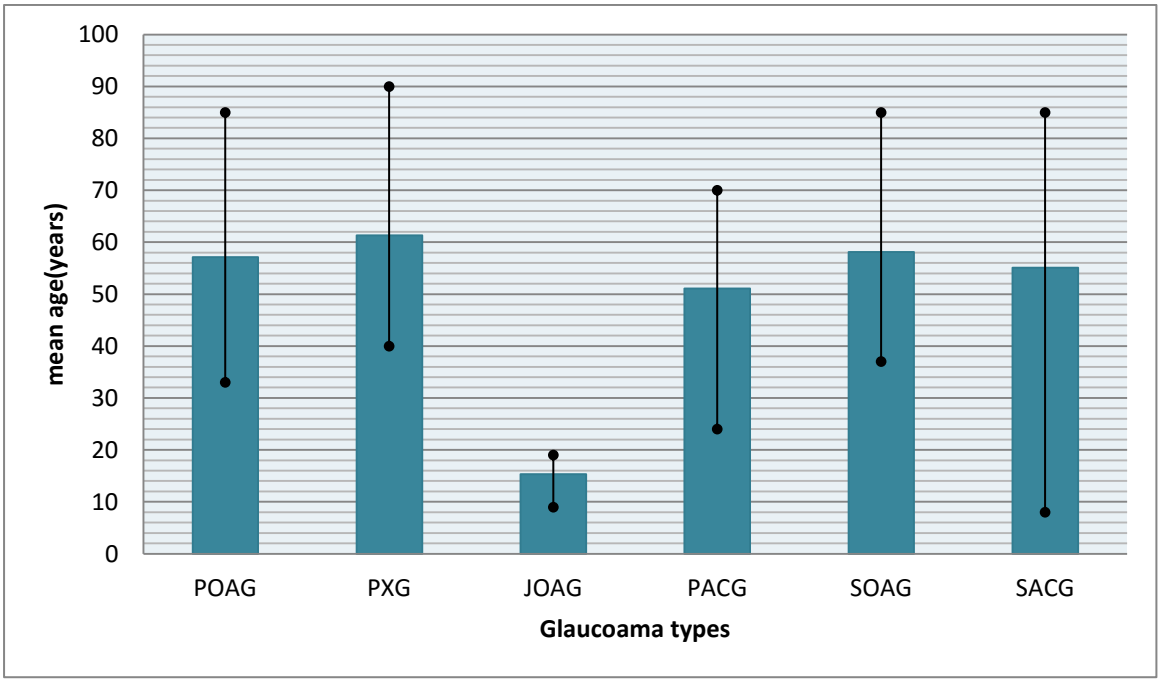


Figure 3. Age Distribution of patients with various glaucoma types in JUSH, 2009 (n=335).

Glaucoma was present in both eyes of 225 (67.2%) patients, while the remaining 110 (32.8%) had a unilateral glaucoma. Among the bilateral cases, optic neuropathy was

asymmetric in 16.5% (37/225) of patients. Advanced glaucoma was present in both eyes of 31.9% of patients, and in one eye only of 60% of patients. Table 3 shows the percentage distribution of laterality, asymmetry and severity of disease in relation to the glaucoma subtypes.

Table 3. Laterality, asymmetry and severity of disease in relation to the type of glaucoma in JUSH, 2009.

	POAG (n=110)	PXG (n=118)	JOAG (n=3)	PACG (n=62)	SOAG (n=11)	SACG (n=31)	Total (N=335)
Laterality							
Unilateral	9(8.2)	37(31.4)	0(0.0)	31(50.0)	9(81.8)	24(77.4)	**110(32.8)**
Bilateral	101(91.8)	81(68.6)	3(100.0)	31(50.0)	2(18.2)	7(22.6)	**225(67.2)**
Asymmetric disease[§]	14(14.0)	14(17.3)	0(0.0)	8(25.8)	1(14.3)	0(0.0)	**37(16.5)**
Advanced disease							
Unilaterally advanced	59(53.6)	73(61.9)	1(33.3)	39(62.9)	6(54.5)	23(74.2)	**201(60.0)**
Bilaterally advanced	41(37.3)	39(33.1)	2(66.7)	16(25.8)	3(27.3)	6(19.4)	**107(31.9)**
Not advanced	10(9.1)	6(5.1)	0(0.0)	7(11.3)	2(18.2)	2(6.5)	**27(8.1)**

[§]The values indicate number and percentage distribution of asymmetric disease among those who had bilateral glaucoma.

Overall, 56.1% and 23.9% of the study patients were unilaterally and bilaterally blind due to glaucoma, respectively. Unilateral and bilateral low vision due to glaucoma were present in 6.6% and 7.5% of patients, respectively (Figure 4). Unilateral blindness was present in 54.3% of the primary and 55.6% of the secondary glaucomas, while bilateral blindness was present in 24.6% of the primary and 25.6% of the secondary glaucomas. The visual acuity in relation to the type of glaucoma is presented in Table 4.

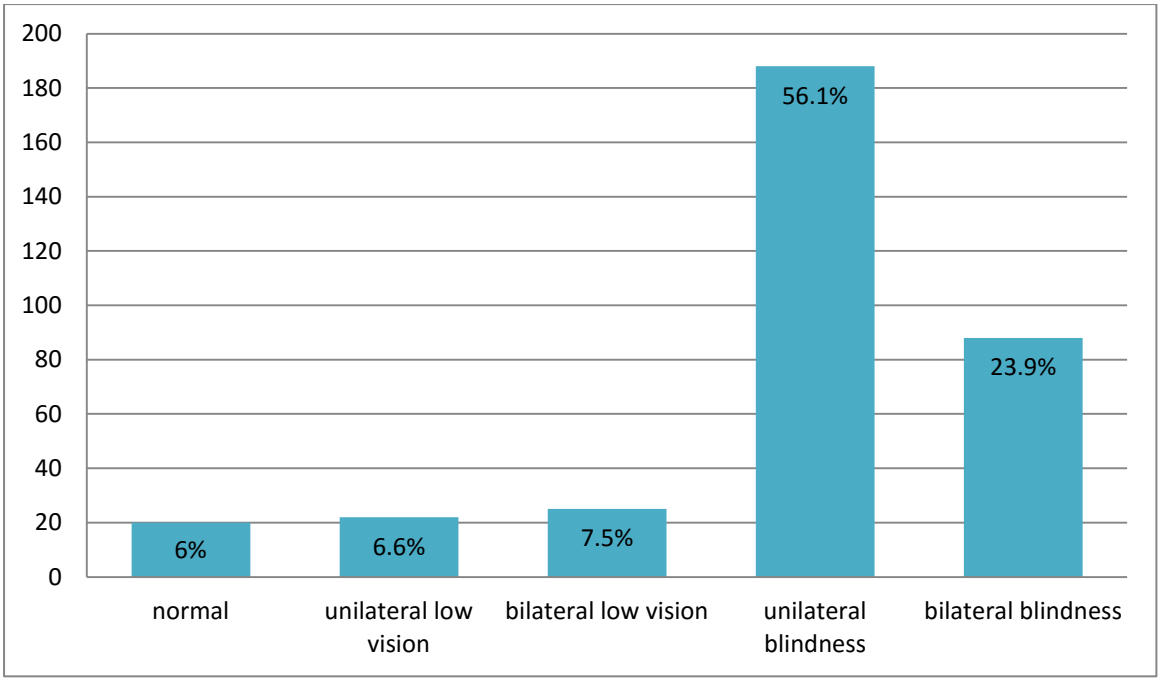


Figure 4. Visual acuity of patients with glaucoma in JUSH, 2009 (n=335).

Table 4. Visual acuity of patients with glaucoma in relation to the type of glaucoma in JUSH, 2009 (n=335).

	Vision				
Glaucoma type	Normal (n=20)	Unilateral Low vision (n=22)	Bilateral Low vision (n=25)	Unilateral Blindness (n=188)	Bilateral Blindness (n=80)
POAG	10(50.0)	6 (27.3)	10(40.0)	57(30.3)	27(33.8)
PXG	6(30.0)	10(45.5)	10(40.0)	65(34.6)	27(33.8)
JOAG	1(5.0)	0(0.0)	0(0.0)	1(0.5)	1(1.3)
PACG	3(15.0)	3(13.6)	4(16.0)	37(19.7)	15(18.8)
SOAG	0(0.0)	2(9.1)	0(0.0)	5(2.7)	4(5.0)
SACG	0(0.0)	1(4.5)	1(4.0)	23(12.2)	6(7.5)

POAG

POAG was diagnosed in 32.8% of all patients with glaucoma in JUSH. Nearly 70% of them were males. The age of most cases with POAG was between 60 and 69 years of age (36.4%) and the mean age at diagnosis was 57.1 ± 12.0 years (Table 2). Nearly a quarter of patients

with POAG (24.5%) were bilaterally blind and 51.8% were unilaterally blind making POAG being responsible for 32.1% of bilaterally and 31.0% of unilaterally blind glaucoma patients in the hospital (Table 4). Bilateral glaucoma was present in 91.8% of POAG patients; only 9 out of the total 102 POAG patients had glaucoma in one eye only at initial presentation. It was asymmetric in 14.0% (14/101) and advanced at presentation in both eyes of 53.6% and one eye of 37.3% of POAG patients (Table 3).

Patients with juvenile open angle glaucoma (JOAG) accounted for 0.9% (n=3) of all glaucoma patients: two males and one female. Mean age of diagnosis was 15.3 (SD 5.5) years.

PACG

Half of the cases with PACG were acute (31/62) while the remaining half were chronic cases. Thirty six of the 62 patients (58.1%) with PACG were males. Females comprised 61.3% (19/31) of patients with acute PACG, while only 22.6% (7/31) of chronic PACG. The gender difference between patients with acute and chronic PACG was statistically significant ($p<0.005$) (Table 5). The mean age of diagnosis of patients with acute PACG was 48.0 years and that of chronic PACG was 54.2 years. Six of the seven patients with bilateral acute PACG presented when the second eye was involved. One patient had both eyes involved simultaneously with acute attack. Most patients with acute PACG (24/31) presented in post-congestive state. Only 3 of the 31 patients with CACG had had symptoms suggestive of intermittent angle closure. Nearly 60% of PACG cases were unilaterally and 24.2% bilaterally blind. Acute PACG caused 62.2% (23/37) unilateral blindness and 20% (3/15) of bilateral blindness among the PACG cases. Overall, PACG was responsible for 20.1% of unilateral and 17.9% of bilateral glaucoma blindness in JUSH (Table 5). In 50% (n=31) of patients with PACG both eyes were affected. Of all patients with chronic PACG, 25.0% (6/24) had asymmetric

glaucoma; 45.2% (14/31) advanced glaucoma in both eyes and 35.5% (11/31) advanced glaucoma in one eye only (Table 4). No statistically significant differences between chronic PACG and POAG patients in regards to age, sex as well as selected clinical parameters like laterality, symmetry and severity were found (Table 6).

Table 5: Comparison of selected parameters of patients with acute and chronic PACG in JUSH, 2009.

	Acute PACG (n=31)	**Chronic PACG (n=31)**	**Odds ratio(95% CI)**	**p-value**
Mean age (SD)	48.0 (9.5)	54.2 (10.5)	6.2(1.1,11.3)	**p=0.0178**
Sex			0.19(0.05,0.63)	**p<0.005**
Male	12	24		
Female	19	7		
Unilateral disease			11.2(3.1,46.2)	
Yes	24	7		**p<0.001**
No	7	24		
Bilateral advanced disease			0.09(0.01,0.45)	**p<0.005**
Yes	2	14		
No	29	17		
Asymmetric disease[§]			1.2(0.1,10.1)	**p=.8410**
Yes	2	6		
No	5	18		
Unilateral advanced disease			3.6(1.1,12.9)	**p=.01797**
Yes	24	15		
No	7	16		
Unilateral blindness			3.4(1.1,11.8)	
Yes	23	14		**p<0.05**
No	8	17		
Bilateral blindness			0.17(0.03,0.77)	
Yes	3	12		**p=.00761**
No	28	19		

[§]only subjects with bilateral disease

Table 6: Comparison of selected parameters of patients with POAG and chronic PACG in JUSH, 2009.

	POAG (n=110)	Chronic PACG (n=31)	Odds ratio (95% CI)	p-value
Mean age (SD)	57.1 (12.0)	54.2 (10.5)	1.31(-1.52,7.32)	**p=.1656**
Sex				
Male	76	24	0.65(0.24, 1.63)	**p=.3812**
Female	34	7		
Unilateral disease				
Yes	9	7	0.31(0.10,0.96)	**p=.0672**
No	101	24		
Bilateral advanced disease				
Yes	41	11	1.08(0.47, 2.56)	**p=.8553**
No	69	20		
Asymmetric disease[§]				
Yes	14	6	0.49(0.17,1.54)	**p=.3034**
No	87	18		
Unilateral advanced disease	59	14	1.40(0.63,3.18)	**p=.4042**
Yes	51	17		
No				
Unilateral blindness				
Yes	57	14	1.30(0.58,2.95)	**p=.6520**
No	53	17		
Bilateral blindness				
Yes	27	12	0.52(0.22,1.23)	**p=.1195**
No	83	19		

[§]only subjects with bilateral disease

PXG

Patients with PXG accounted for 35.2% of all patients with glaucoma. Fifty four (45.8%) patients with PXG were in their seventh decade of life; and the mean age at diagnosis was 61.3 (SD 9.6) years. Majority of them were males (84.7%) (Table 3). Over 50% of PXG patients (65/118) were unilaterally blind and 24.1% were bilaterally blind making PXG being responsible for 35.3% of unilateral and 32.1% of bilateral blindness among glaucoma patients in JUSH (Table 4).

One eye only was affected in 31.4% (37) of patients with PXG. It was asymmetric in 17.3% (14/81) of bilateral cases. Glaucomatous optic neuropathy was advanced in both eyes of 33.1% of patients and one eye only of 61.9% of patients with PXG (Table 3). Patients with PXG were significantly older than those with POAG (p<0.005) with male dominance (p<0.005). Unilateral disease was significantly more common among patients with PXG than POAG (p<0.0001) (Table 7).

Table 7: Comparison of selected parameters of patients with POAG and PXG in JUSH, 2009.

	POAG (n=110)	**PXG (n=118)**	**Odds ratio(95% CI)**	**p-value**
Mean age (SD)	57.1 (12.0)	61.3 (9.6)	4.2(1.4,7.0)	**P<0.005**
Sex			0.4(0.2,0.8)	**p=.0052**
Male	76	100		
Female	34	18		
Unilateral disease			0.2(0.1,0.5)	**p<0.0001**
Yes	9	37		
No	101	81		
Bilateral advanced disease			1.2(0.7,2.2)	**p=.5045**
Yes	41	39		
No	69	79		
Asymmetric disease[§]			0.8(0.3,1.8)	**p=.5248**
Yes	14	14		
No	87	67		
Unilateral advanced disease			0.7(0.4,1.3)	**p=.2090**
Yes	59	73		
No	51	45		
Unilateral blindness			0.9(0.5,1.5)	
Yes	57	65		**P=.6212**
No	53	53		
Bilateral blindness			1.1(0.6,2.1)	
Yes	27	27		**P=.7677**
No	83	91		

[§]only subjects with bilateral disease

Secondary glaucomas

Phacomorphic glaucoma was the most frequently identified cause of secondary glaucoma comprising 52.4% (22/42) of all secondary glaucomas (excluding exfoliative glaucoma). Five patients with phacomorphic glaucoma had presented when the second eye was affected. Glaucoma secondary to chronic uveitis was diagnosed in 8 patients; five of them had peripheral anterior synechiae with closed angles. The disease was bilateral in half (n=4) of the uveitic cases. Three patients with glaucoma in aphakia were diagnosed. All the patients with aphakic glaucoma had open angles and unilateral glaucomatous optic neuropathy. Two patients had unilateral glaucoma secondary to angle recession. One of these patients admitted history of trauma to the eye with a football in young age while the other patient denied any history of trauma despite the finding of a widened ciliary body band and sclerap spur on gonioscopy.

The remaining 7 cases with secondary glaucoma were neovascular glaucoma (NVG), making the contribution of NVG to 2.1% of all glaucomas. All patients with NVG had unilateral disease. In 4 out of the 7 patients, angle closure was the underlying mechanism. The cause of NVG was advanced diabetic eye disease in 3 patients, central retinal vein occlusion in 3 patients, and presumed to be Coats' disease in the remaining 1 patient.

Miscellaneous findings

The commonest presenting symptom among patients with glaucoma was reduced vision (81.8% of patients). Eye pain was the chief presenting complaint in 16.7% of patients. Glaucoma was diagnosed in 3 asymptomatic individuals who came for reading glasses and another 2 who were referred for diabetic eye care.

The overall mean IOP was 32.6 (SD 11.2), and the overall mean VCDR was 0.96 (SD 0.11). The proportion of blind eyes among glaucoma patients was 50.4% and the ratio of blind to non-blind eyes was 1.02:1 (Table 8).

Nearly 45% (149 patients) of all study subjects had pseudoexfoliation syndrome (PXS). In 79.9% of them the PXS was bilateral. The mean age of subjects with PXS was 62.3 (SD 9.5) years, and 81.9% of them were males.

Table 8. Distribution of mean vertical cup-to-disc ratio (VCDR), mean intraocular pressure (IOP) and proportion of blind eyes in relation to glaucoma types in JUSH, 2009 (n=335).

	POAG (n=110)	PXG (n=118)	JOAG (n=3)	PACG (n=62)	SOAG (n=11)	SACG (n=31)	Total (N=335)
VCDR† (Mean ± SD)	0.95±0 .13	0.97±0 .09	0.97±0 .06	0.96±0 .12	0.96±0 .09	0.88±0 .29ǂ	0.96±0.11
IOP § (Mean ± SD)	26.4±5.2	31.0±6.5	32.7±10.7	41.2±15.2	27.6±3.0	45.3±13.5	32.6±11.2
Blind eyes(%)	45.9	50.4	50.0	54.0	59.1	56.7	50.4
Blind:non-blind eyes	0.85:1	1.02:1	1.0:1	1.18:1	1.45:1	1.30:1	1.02:1

†When both eyes of a patient had glaucomatous optic neuropathy, the higher CDR of the two was taken.

ǂ the optic discs of 25 eyes of patients with unilateral disease were not visible due to media opacity.

§When both eyes of a patient had high IOP, the higher measurement of the two was taken.

Discussion

The distribution of the types of glaucoma is not uniform among various ethnic groups and across different geographic locations. In Caucasians, POAG is the most common type of glaucoma accounting for 75-95% of the primary glaucomas whereas in Asians and Eskimos angle closure accounts for 80-90% of the primary glaucomas.[29] Ethnic variation as a factor for differences in the frequency of subtypes of glaucoma is reflected by studies reported from some countries of Asia. A clinic-based study in a referral ophthalmic practice in Northern India revealed PACG as the most common type of glaucoma,[20] whereas clinic-based studies in Thailand[22] and Saudi Arabia[23] found POAG as the most frequent type of glaucoma. On the other hand, NTG was the most prevalent glaucoma subtype in a Japanese survey[25] as well as among a large Japanese American clinic population.[24] It is widely accepted that the predominant form of primary glaucoma in sub-Saharan Africa and people of African origin is open angle.[16,17] However, differences are expected due to large variations in genetic, ethnic and environmental factors.

In our study PXG was found to comprise slightly over a third of glaucoma cases. We also documented that 44.5% (149 patients) of patients in this study had pseudoexfoliative material (PXS) in the anterior segment of their eyes (79.9% of them had bilateral PXS). Previous studies conducted in Menelik II hospital, Addis Ababa, Ethiopia reported that 25% of new glaucoma patients[30] and 39% of patients scheduled for cataract surgery had PXS.[31] A recent retrospective study from the same hospital reported PXG accounting for 11.3% of all glaucomas.[18] In Northern Europe, PXG accounts for 50 to 60% of open angle glaucomas, whereas PXS and PXG are not common in Africans and people of African origin.[32]

It is noteworthy that the presence of PXS in addition to glaucomatous optic neuropathy was not the only criterion to diagnose PXG in our study as PXS is common in Ethiopian patients. The additional findings of trabecular hyperpigmentation, Sampaolesi line and pseudoexfoliative material in the anterior chamber angle recess were also taken as other criteria to make the diagnosis of PXG, because it is known that glaucoma is associated with the severity of exfoliation and the magnitude of trabecular hyperpigmentation.[33,34]

Our patients with PXG were on average older than the POAG patients (61.3 v 57.1 years) ($p<0.0001$), the male to female ratio was higher (5.6:1 v 2.2:1) ($p<0.005$). Unilateral disease (31.4% v 8.2%) was significantly more common among patients with PXG ($p<0.0001$). Asymmetric glaucomatous optic neuropathy was more common among patients with PXG as compared to POAG (20.9% vs. 16.1%) though the difference does not reach statistical significance ($p=.5248$). Male preponderance among PXG patients was observed in a clinic-based study in Greece.[36] The PXG patients in that study were on average older than our patients with PXG (68.2 years vs. 61.3 years).

The mean age of POAG diagnosis in our study is noted to be over a decade earlier than in Caucasian race (57.1 v 69.1 years) and over 5 years earlier than in black Americans (63.7 years).[15] Over 37% of our patients with POAG had advanced disease in both eyes and nearly a quarter of them were bilaterally blind. It could be assumed that POAG has an earlier age of onset and rapid progression in Ethiopians. There is evidence that POAG presents earlier and progresses rapidly in Black Americans than in Whites and is more likely to result in irreversible blindness.[16] The advanced stage of disease in relatively younger patients in this study could also be due to shorter life expectancy of Ethiopians (52.9 years).[36]

This study showed that all types of glaucoma except acute PACG were commoner in males than in females. The difference in our setting could likely be due to unequal health service utilization rather than a true gender difference in prevalence of glaucoma types. It is, however, interesting to note that acute PACG, but not the chronic form, showed a statistically significant female preponderance (M:F ratio=0.6:1) ($p<0.005$). Similar finding was reported from a clinic-based study in India.[20]

PACG in our study make up 18.2% of all glaucomas, and 34.3% of the primary glaucomas. This is higher than that in whites (17%) as well as blacks (13%), but lower than people of mixed ethnic background (46.7%) in a hospital-based study in Cape Town, South Africa.[37] The proportion in our study is also higher than that reported in a similar study in Ghana (6.6%).[26] PACG accounted for 58.9% of the primary glaucomas in clinic glaucoma population in Northern India.[20] It is interesting that the demographic and clinical parameters between patients with POAG and chronic PACG are not statistically significantly different in this study. We cannot overemphasize the expertise of gonioscopy in the management of glaucoma patients as these two types of chronic glaucoma share similar clinical features despite distinct pathophysiologic, therapeutic and prognostic features.

We found asymmetric disease in 14.0% of patients with POAG. Asymmetric glaucoma was reported in 13% of patients in an Indian study.[20] In the Blue Mountains Eye Study, Australia, 10% of POAG cases had asymmetric disease.[21]

Advanced POAG at presentation was seen in 18.5% of Caucasian patients and 33.3% of black patients in a Wilmer Eye clinic (USA) study.[15] We documented advanced glaucoma in both eyes of 37.3% of POAG, 33.1% of PXG and 25.8% of PACG patients. One can rightly assume that these patients are at risk of losing their sight from glaucomatous optic atrophy.

Confounding this is the poor compliance to treatment observed among glaucoma patients in JUSH (data not shown).

Bilateral blindness from glaucoma was documented in 24.5% of POAG, 22.9% PXG and 18.8% of PACG. These numbers would have been higher if visual field loss had been part of the definition of glaucoma in this study. Overall, 23.9% of all of our patients with glaucoma were bilaterally blind according to the WHO definition (best corrected visual acuity ≤3/60 in the better-seeing eye).[38] This is much higher than those reported from clinic-based studies in Thailand (0.015%)[22] and Saudi Arabia (11.3%).[23] Nearly 9% of all POAG and 14% of PACG patients were bilaterally blind in an Indian study.[20] Unilateral or bilateral blindness was reported in 41.4% of patients with glaucoma from the Menelik II hospital study, Addis Ababa. [18] Fifty two per cent of eyes were already blind at presentation in a retrospective study of glaucoma patients in North-East Ghana.[39] This is nearly similar to the finding in our study (54.3%).

Table 9 summarizes comparison of the distribution of glaucoma subtypes in our study with those reported in similar studies.

Table 9: Comparison of the percentage distribution of subtypes of glaucoma in the current study with other similar studies.

Author (year)	Country	Study design (no of study subjects)	POAG	PXG	PACG	JOAG	Secondary (other than PXG)
Current study	Southwestern Ethiopia	*Consecutive 1-yr (335)*	32.8	35.2	18.5	0.9	12.6
Pekmezci (2009)[24a]	US (Japanese Americans)	*Retrospective 10-yr (112)*	16.9	0.0	1.8	0.0	9.0
Eid (2008)[23b]	Saudi Arabia	*Retrospective 1-yr (417)*	38.1	5.3	28.5	0.0	25.2
Sothornwit (2008)[22c]	Thailand	*Cross-sectional (106)*	33.0	0.6	23.0	6.6	16.0
Melka (2006)[18d]	Central Ethiopia	*Retrospective 3-yr (1586)*	39.7	11.3	17.9	0.0	26.7

Das (2004)[20e]	Northern India	*Retrospective 5-yr (2425)*	21.6	0.005	36.6	3.4	6.7
Herndon (2002)[26f]	Ghana	*consecutive patients(198)*	44.2	0.0	6.6	1.0	5.0

[a]The remaining 2.7% of cases had mixed-mechanism glaucoma (defined in the study as a progressive glaucoma in patients with a history of narrow-angle and laser iridotomy), and the large majority (69.6%) were NTG.

[b]The remaining 2.9% glaucoma types were congenital.

[c]The remaining 16% were NTG. The authors reported 31 glaucoma suspect cases.

[d]The remaining 2.1% were cases of congenital glaucoma.

[e]The remaining 0.6% were NTG.

[f]The authors reported the remaining large group of patients as glaucoma suspects (30.5%), and indeterminate (12.7%).

It is to be noted that 17 eyes of 17 patients and 4 eyes of 2 patients in our study had high IOP, but below 30 mmHg, the 99.5th percentile of the population.[4] In addition, it was not possible to examine the fundus in 15 eyes due to cataract, and in the remaining 6 eyes corneal opacities precluded examination of both the fundus and the anterior chamber angle. Therefore, the data from these patients were excluded from the above analyses.

One of the limitations of this study is the absence of visual field tests which could possibly resulted in underestimation of the number of glaucoma patients. The importance of field testing of every participant is illustrated in the St. Lucia survey. Humphrey threshold 30-2 fields were performed on every third individual in the sample, whereas in the remainder only IOP and disc examination were carried out. A subsample of 299 people from those who did not have field tests initially, and who had been declared ‘normal’ on the basis of IOP and

disc appearance, were then field tested; of these, 32 (10.7%) had field defects consistent with glaucoma.[6]

The diagnostic criteria used in this study were strictly applied and it is fairly certain that virtually all cases identified as glaucoma were genuine. The proportion of the glaucoma types in this study change very little if we shift the cutoff point for the minimum disc requirement from a vertical CDR of at least 0.7 up to at least 0.9. (Table 10).

Table 10. The effect of changing the diagnostic algorithm on the proportion of glaucoma types in JUSH, 2009.

All cases (N=335)	**POAG (n=110)**	**PXG (n=118)**	**JOAG (n=3)**	**PACG (n=62)**	**SOAG (n=11)**	**SACG§ (n=31)**
%	32.8	35.2	0.9	18.5	3.3	9.3
Cases with VCDR ≥0.9 (N=314)	**POAG (n=101)**	**PXG (n=111)**	**JOAG (n=3)**	**PACG (n=60)**	**SOAG (n=10)**	**SACG (n=29)**
%	32.2	35.4	1.0	19.1	3.2	9.2

§ In 25 eyes, the optic discs were not visible and glaucoma diagnosis was made based on IOP ≥30 mmHg (above 99.5th percentile of the population) and visual acuity ≤ 3/60.

Conclusions

1. Our study showed that open angle glaucoma is more common than angle closure glaucoma in hospital population of southwestern Ethiopia.
2. The proportion of angle closure glaucoma appears to be lower than that in South East Asians but much higher than other African hospital population.
3. The finding that PXG is the commonest type of all glaucomas in the present clinic-based study is interesting. However, this needs to be substantiated with community-based studies representing all ethnic groups in the area.

4. Patients with POAG in this study are relatively young and tend to have advanced disease at initial presentation. Cohort studies are needed to see whether or not POAG has an earlier onset and rapid progression in Ethiopians.
5. Most of our patients with chronic glaucoma failed to present in early stages due to socioeconomic or other reasons which merits investigation. It is disturbing to observe that majority of our patients consider cataract as the only cause of gradual blindness, and come for 'cataract extraction' when they no longer are able to navigate by themselves.
6. Regarding acute angle closure glaucoma cases, it is very sad to see a large number of acute glaucoma (acute PACG and phacomorphic glaucoma) patients present in the post-congestive state with total visual loss and sever pain in the affected eye and or second eye involvement. Most of such patients reportedly had sought medical care in nearby health centers or private clinics and were prescribed antipain tablets and/or topical eye medications (mostly antibiotic or antibiotic-steroid drops or suspensions) and discharged home. We suspect than there is a severe lack of awareness of the manifestations of acute glaucoma among non-ophthalmic health care workers. Additionally, the referral system might be unnecessarily more bureaucratic.

Recommendations

1. The very high proportion of people with blindness due to advanced glaucoma at initial presentation is alarming. The conservative nature of the diagnostic criteria may explain the observed high proportion of blindness in glaucomatous eyes or it could likely be due to late presentation. However, prevention of glaucoma blindness

needs to be entertained in the national policies, in addition to other common causes of blindness in the country such as cataract and trachoma.

2. Public education through mass media and other means could be a cost-effective method to increase awareness about glaucoma and eventual health seeking behavior.
3. Short-term trainings for non-ophthalmic health workers to enable them manage acute congestive glaucoma is recommended in addition to the supply of essential and affordable antiglaucoma drugs necessary for the emergency management of acute glaucoma such as acetazolamide tablets, pilocarpine eye drops and timolol eye drops to even the lowest health facility.
4. Expanding outreach cataract campaigns may serve as a very good opportunity to raise public awareness about glaucoma and other blinding conditions. It has the added advantage of decreasing irreversible blindness from phacomorphic glaucoma in some patients.
5. Community-based screening for glaucoma is not recommended and is not used anywhere. However, opportunistic case detection may be appropriate by screening of people at risk, such as those 40 years and older who are seen for whatever reason in primary and secondary care clinics. In a study carried out at a hospital in South Africa of African patients aged 40 years and older; testing the pinhole visual acuity using a cut point of 6/18 in one or both eyes was found to be suitable for case detection of both cataract and glaucoma, with a sensitivity and specificity over 90%, a positive likelihood ratio higher than 10.0, a negative likelihood ratio less than 0.1, and accuracy greater than 90%. This test may be suitable for use by clinic nurses working in primary care clinics. Examination of the optic disk with a lens-free direct

ophthalmoscope using a cut point of 0.7 for the vertical CDR combined with testing for an afferent pupillary defect was, similarly, found to be suitable for case detection of glaucoma alone. This combination of tests may be suitable for use by ophthalmic nurses/assistants working in community health centers and district hospitals.[17] We believe that these screening methods can be adopted to our situation.

6. It is agreeable that the training of more ophthalmologists would improve the quality of care for not only patients with glaucoma but also patients with other eye diseases.
7. It is of paramount importance to further train at least one ophthalmologist in the field of glaucoma, as there is none in southwestern Ethiopia, in order to provide optimal services for glaucoma patients in this part of country.

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Questionnaire format for the collection of socio-demographic, clinical and other data of glaucoma patients seen from April 1, 2007 to March 30, 2008 in the Department of Ophthalmology of Jimma University Specialized Hospital.

I. Identification

1. Identification number _____
2. Date of examination [dd/mm/yyyy] ___/ ___/ _____
3. Area of residence_____
4. Health care cost **self/government**

II. Demographic data

5. Sex **Male/Female**
6. Age [years] _____
7. Marital status
   1. Married
   2. Single
   3. Divorced
   4. Widow
8. Ethnicity
   1. Oromo
   2. Amhara
   3. Keficho
   4. Dawro
   5. Yem
   6. Gurage
   7. Tigre
   8. Others, specify_____
9. Religion
   1. Muslim
   2. Orthodox Christian
   3. Protestant Christian
   4. Catholic Christian
   5. Traditional religion
   6. No religion
   7. Others, specify_____
10. Educational level
    1. Illiterate
    2. Read & write only
    3. 1-4 grade completed
    4. 5-8 grade completed
    5. 9-12 grage completed
    6. College education
    7. Others, specify_____
11. Occupation
    1. Farmer
    2. Housewife
    3. Government employee
    4. merchant
    5. none
    6. others, specify_____

III. Ophthalmic history and physical examination

12. Chief complaint(s)

	Right eye (OD)	**Left eye(OS)**
	1. reduction/loss of vision	1. reduction/loss of vision
	2. eye pain	2. eye pain
	3. eye redness	3. eye redness
	4. reading difficulty	4. reading difficulty

□ 5. others, specify_____□
□ 6. none

5. others, specify_____
6. none

13. How long chief complaints_____
14. Corrected distance visual acuity
OD_____
OS_____
15. IOP [mmHg]
OD_____
OS_____
16. Orbit

OD	**OS**
□a. Normal □	b. Normal
□ b. Abnormal, specify_____	□ b. Abnormal, specify_____

17. Lid

OD	**OS**
□ a. Normal □	a. Normal
□ b. Abnormal, specify_____	b. Abnormal, specify_____

18. Conjunctiva

OD	**OS**
a. Quite	□a. Quite
□ b. Perilimbal injection □	b. Perilimbal injection □
c. Others, specify_____	c. Others, specify_____

19. Episclera/sclera

OD	**OS**
□a. Normal □	a. Normal
□ b. Abnormal, specify_____	b. Abnormal, specify_____

20. Cornea

OD	**OS**
□ a. clear	□ a. clear
□ b. Edematous	□ b. Edematous
□ c. Opacity	c. Opacity
d. Krukunberg's spindle	□ d. Krukunberg's spindle
e. Keratic precipitates □	e. Keratic precipitates
□ f. Others, specify_____	f. Others, specify_____

21. Van Herick Anterior chamber (AC) grading

OD	**OS**
□ a. Grade 4	□a. Grade 4
□ b. Grade 3	□b. Grade 3
□ c. Grade 2	□c. Grade 2
□ d. Grade 1	□d. Grade 1
□ e. Grade 0	□e. Grade 0
□ f. can't comment, specify reason__	f. can't comment, specify reason__

22. AC flare

	OD		OS
	a. 0	□	a. 0
□	b. 1+	□	b. 1+
	c. 2+	□	c. 2+
□	d. 3+		d. 3+
□	e. 4+		e. 4+
□	f. can't comment__	□	f. can't comment__

23. AC cells

	OD		OS
□	a. 0		□a. 0
	b. 1+		□b. 1+
	c. 2+		□c. 2+
□	d. 3+		□d. 3+
□	e. 4+		□e. 4+
□	f. can't comment	□	f. can't comment

24. AC-other findings

	OD		OS
□	a. Hyphema	□	a. Hyphema
□	b. Lens material		b. Lens material
□	c. Vireous in AC		c. Vireous in AC
	d. Vitreous in pupillary plane		d. Vitreous in pupillary plane
□	f. Others, specify__	□	e. Others, specify__
□	g. None		f. None
□	h. can't comment___	□	g. can't comment___

25. Gonioscopy [*Shaffer grading]*

	OD	OS
□	a. Grade 4	a. Grade 4
	b. Grade 3	b. Grade 3
	c. Grade 2	c. Grade 2
□	d. Grade 1	d. Grade 1
□	e. Slit	e. Slit
□	f. Grade 0	f. Grade 0
□	g. can't comment	g.can't comment_____

26. Gonioscopy-other findings

	OD		OS
□	a. Neovascularization (NV)-iris		a. NV-iris
□	b. NV-angle		b. NV-angle
□	c. PXS-angle		c. PXS-angle
□	d. PAS	□	d. PAS
□	e. Sampoelesi	□	e. Sampoelesi
□	f. Hyperpigmentation	□	f. Hyperpigm
□	g. Angle recession		g. Angle recession
□	h. Others, Specify__		h. Others, Specify___
□	i. None	□	i. None
	j. can't comment_____		j. can't comment_____

27. Iris

OD	OS

	a. Normal		□a. Normal
□	b. Posterior synechiae, degree___	□	b. Posterior synechiae, degree____
	c. Patchy atrophy		□ c. Patchy atrophy
	d. Sectoral atrophy	□	d. Sectoral atrophy
	e. Rubeosis iridis		e. Rubeosis iridis
	f. Hyperpigmented	□	f. Hyperpigmented
	g. Hypopigmented		g. Hypopigmented
	h. Iris bombe		h. Iris bombe
	i. Others, Specify_____		i. Others, Specify_____
	j. can't comment, specify reason_____		j. Can't comment, specify reason_____

28. Pseudoexfoliation (PXS)

	OD		**OS**
	a. Yes, specify location_____		a. Yes, specify location_____
	b. No	□	b. No
	c. can't comment, specify reason_____	□	c. can't comment, specify reason

29. Pupil

	OD		**OS**
□	a. Normal		a. Normal
□	b. Abnormal, specify_	□	b. Abnormal, specify
□	c. can't comment, specify reason____	□	c. can't comment, specify reason

30. Lens

	OD		**OS**
	□a. Clear		a. Clear
□	b. Immature cataract		b. Immature cataract
□	c. Mature cataract	□	c. Mature cataract
□	d. Hypermature/intumesent		d. Hypermature/intumesent
□	e. Aphakia	□	e. Aphakia
□	f. Pseudophakia		f. Pseudophakia
□	g. Subluxation/luxation	□	g. Subluxation/luxation
	h. Cataract & ectopia		h. cataract & ectopia
	i. Others, Specify____	□	i. Others, Specify_____
□	j. can't comment_____		j. can't comment_____

31. Vitreous

	OD		**OS**
□	a. Normal		□a. Normal
□	b. abnormal, specify_____	□	b. abnormal, specify_____
	c. can't comment_____		□c. can't comment_____

32. Narrowest neuroretinal rim to disc ratio (between 11 and 1 o'clock or 5 and 7 o'clock)

		OD		**OS**
		a.0.1		a. 0.1
□	□	b. 0.2		b. 0.2
□	□	c. 0.3	□	c. 0.3
□		d. 0.4	□	d. 0.4
□	□	e. 0.5	□	e. 0.5

f. can’comment____ f. can’t comment____

33. Vertical cup-to-disc ratio (from between 11 and 1 o’clock and 5 and 7 o’clock)

	OD		**OS**
□	□a. 0.1		a. 0.1
□	□b. 0.2		b. 0.2
□	□c. 0.3	□	c. 0.3
□	d. 0.4	□	d. 0.4
□	□e. 0.5	□	e. 0.5
□	□f. 0.6		f. 0.6
□	□g. 0.7		g. 0.7
□	□h. 0.8		h. 0.8
□	i. 0.9	□	i. 0.9
□	j. 1.0	□	j. 1.0
□	k. Can’t comment□		k.can’t comment

34. Other optic disc changes

OD	**OS**
a. Diffuse NRR thinning	a. Diffuse NRR thinning
b. Hemorrhage	b. Hemorrhage
c. Peripapillary atrophy	c. Peripapillary atrophy

35. Nerve fiber layer

OD	**OS**
a. normal	a. normal
b. local atrophy	b. local atrophy
c. diffuse atrophy	c. diffuse atrophy
d. can’t comment_____	d. can’t comment_____

36. Macula

	OD	**OS**
□	a. Normal	□a. Normal
□	b. Abnormal, specify_____	□b. Abnormal, specify_____
	c. can’t comment	□c. can’t comment

37. Peripheral retina

	OD	**OS**
□	a. Normal	□ a. Normal
□	b. Abnormal, specify_____	□b. Abnormal, specify_____
□	c. Can’t comment	□ c. Can’t comment

IV. Glaucoma type

38. Glaucoma type

	OD		**OS**
□	1. POAG	□	1. POAG
□	2. PXG		2. PXG □
□	3. congestive PACG	□	3. Congestive PACG
□	4. Postcongestive PACG	□	4. Postcongestive PACG
□	5. Chronic ACG		5. Chronic ACG
	6. SOAG, specify___		6. SOAG, specify____

□	7. SACG, specify____		7. SACG, specify____
	8. Undetermined		8.Undetermined
□	9. Ocular HTN	□	9. Ocular HTN
□	10. No Glaucoma	□	10. No Glaucoma
□	11. Occludable angle	□	11. Occludable angle
	12. Undetermined	□	12. Undetermined