PATTERN OF GLAUCOMA AMONG ADULT SOMALI PATIENTS ATTENDING LIONS SIGHT FIRST EYE HOAPITAL NAIROBI, KENYA

A DISSERTATION PRESENTED IN PART FULFILLMENT FOR THE DEGREE OF MASTER OF MEDICINE (OPHTHALMOLOGY), UNIVERSITY OF NAIROBI

BY

DR. AL-SHABIBI AMAL AHMED SAEED

2010

DECLARATION

This thesis is my original work and has not been presented for a degree at any other university.

SIGNED:_____ Date:_____

Dr Amal Ahmed Saeed Al - Shabibi

APPROVAL

This dissertation has been submitted for examination with our approval as supervisors:

Dr. Dunera Rahel Ilako

MBchB (Nairobi), M. Med. Ophthal (Nairobi), MBA-Health (Durban), FEACO,

Senior Lecturer, Dept of Ophthalmology, UON

---------- ----------

(SIGNATURE) (DATE)

Dr. Millicent Kariuki

MBchB (Nairobi), M. Med. Ophthal (Nairobi), FEACO,

Lecturer, Dept of Ophthalmology, UON

---------- ----------

(SIGNATURE) (DATE)

Dr. Fayaz Khan

M.B.B.S.M Med Ophthalmology (NBI), FEACO,

Chief Ophthalmologist Lions Sight First Eye Hospital

---------- ----------

(SIGNATURE) (DATE)

DEDICATION:

This dissertation is dedicated to my lovely husband Mohamedsaadieq for all his support.

And to my Mum Hawa, Dad Ahmed and sister Sameera for their encouragement and prayers**.**

ABBREVIATIONS

ACG	Angle closure glaucoma
AC depth	Anterior Chamber depth
BRVO	Branch retinal vein occlusion
CCT	Central corneal thickness
CI	Confidence Interval
CRVO	Central retinal vein occlusion
CDR	Cup disc ratio
DM	Diabetes mellitus
DR	Diabetes retinopathy
HTN	Hypertension
HR	Hypertensive retinopathy
IOP	Intraocular pressure
Nd:YAG	neodymium-doped yttrium aluminium garnet
OAG	Open angle glaucoma
OR	Odds ratio

PACG	Primary open angle glaucoma
PAS	Peripheral anterior synechiae
PEX	Pseudoexfoliation
POAG	Primary open angle glaucoma
Ref.error	Refractive error
<	Less than
>	Greater than
≥	Greater than or equal to
≤	Less than or equal to

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ABSTRACT

Study design: Hospital based cross-sectional study

Objectives: To determine the patterns of Glaucoma among adult Somali patients in Lions First Sight Eye Hospital and to determine some of the associated risk factors related to open angle glaucoma and closed angle glaucoma for example: sex, age, family history, refractive error, Intra ocular pressure, Pseudoexfoliation, Hypertension and Diabetes mellitus.

Methods: Adult Somali patients with glaucoma above 16 years old underwent comprehensive eye evaluation including visual acuity, subjective and objective refraction, Humphrey visual field test, anterior segment examination with a slit lamp, central cornea thickness, AC depth, axial length, Intra ocular pressure, gonioscopy and fundus examination after pupil dilatation. Patients were classified broadly as Open angle glaucoma and Angle closure glaucoma following Foster's classification**.**

Results: A total of 64 adult patients were examined. There were 26 females (40.6%) and 38 males (59.4%). Majority of patients were over 50 years. The patterns of glaucoma found were 82.80% angle closure glaucoma and 17.2% of open angle glaucoma. 44 patients (67.7%) had IOP >21mmHg, 23 patients (35.9%) had pseudoexfoliation, 21 patients (32.8%) had refractive errors. CCT <520µm was found in 53 patients (82.8 %). Pseudoexfoliation and anterior chamber depth were the significant risk factors related to angle closure glaucoma**.** Risk factors which did not have a statistically significant relationship with glaucoma were diabetes, hypertension.

Conclusions: Angle closure glaucoma is the predominant pattern of glaucoma in Somali patients. Pseudoexfoliation and anterior chamber depth were the significant risk factors related to angle closure glaucoma**.**

Recommendations: Thorough screening of patients should be done to classify them appropriately. Central corneal thickness should be considered when measuring intra ocular pressure. Further studies are needed to ascertain the correlation between pseudoexfoliation and angle closure glaucoma.

1. INTRODUCTION AND LITERATURE REVIEW

Glaucoma is an optic neuropathy with a characteristic appearance on optic disc and specific pattern of visual field defect[20].Glaucoma is estimated to be the second most prevalent cause of blindness worldwide after cataract. [1] It is also the first leading cause of blindness among African Americans[2]. According to the 2002 World Health Organization model on blindness, glaucoma accounts for 12.3% of global blindness. In Somalis an extrapolated undiagnosed prevalence of glaucoma in 2004 was found to be 30,531 patient with chronic glaucoma, this is related to a population estimated used 8,304,601 in US[3].

There are several definitions for glaucoma based on various factors for example: genetic, etiological, time of onset and anatomical structural relationship, based on that glaucoma can be defined as primary, developmental, secondary and traumatic[20]. It can also be divided roughly into two main categories, "open angle" and "closed angle" glaucoma based on anterior chamber angle anatomical structure on gonioscopic evaluation. An appropriate case definition is the keystone of epidemiological research whether measuring prevalence, studying risk factors, or conducting clinical trials. . Foster classification for cross sectional epidemiological research was proposed in 1998 as a reconsideration of the definition and classification of glaucoma, to establish a structural ,uniformed and comparative data between any epidemiological study related to glaucoma worldwide[18].

There is considerable variation in open angle glaucoma (OAG) and angle closure glaucoma (ACG) among black populations. Studies published by M.H. Luntz showed an equivalent prevalence of ACG among black South Africans and white South Africans[15]. Supporting this variation, a Tanzanian population-based study showed that the high prevalence of OAG in Tanzanian glaucoma patients was similar to that of African-derived persons in the United States but less than in African-Caribbean populations and ACG was more prevalent in East Africans than suggested by anecdotal reports[16, 17].

1.1 Open angle glaucoma (OAG)

Primary open angle glaucoma is defined as progressive, bilateral, optic neuropathy with open anterior chamber angle, and typical pattern of nerve fiber bundle visual field loss. POAG is either idiopathic or genetic.

Secondary open angle glaucoma is caused by a variety of local or systemic disorders eg. Pseudoexfoliation syndrome, pigment dispersion syndrome, uveitis, lens induced, intraocular tumors, trauma, drugs such as steroids, retinal detachment, pituitary tumors, post operative laser and surgical procedures, uveitis-glaucoma-hyphema syndrome and many other causes[26].

The prevalence of OAG has been evaluated in American, European [3-11] and African descendants of the United States and Caribbean, and it was noted that OAG is more prevalent among persons from Africa than among Europeans.[3-14]A study by Quigley HA et al showed that- ACG is believed to be at least as prevalent as primary open angle glaucoma OAG [4].

OAG often is painless and does not have acute attacks. The only signs are gradually progressive visual field loss, and optic nerve changes (increased cup-to-disc ratio on fundoscopic exam).

1.2 *Angle closure glaucoma*

Primary angle closure glaucoma is caused by contact between the iris and trabecular meshwork, which in turn obstructs outflow of the aqueous humor from the eye.

The contact between iris and trabecular meshwork (TM) may gradually damage the function of the meshwork until it fails to keep pace with aqueous production, and the pressure rises. In over half of all cases, prolonged contact between iris and TM causes the formation of synechiae (effectively "scars"). These cause permanent obstruction of aqueous outflow. In some cases, pressure may rapidly build up in the eye causing pain and redness (symptomatic or so called "acute" angle-closure). In this situation the vision may become blurred, and halos may be seen around bright lights. Accompanying symptoms may include headache and vomiting. Diagnosis is made from physical signs and symptoms: pupils mid-dilated and unresponsive to light, cornea edematous (cloudy), reduced vision, redness, pain. However, the majority of cases are asymptomatic. Prior to very severe loss of vision, these cases can only be identified by examination, generally by an eye care professional. Once any symptoms have been controlled, the first line (and often definitive) treatment is laser iridotomy. This may be performed using either Nd: YAG or argon lasers, or in some cases by conventional incisional surgery. The goal of

treatment is to reverse, and prevent, contact between iris and trabecular meshwork. In early to moderately advanced cases, iridotomy is successful in opening the angle in around 75% of cases. In the other 25% laser iridoplasty, medication (pilocarpine) or incisional surgery may be required.

Secondary angle closure glaucoma is caused by contraction of fibrovascular tissue in the angle with pulling of the peripheral iris over the trabeculum[24].

PACG is believed to be at least as prevalent as primary open angle glaucoma (POAG)[4] also it has been reported to be more common among some Asian populations, than among Europeans[5]. The prevalence of ACG or the pattern of glaucoma in different black African ethnic groups has not been widely studied.

2.0 RISK FACTORS

2.1 Race

Race is a risk factor for the type of glaucoma; Open angle glaucoma is more common amongst black African Americans than Europeans and angle closure glaucoma is more common among some Asian population than Europeans. However, in a study by Luntz in South Africans showed equal prevalence of angle closure glaucoma between white Africans and black Africans[15].

The Somali people belong to one African ethnic group and share a common language (Somali language), and they live in the eastern part of Africa facing the Indian Ocean. While there is no published study that has addressed the prevalence or pattern of glaucoma among the Somali people, it is remarkable that the Somali name for glaucoma is Ario or Biyo; which probably shows that it is a recognized disease amongst them.

Anecdotal evidence based on observations made by Luntz showed that acute angle closure glaucoma attacks occurred in relatively young adult Somalis[18].

2.2 Family history

Glaucoma is frequently inherited. In OAG an approximate risk to siblings of 10%and to offspring of 4%has been suggested[17]; while in ACG first degree relatives are at increased risk because the predisposing anatomical factors such as relatively anterior location of the –lens

diaphragm, shallow anterior chamber and narrow entrance to the chamber secondary to: lens size, corneal diameter and axial length are inherited[24].

2.3 Age

Increased age is a known risk factor for glaucoma which affects 1 in 200 people aged fifty and younger, and 1 in 10 over the age of eighty[2]. Primary open angle glaucoma occurs more commonly over the age of 40 years. Acute angle closure glaucoma occurs more commonly over the age of 45 years. However Luntz reported acute angle closure attacks in relatively young people in Somalia[18].

2.4 Refraction

Axial refractive errors are known risk factors for glaucoma. Hypermetropia predisposes to angle closure while myopia predisposes to open angle. While there are no studies on the refractive error amongst the Somali community, it has been observed that Somalis tend to be hypermetropic rather than myopic. This will influence the status of the anterior chamber depth therefore the anterior chamber angle, which is a risk factor for angle closure (anecdotal evidence).

2.5 Increased IOP

Persistent high intraocular pressure will lead to optic nerve damage. The central corneal thickness (CCT) plays a role in estimation of actual IOP. If the CCT is thinner than <520µm[27] then actual IOP can be under estimated hence can lead to potential wrong classification of the glaucoma.

2.6 Pseudoexfoliation

Pseudoexfoliation can lead to pigment deposition on the trabecular meshwork which can lead to increase of IOP. It had been shown that open angle glaucoma is related to PEX in Kenya and in Europe [20, 29, 30].

2.7 Other risk factors

The following are precipitates to OAG or ACG: Diabetic mellitus, Hypertension, steroid use, ocular disease or surgery, branch or central retinal vein occlusion, retinal detachment.

3.0 DEFINITIONS AND CLINICAL TERMS

There are various definitions of glaucoma. In this study the definition and classification by Foster has been adopted[18] .Glaucoma: is optic neuropathy characterized by structural damage to the optic nerve and visual dysfunction that may be caused by various pathological processes. Raised intra-ocular pressure (IOP) is a risk factor[18].

3.1 Assessment of Functional damage (Visual Field defects):

- Asymmetrical field defects cross the horizontal mid-line in early and moderate cases
- Defects located in the mid-periphery
- Cluster defects of 3 neighbouring points at a level of 5% on the pattern deviation plot
- Defects reproducible on at least 2 occasions
- Defects not explained by any other disease

3.2 Assessment of Structural Defects:

Three categories were used for diagnosis:

- Category 1 (Structural and functional evidence):CDR ≥0.7 or VCDR asymmetry ≥0.2, NRR reduced to ≤0.1 CDR at 11-1 o'clock or 5-7 o'clock ,that also shows definitive visual field defect consistent with glaucoma. No alternative explanation for CDR findings or visual field defects.

- Category 2 (Advanced structural damage with unproved field loss): CDR ≥0.8 or VCDR asymmetry ≥0.3. Glaucoma is diagnosed solely on structural evidence.

In diagnosing category 1 or 2 there should be no alternative explanation for CDR findings (dysplastic disc, marked anisometropia) or visual field defect(branch or central vein occlusion ,or macular degeneration or cardiovascular disease .

- Category 3 (optic disc not seen, field test impossible):

a) Visual acuity <3/60 and IOP ≥30mmHg

b) Visual acuity <3/60 and eye shows evidence of glaucoma filtering surgery, or records available confirming glaucomatous visual morbidity

3.3 Primary Open-angle Glaucoma (POAG)

Is defined as any of the above three categories in an eye which does not have angle closure on gonioscopy or evidence of secondary cause of glaucoma.

3.4 Primary Angle Closure Glaucoma (PACG):

a) Primary angle closure suspect: an eye in which appositional contact between posterior iris and trabecular meshwork is visible through three quarters or more angle circumference in primary position without manipulation or indentation.

b) Primary angle closure: an eye with an occludable drainage angle and features indicating trabecular obstruction by peripheral iris has occurred e.g. PAS, elevated IOP, iris whorling (distortion of the radially oriented iris fibers), lens opacity (“glaucomfleken”) or excessive

pigment deposition on the trabecular surface. Optic disc does not have glaucomatous damage.

c) Primary angle closure glaucoma: Point (b) together with evidence of glaucoma as defined in the categories above

d) Acute PACG: if patient had signs of past attack of acute angle closure on iris and lens surface, or they have reported clear history of seeing rainbow halo around light, sudden or intermittent attacks of painful red eye and dimness of vision

e) Chronic PACG: in absence of any other cause for angle closure, patients with an occludable angle meeting any of the categories described above.

3.5 Secondary Glaucoma[18]:

Is based on optic neuropathy alone in an eye with a second form of ocular pathology which has caused elevation of IOP >21mmHg, leading to optic nerve damage. May include one of the following:

- Neovascularisation
- Uveitis
- Trauma
- Lens-related (Phacomorphic, phacolytic)
- Pseudoexfoliation (PEX)/PEX syndrome

Secondary OAG or AGC: were based on the angle chamber status using Volk Gonioscopy lens

3.6 Glaucoma suspects classification:

a) Disc suspect: those who met category 1 disc criteria but were not proven to have defined field defect.

b) Field suspect: those with defined field defect but did not meet category 1 disc criteria.

c) Optic disc: those with margin splinter hemorrhage

d) IOP >21mmHg

e) Those with occludable drainage angle but normal optic disc, visual field, IOP and no PAS.

3.7 Grading of chamber angle by Shaffer 1960

Table 1 : Grading of chamber angle by Shaffer 1960

Grade	Angle width	Description	Risk of closure
4	45^{o}-35^{o}	Wide open	Impossible
3	35^{o}-20^{o}	Wide open	Impossible
2	20^{o}	Narrow	Possible
1	$\leq 10^{o}$	Extremely narrow	Probable

Slit	Slit	Narrow to slit	Probable
0	0^{o}	Closed	closed

This table has been taken from J. Kanski Clinical Ophthalmology a Systemic Approach fifth edition.

4.0 STUDY RATIONALE

Minimal studies have described the pattern of glaucoma among different ethnic groups in East Africa (specifically) and in African populations in general. A closer understanding of the pattern of glaucoma in the Somali patients will facilitate a better approach in early diagnosis, management and control of progression of glaucoma

The results of this study will give a guideline of minimal and appropriate screening of the type of glaucoma in different ethnic groups in Kenya.

There is no study addressing the pattern of glaucoma among Somali patients, yet different anecdotal reports have been mentioned of the possibility of having high prevalence of angle closure amongst Somali patients.

The results will provide base-line data necessary for future references in the study population.

5.0 STUDY OBJECTIVES

5.1 Main Objective

1. To determine the pattern of glaucoma among adult Somali patients attending the Lions Sight First Eye Hospital, Nairobi,Kenya.

5.2 Specific objectives

1. To determine the association between age, sex and family history with open and closed angle glaucoma.
2. To evaluate the effect of IOP, AC depth and refractive error on the open and closed angle glaucoma.
3. To discern the influence of co-morbidities specifically exfoliation syndrome, hypertension and diabetes mellitus on open and closed angle glaucoma.

6.0. METHODOLOGY

6.1 Study design

This was cross-sectional hospital based study

6.2 Reference population

All adult Somali patients newly diagnosed or already diagnosed to have glaucoma.

6.3 Study setting

The research was carried out at Lions Sight First Eye Hospital, Nairobi, Kenya. This hospital serves a large catchment area around the capital city of Nairobi and the hospital currently conducts minimum of 6,000 cataract and 600 glaucoma operations per annum.

6.4 Sample size

The formula used to calculate Sample Size in a hospital based study, where by

The average numbers of Somali patient seen per day are 30 patients

$$n = \frac{Z^2_{\alpha/2} \times P (1-P)}{d^2}$$

Where;

n - Sample size is: 64 Glaucoma patients.

$Z_{\alpha/2}$ -Standard normal deviate at 5% level of significance (95% CI) is 1.96

P - Prevalence of glaucoma 4.16 %.(according to Tanzanian study)

d -Margin of error at 9%

6.5 Related definitions in this study

6.5.1 Glaucoma definition

The definition used in this study will be the Foster classification as mentioned above.

6.5.2 Diabetes Mellitus

Diagnosis is based on:

1. Patients with a fasting blood sugar ≥7.0 mmol/l (126 mg/dl); or random blood sugar ≥11.1mmol/l (200 mg/dl) in 2 separate readings [21-22]; or

2. Patient on treatment for diabetes.

6.5.3 Hypertension diagnosis

Based on descriptive categories where 2 separate reading of BP ≥140/90 mmHg have been found[23]; or patients on treatment for hypertension.

6.5.4 Mathematical formula for IOP adjustments[31]

Corrected IOP = measured IOP (CCT – 519 /30) × 1.1 mmHg

Where: 519 µm is mean CCT

1.1mmHg is the linear scale added or subtracted for every 30µm difference in CCT from 519 µm.

6.5.5 Glaucoma Family History – it is known in the Somali community glaucoma as Areo or Biyo Buluug.

6.6 Inclusion criteria

- All adult glaucoma patients of Somali origin (WHO classification: Age >16 years)
- All patients who had a signed informed consent by the patient or the guardian
- The patients who were co-operative and completed all required ocular examinations, with adequate visualization of their anterior chamber angle.

6.7 Exclusion criteria

- All patients who were under 16 years and not from Somali origin or not diagnosed with glaucoma.
- The patients or guardian who had refused informed consent, or had refused to complete all examinations which were required in the study.
- All Patients with opaque ocular media in whom visualization of their anterior angle chamber with gonioscopic lens was impossible even after treatment.

6.8 Instruments

- Questionnaire (Appendix III)
- Fluorescein dye
- Tropicamide 1%eye drop
- Tetracaine 1% local eye drop
- Snellen's chart
- Heine Beta 200 retinoscope
- Slit lamp

- Applanation Goldmann tonometer
- +90D Volk Loup
- Volk 4 mirror Gonioscopy lens
- Frequency doubling perimetry and Zeiss Humphrey visual field analyser 2.
- Pachymeter Alcon Ocuscan.
- A-scan
- Fundus Camera

6.9 Methods used for screening and recruitment

All adult Somali patients (above 16 years old –according to WHO definition) attending Lions First Sight Eye Hospital were screened and recruited in the following method:

The attending patients were asked their place of origin during the triage stage. All patients of Somali origin were informed that participation in the study is voluntary, at no additional cost to them, and they have the option to withdraw from the study at any stage. Signed consent was then obtained for those who accepted to be part of the study.

Consenting patients had visual field screening test with frequency doubling perimetry to determine the viability and the functions of the nerves in the eye. Subsequently, full eye examinations using a slit lamp were done. For the purpose of this examination, local anaesthetic eye drops, dilating eye drops and fluorescein dye were instilled in to both eyes of the patient and the patient was again explained to the expected side effects and the purpose of the drops and the dye.

Intraocular pressure was measured using a Goldmann applanation tonometer to determine the eye pressure; then anterior chamber depth was screened using the Van Herick slit lamp beam. The final stage was examination of the fundus structures using a slit lamp with +90D Volk lens.

The patients in whom a working diagnosis of glaucoma was made, they were informed of their diagnosis, the need for further examinations, the complications of the disease, the modalities of treatment and that participation in the study would not interfere or delay delivery of appropriate treatment. Consenting patients then proceeded to the next stage in the study.

Patients who were already known to have glaucoma were also recruited into the study after obtaining informed consent.

Both the newly diagnosed and the patients already known to have glaucoma, who had consented to participation in the study, were subjected to further examinations as follows: Objective and subjective visual acuity correction for far and near vision for the patients with a refractive error. A detailed visual field test analysis was carried out using Humphrey Visual field 24 – 2 to obtain an accurate evaluation of any field defects. Local anaesthetic eye drops (Tetracaine) were instilled in to both eyes and the following measurements were carried out: central corneal thickness using a pachymeter machine (Ocuscan), anterior chamber depth and ocular axial length using an A-Scan machine (Ocuscan), and finally gonioscopy of the anterior chamber angle using Volk 4 mirror gonio-lens. These measurements were to determine the actual intraocular pressure for each individual, the depth of the anterior chamber and the structural evaluation of the anterior chamber angle.

With the above data, patients were classified into the various patterns of glaucoma as defined in the case definitions above.

Below is a summarized flow chart of the above.

Flow chart

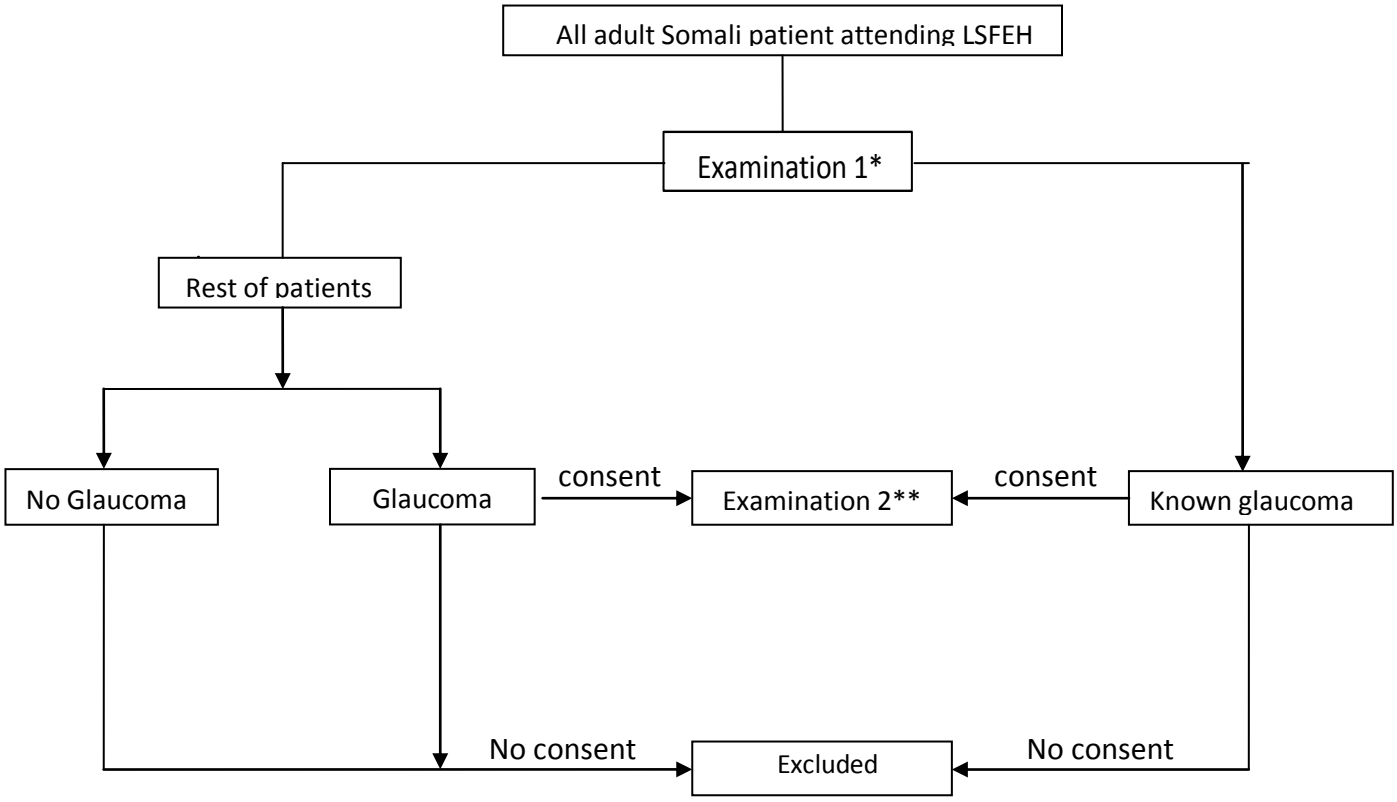

Figure 1: Methods used for screening and recruitment

- *Examination 1 included the following:

  - Visual acuity measurement with Snellen's chart

  - Visual field screening test with frequency doubling perimetry

  - Anterior chamber angle depth measured using Van Herick slit lamp beam

  - Intraocular pressure measured using applanation Goldmann tonometer after instilling Tetracaine local eye drop and fluorescein dye.

- Slit lamp examination of the rest of the ocular structures.

- Fundus examination using +90D lens, after dilating pupils with tropicamide.

- **Examination 2 included: examination 1 and the following:

  -Visual acuity corrected for far and near after objective refraction is performed

  - Central corneal thickness measurement with pachymeter Ocuscan

  -Axial length and anterior chamber depth measurement with A-scan

  - Humphrey visual field 24-2/30-2

  - Gonioscopy using Volk 4 mirror gonio-lens after instilling Tetracaine local anaesthetic eye drops.

  - Fundus photography for the patients in whom the fundus is clearly visualized.

- Following Examination 2 Glaucoma patients were subsequently classified as follows:

  1. Glaucoma suspect
  2. Angle closure
     a. Primary angle closure
        i. Primary angle closure suspect
        ii. Primary angle closure
        iii. Primary angle closure glaucoma
           1. Acute primary angle closure glaucoma
           2. Chronic primary angle closure glaucoma
     b. Secondary angle closure glaucoma
        i. Acute angle closure glaucoma
        ii. Chronic angle closure glaucoma

3. Open angle glaucoma
    a. Primary open angle glaucoma
    b. Secondary open angle glaucoma

6.9.1 Standardization

To reduce bias the principle examiner had counterchecked his clinical signs and findings with the supervisors. The same method has been used for standardization.

6.10 Data management

Data collection procedures:

Data was collected from patients' files after Examination 1 and 2 (refer to screening and recruitment flow chart in section 6.9) and recorded in a well structured questionnaire (Section 7). Collected data was entered in Microsoft Access then converted into Statistical Package for Social Sciences (SPSS) version 15 for cleaning and analysis.

6.10.1 Descriptive and Analytic Statistics:

Nominal and categorical variables were summarized using frequencies and percentages, while continuous data was summarized using means, standard deviations, median, minimum and maximum. Chi-square test of independence was used to test for association between categorical/nominal. Odds ratio were used to assess the magnitude of the relationship between risk factors and primary outcome. 5% Level of significance were used to determine statistical significance.

6.11 Source of error

Intra observer variation:

- This was minimized by the findings being confirmed by the supervisor and consultant, when the patients came for their booked appointments.

6.12 Study feasibility

- Records from Lions Sight First Eye Hospital show an average of 50-60 Somali patients per week; approximately 1-2 glaucoma patients are seen each day.
- Estimates of 8 Somali glaucoma patients per week equating to 64 patients in the 8 weeks study period.

6.13 Study Limitations

- Some of the risk factors were to be determined clinically rather than definitively.

7.0 ETHICAL CONSIDERATIONS

7.1 Approval

Ethical approval was obtained from the following institutions:

- The Department of Ophthalmology – School of Medicine at the University of Nairobi,
- Lions Sight - First eye Hospital in Loresho – Nairobi
- Kenya Medical Research Institute / National Ethics review committee - Nairobi

7.2 Benefits of the project

A closer understanding of the pattern of glaucoma and some of the potential risk factors in the Somali patients will facilitate a better approach in early diagnosis, management and control of progression of glaucoma.

The results will encourage appropriate screening for the patterns of glaucoma in different ethnic groups in Kenya, and it will provide base-line data necessary for future references in the study population.

The patients were recommended for any further treatment necessary, by a senior ophthalmologist in Lions Eye Hospital.

7.3 Obtaining Consent

Informed consent was taken from the patients prior to participation in the study. For patients above the age of 18 years consent was obtained from the patient him/herself. For the patients

below the age of 18 years, consent was obtained both from the patient and an attending parent or guardian. Consenting patients/parents/guardians were required to either sign on the consent form, or give a thumbprint for those who were illiterate.

Patients were informed about the study in English, Swahili or Somali depending on which language they prefer to use.

All patients were informed in detail about the examinations to be conducted, the medications to be used and their side effects.

Patients were informed that participation in the study is fully voluntary and utmost confidentiality was to be maintained. They were also informed that they could withdraw from the study at any stage without compromising their treatment.

The patient's name only appeared in the consent form. All other data collected from the patient was coded for purposes of maintaining confidentiality in an analysis and discussion.

7.4 Potential risks of the procedures

Some of the eye examinations required direct contact between the instruments and the corneal surface which is irritating to the eye. To reduce this irritation, local anaesthetic eye drops were instilled into the eye. In this study, tetracaine eye drops were used as local anaesthesia. They do cause mild discomfort in the eye for 10 seconds after instilling and this discomfort resolves spontaneously. The anaesthetic effect lasts for 20 minutes which is sufficient time for all subsequent examinations to be conducted. The patients were advised not to scratch the eyes during the period of anesthesia as this puts them at risk of unknowingly inflicting damage on the cornea.

Detailed examination of the fundus required full dilatation of the pupils. Tropicamide(dilating drops) were used for this purpose. The patient will experience some degree of blurring of vision during the period of dilatation which can last up to 9 hours. Patients were therefore, advised not to drive on the day of fundus examination.

Flourescein dye is used to facilitate the assessment of the intraocular pressure. It causes a yellowish discolouration of the tears and this resolves within 30 minutes. It is excreted out in the tears and therefore, has no harmful effects on the kidneys or the liver.

All the above medications are registered in Kenya.

8.0 RESULTS

A total of 1119 patients were examined between 1st october 2009and 15th January 2010. Of these, 173 were not screened for recruitment as they attended the hospital on the days when the Principal investigator was not available. Out of the remaining 946, 882 were excluded from the study for the following reasons: lack of consent, not diagnosed with glaucoma and / or not meeting the inclusion criteria. 64 glaucoma patients were therefore recruited.

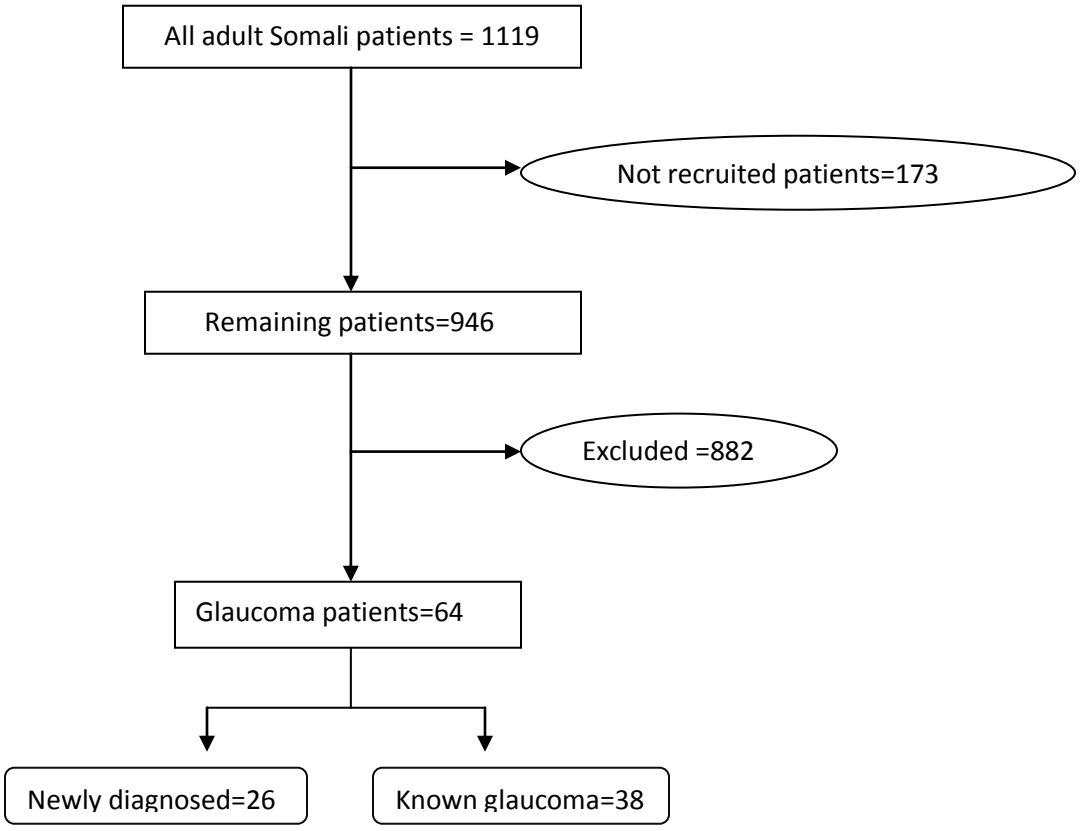

Figure 2 : Prevalence of patients

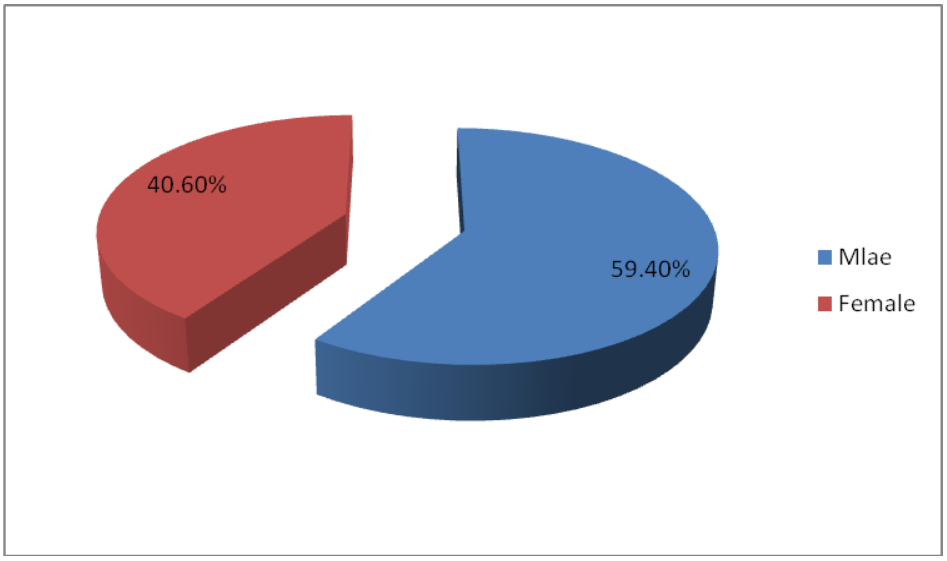

Figure 3 : Distribution by Gender (n= 64)

The Male: Female ratio was 1.5 : 1

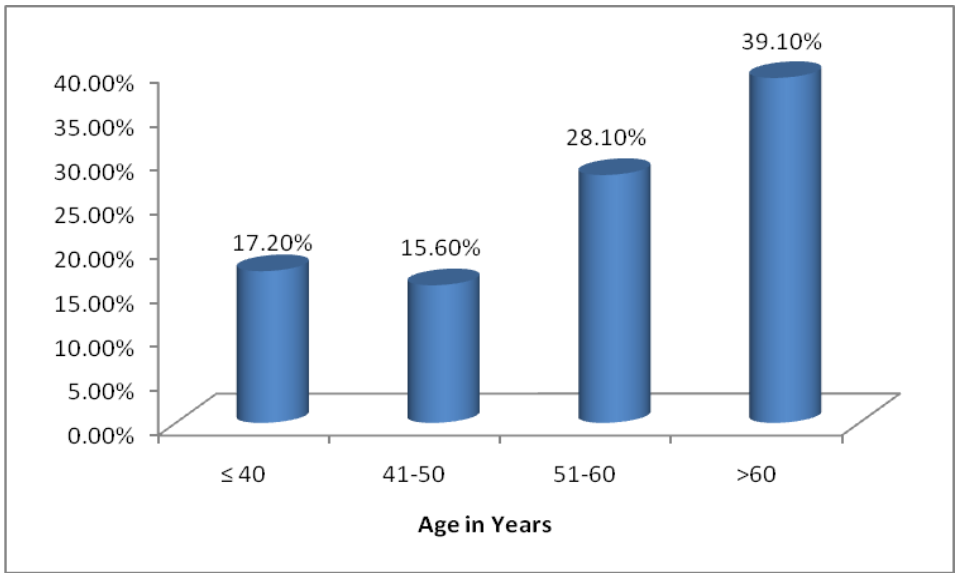

Figure 4 : Distribution by Age (n= 64)

Most patients were over the age of 50 years. There were 2 teenage patients accounting for 3.1% of the study population.

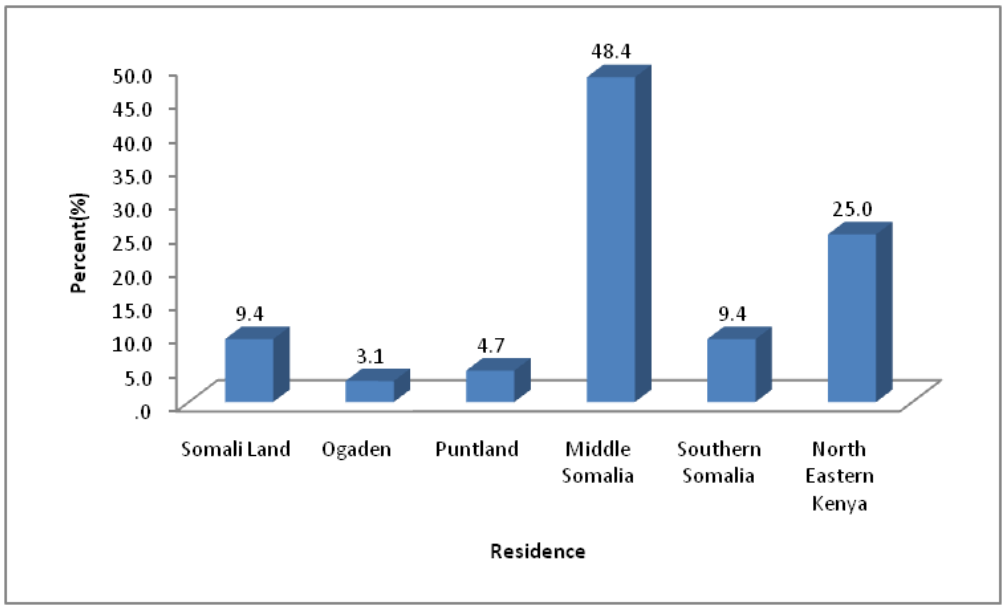

Figure 5 : Distribution by Residence (n=64)

71.9% of the patients in this study were from Somalia. Majority of these were from Middle Somalia.

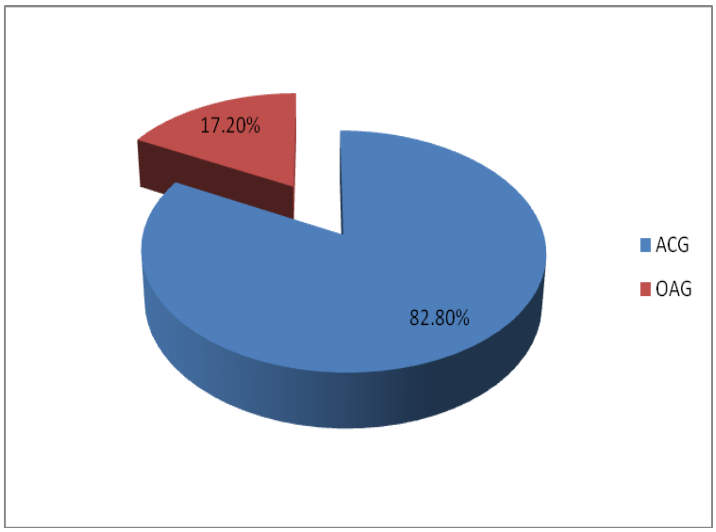

Figure 6: Broad classification of the pattern of Glaucoma n= (64)

The patients with Angle Closure Glaucoma (53 patients) formed the majority of the patients accounting for 82.8% of the study population.

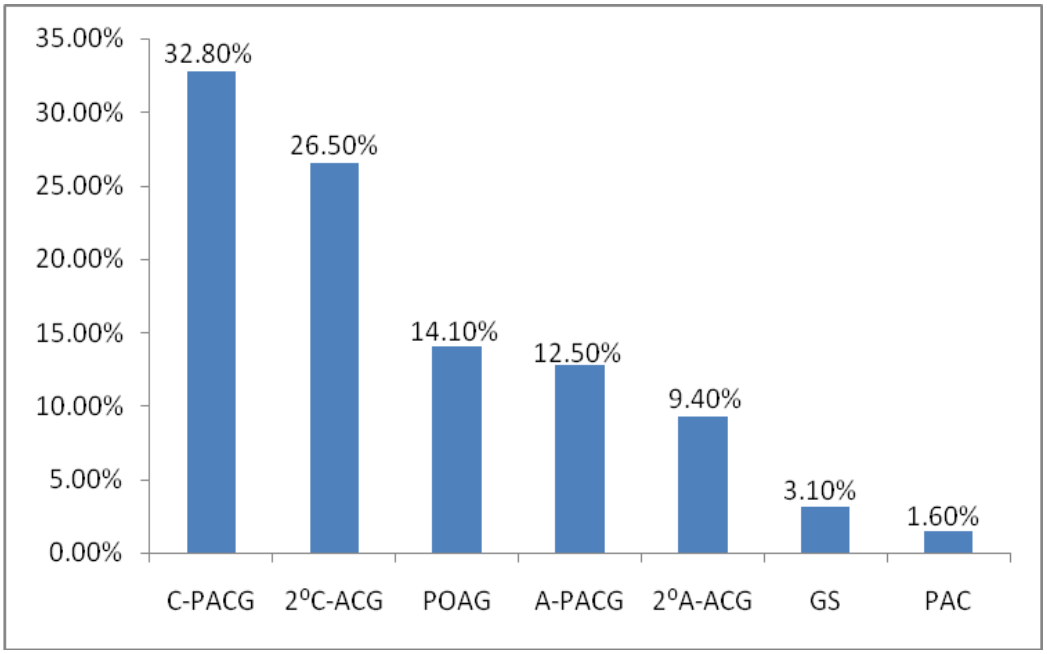

Figure 7 : Specific (Foster) classification

Chronic primary angle closure glaucoma(C-PACG) was the most common accounting for 32.8%; while Primary Angle closure was the least common accounting for 1.6%.

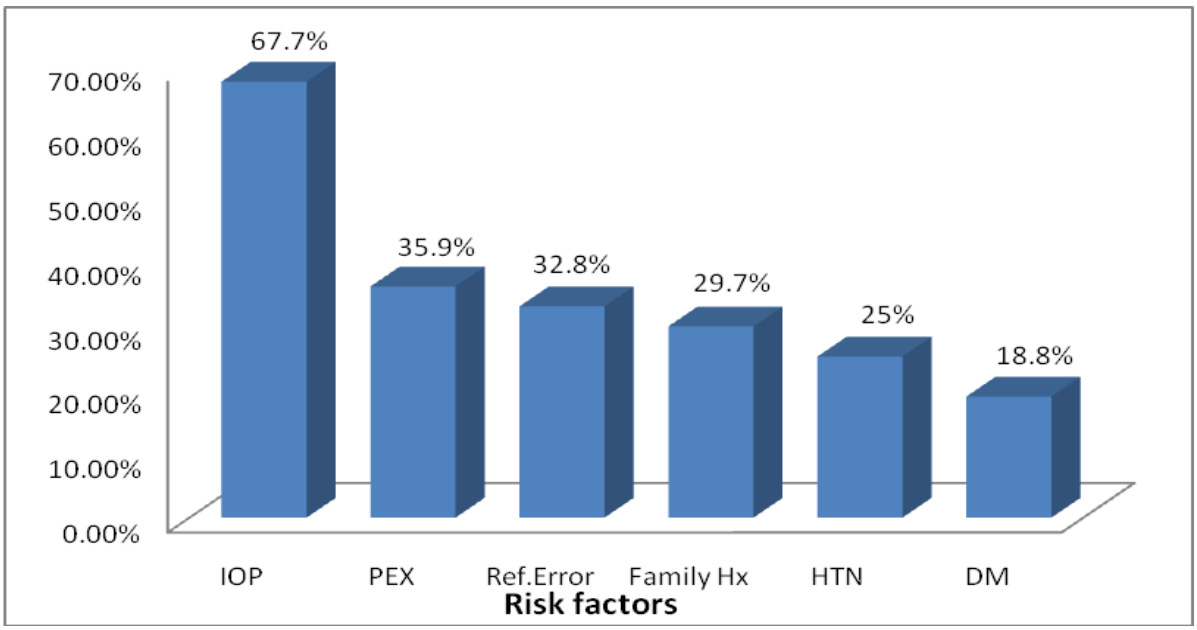

Figure 8: Prevalence of risk factors (n = 64)

The most prevalent risk factor was IOP > 21mmHg; accounting for 67.7% with Diabetes mellitus the least prevalent.

Table 2 : Correlation of the Risk factors and Type of Glaucoma

RISK FACTORS	OAG P-Value (OR)	ACG P-Value (OR)
SEX	0.096 (3.724)	0.096 (0.269)
AGE	0.242 (2.464)	0.242 (0.406)
Family History	0.208 (2.321)	0.208 (0.431)
HTN	0.085 (3.182)	0.085 (0.314)

DM	0.367 (0.382)	0.367 (2.619)
Refractive error	0.667 (0.729)	0.667 (1.371)
IOP	0.395(1.76)	0.395 (0.567)
PEX	0.041 (0.141)	0.041 (7.097)

There was a strong relationship between pseudoexfoliation and angle closure glaucoma (OR = 7.097)

Table 3 : Significance of refractive error and biometric parameters in glaucoma

REFRACTIVE ERROR		**OAG**	**ACG**
Hyperopia	**P-Value**	0.123	0.123
	OR,	0.212	4.722
	(CI 95%)	0.025 – 1.791	0.558 – 39.937
Myopia	**P-Value**	0.020	0.020
	OR	11.556	0.087
	(CI 95%)	0.946 – 141.139	0.007 – 1.057
AC Depth	**P-Value**	0.013	0.013

	OR	0.100	10.0
	(CI 95%)	0.012 – 0.838	1.193 – 83.837
AXIAL LENGTH	**P-Value**	0.152	0.152
	OR	0.361	2.769
	(CI 95%)	0.086 – 1.512	0.661 – 11.595

Out of 64 patients, 21 (32.8%) patients had refractive error. Hyperopia was in 18 (28.1%) patients. Myopia was found in 3 (4.7%) patients.

There was a relationship between anterior chamber depth and glaucoma which was found to be statistically significant.

Table 4: CCT in study population

CCT < 520 um	53 (82.8%)
CCT > 520 um	11 (17.2%)

- The mean CCT in this study population was 493 µm (2.6 SD), with a median of 489, and a range of 401-583 µm

Table 5 : Range of IOP

IOP mmHg	Number (n = 64)	Percentage
> 21	44	68.7%
18 – 21	7	10.9%
< 18	13	20.3%

Of the patients with IOP $\leq$ 21mmHg, 2 patients were not on medication as they were being managed as Glaucoma suspect and normotensive Glaucoma. The IOP was corrected for the CCT and the corrected values are demonstrated in the table below:

Table 6 : Corrected IOP for CCT

Initial diagnosis	Measured IOP	CCT	Corrected IOP
Glaucoma suspect	18 mmHg	401	22 mmHg
Normotensive glaucoma	18 mmHg	450	22 mmHg

The measured IOP for both patients was 18 mmHg. After correction for CCT both patients had IOP >21 mmHg.

Table 7: Relationship between family history and glaucoma n=19

Type of glaucoma	Number of patients	Prevalence in %
OAG	5	26.31%
ACG	14	73.68%

Out of the 19 glaucoma patients known with family history OAG was found to have 26.31% and ACG was 73.68%.

Table 8: Relationship between secondary angle glaucoma and PEX

Variable	SACG		P-value	OR (CI 95%)
PEX	YES N (%)	NO N (%)		
YES	19(82.6%)	4 (17.4%)	0.000	43.93(9.88-195.39)
NO	4 (9.8%)	37(90.2%)		

Secondary angle closure glaucoma has significant relationship with PEX.

9.0. DISCUSSION OF RESULTS

A total of 64 patients, 26 females and 38 males, aged 17 and above were examined. Their age range was from 17 years to 83 years with the peak age between 50 – 75 years. Male to female ratio was noted to be 1.5:1, although the estimated female to male ratio in the general Somali population is 1: 1. The reason behind the high male to female ratio in this study was that majority of the patients were travelling from Somalia (71.9%), mainly from middle Somalia. There is constant conflict in middle Somalia thus Non-Governmental Organizations and eye care facilities are lacking unlike the other parts of Somalia. Another reason could be cultural aspects whereby the Somali womenfolk take care of their children at home and would therefore, stay behind in Somalia while the men travel abroad to seek medical care. In middle Somalia there are more economic activities going on than in other parts of Somalia. Also, this region is urban and the population is more educated. Therefore they will understand the importance of medical eye care and seek for it abroad.

The majority of patients in this study were classified to have angle closure glaucoma (82.8%) and the remaining had Open Angle Glaucoma (17.2%). This is in keeping with the anecdotal reports that ACG is more prevalent in East African patients of Somali origin. Such high prevalence of ACG was found in the 64 glaucoma patients not in the studied population of 1119. Therefore this is not a sampling error.

In our study, chronic PACG had the highest prevalence of 32.8% and that of POAG was 14.1%. This is unlike what has been found by other studies done in East Africa and Asia [16, 25]. Bhaiji et al in 1987 in Kenyatta National Hospital found the prevalence of POAG to be 54.7 %, primary

closed angle glaucoma 23.9% and secondary glaucoma 21.4%[27]. In our study the difference may be due to shallow anterior chamber depth <2.7mm in 42.18% of the patients and short axial length <23mm in 51.5% of the patients (Table 2).

In this study, the main factors responsible for such a high prevalence of ACG were PEX, AC depth and family history. PEX showed a P value 0.04 with odds ratio 7. 097. Having in mind that 28.1% of the patients were hyperop with shallow anterior chamber depth <2.7mm with a significance of odds ratio of 10. Out of the 19 glaucoma patients known with family history OAG was found to have 26.31% and ACG was 73.68%.

9.1 Related risk factors

It has been shown in our study that male to female ratio is 1.5 : 1. This is similar to what had been found in the past in a hospital-based study by Bhaiji et al [27]. While a recent study showed that glaucoma affects more women than men, in our study, gender was not a significant predisposing factor to either open or closed angle glaucoma [17]. (Table1).

Majority of the patients were 50 years old and above (Figure 2) and this is in keeping with other studies carried out in Kenya, Tanzania and west Bengal [17, 25, 27]. Increasing age is a well known risk factor for glaucoma.

The prevalence of family history in this study was 29.7% and it was not statistically significant (Figure 6). Most of the patients with positive family history had closed angle glaucoma (Table 6). However, this may be due to the higher prevalence of ACG in this study.

Refractive error was noted to be a risk factor with a prevalence of 38.2% in this study. There were 8 patients with POAG and of these 2 patients were myopic (25%) P=0.02(OR=11.5, 95%CI

0.95-141.4). This finding is in keeping with what has been found in other studies, that myopia is associated with open angle glaucoma[22,27] .The number of patients with PACG were 28 and of these 18 patients were hyerpropes (64.3%) p=0.03, which is statistically significant. This is in keeping with what is known that myopia and hyeperopia are related to primary open or closed glaucoma respectively[22, 27].

The relationship between glaucoma and anterior chamber (AC) depth was found to be significant with a p-value of 0.013 in both OAG (OR= 0.1, 95%CI 0.012 – 0.838) and ACG (OR 10.0, 95%CI 1.193 – 83.837). The large confidence interval suggests that glaucoma could also be influenced by other factors for example pseudoexfoliation which was a significant risk factor for ACG in our study.

The prevalence of intraocular pressure greater (IOP) than 21 mmHg in this study was found to be the highest (67.7%) is similar to previous studies done in Kenya and Tanzania [16, 27].

Ten percent of the patients had IOP between 18 and 21 mmHg. After IOP correction for CCT these patients had IOP>21 mmHg and hence were treated as glaucoma patients (Table 3&4).

In our study pseudoexfoliation was not found to be an associated risk factor for glaucoma; having a prevalence of 35.9% with a p- value of 0.041 (OR= 0.14,95%CI 0.017-1.18%) for OAG and (OR=7.097,95%CI 0.84-59.54) in ACG (Table1). However, in our study there was a strong relationship between PEX and secondary angle closure glaucoma (Table 7). This is unlike what was found in other studies where PEX is related to OAG [20, 29, 30].

The prevalence of diabetic in this study was 18.8% for OAG p=0.37 (OR 0.38) and for ACG p=0.37 (OR 2.62) (Table 1). This finding was not statistically significant in keeping with what is known that diabetic is believed to be a protective factor against glaucoma [(22, 27)].

The prevalence of hypertension (25%) was found not to be statistically significant with p-value for OAG p=0.083 (OR 3.18) and for ACG p= 0.08 (OR 0.31)(Table 1). This in keeping with what was found in blue mountain eye study group and in black Africans [35, 36].

10.0 CONCLUSIONS

1. Angle closure glaucoma is the predominant pattern of glaucoma in Somali patients

2. Pseudoexfoliation and AC depth were the significant risk factors related to ACG

3. Thinner CCT underestimates the IOP.

11.0. RECOMMENDATIONS

1. Thorough screening of patients should be done to classify them appropriately

2. CCT should be considered when measuring IOP

3. Further studies to ascertain the correlation between PEX and ACG.

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APPENDICES

APPENDIX 1: Consent

I am Dr.Amal, a postgraduate student in the department of Ophthalmology in the University of Nairobi. I am conducting a study on the pattern of Glaucoma among adult Somali patients attending the Lions Sight First Eye Hospital,Loresho, Nairobi, Kenya.

The results of this study will help add to the existing knowledge on this condition and will facilitate appropriate therapy.

You will not be subjected to unnecessary examinations and /or invasive procedures. All medications that were instilled in the eye during examination are purely for the purpose of facilitating examination of the eye and they are registered in Kenya. The main side effects of the drugs are: Burning sensation from the local anesthetic drops (Tetracaine) which resolves in 10 seconds and the effect of the anesthesia lasts up to 20 minutes. The dilating drops (Tropicamide) cause blurring of vision which lasts for up to 9 hours and therefore, you are advised not to operate any machinery or drive on that day.

Flourescin dye is used to facilitate the assessment of the intraocular pressure. It causes a yellowish discolouration of the tears and this resolves within 30 minutes. It is excreted in the tears and therefore, has no harmful effects on the kidneys or the liver

Participation in this study is voluntary and will not delay your treatment in any way. The data from this study were handled with strict confidentiality and will only be used for its intended purposes. You have the freedom to withdraw from the study at any one time.

If you have any questions or queries, you may contact me or the Ethical approval committee on the following numbers:

Dr. Amal : mobile number 0721289369

Kenya Medical Research Institute: Landline number: 254-020-2722541 /2713349

Mobile number: 0722-205901, 0733-400003.

I _____ (self, spouse, other relative(state)_____ _____ Hereby give consent for inclusion in this study; I am informed By Dr. Amal that the information obtained were handled with strict confidentiality.

Signature (patients/spouse/other relative) _____date _____,

Thump print (patients/spouse/other relative) _____date_____,

Signature (informant) _____date_____.

APPENDIX 2: Consent in Native Somali - Ogalaansho

Anigu Magaceyga waa Drs Amal waxaana ahay arday ka dhigta Jaamacadda Nairobi Iskuulka caafimaadka Qeybta Indhaha.

Waxaan elmi baaris ka samaynayaa Cisbitaalka Laayons fast aay eek u yaala Loresho – Nairobi.

Waxaana elmi Baaristaydu ku saabsan tahay sida uu u saameeyo dadka da,da ah (waa qofkii ka weyn 16 sano) Cudurka Indhaha gala ee loo yaqaano Galowkooma.(aaryo ama biyo) Natijada elmi baaristan waxa uu wax ka kaalmaynayaa barashadda Cudurkan iyo sidii wax looga qaban lahaa dadka uu saameeyo Mustaqbalka.

Ka qeyb galga elmi baaristan wax shuruud ah kuma xirna waa iskaa u gal, haddii aad dooneyso waad ka bixi kartaa waqtigaad rabtid. Inta aad ka qeyb qaadaneysid elmi baaristaan wax xannuun ah luguuma beegsanaayo. Wixii qoraal ah oo lagaa qoraayana waa la xifdinayaa oo waxaana elmi barristaan ahayn loolama isticmaalayo.

Haddii suaal aad ka qabtid elmi baaristaan fadlan ilaga soo xirrir teleefoonkayga 0721289369. Ama la xirrir waaxdda elmi baarrista ee loo yaqaano marka magaceedda la soo gaabiyo, KEMRI/ERC.

Teleefonkeeduna yahay 0202722541 ama mobiilka 0722205901.

Anigoo ah…… (Ama qaraabadiisa) oo Ku nool …….. waxaan ogolaansho siiinayaa Drs, Amal In la igu daro celmi baaristan waxaana la ii sheegay in wax qoraal ah oo aniga igu saabsan in la xifdinaayo oo cid kale ay khusaynin eeynan arkaynin.

Saxiixa qofka (ama qaraabadiisa)……. Taariikhda …….

Saariida suulkaaga(ama qaraabadiisa)……Taariikhda…….

Saxiixa (cilmi baariyaha) …….. Taariikhda…….

APPENDIX 3: Questionnaire

Study on pattern of glaucoma among adult Somali patients attending Lions Sight First Eye Hospital Nairobi, Kenya.

Case no: _____ **IP/OP no**: _____

Date: _____

Section A: socio-demographic data

1. Age (in complete years):_____
2. sex: [__] Male [__] Female
3. Education: [__] None [__]Primary

   [__]Secondary [__] Tertiary

4. Place of residence: _____

Section B: medical History (Glaucoma risk factors)

1. HTN [__] Yes [__] No
2. DM [__] Yes [__] No
3. Ocular injury: [__] Hyphema [__] Ruptured lens [__] Perforating injuries
4. Ocular disease [__]HR [__]CRVO [__]BRVO [__]PEX [__]CATARACT [__]RD

   [__] Refractive error [__] Uveitis [__] DR [__] none
5. Ocular surgeries: [__] VR [__] glaucoma [__] anterior segment

   [__] squint [__] cataract [__] Extraocular surgery [__] none
6. Systemic treatments (list down):_____
7. History of steroid use [__] Yes [__] No

8 .Family history of glaucoma [__] Siblings [__] Parents [__] First degree relative [__] none

Section C: Glaucoma History

C.1Symptoms and duration (yes/no):-

Duration

1. [__] Tearing _____
2. [__] Painful red eye _____
3. [__] Painful eye _____
4. [__] Headache _____
5. [__] Nausea _____
6. [__] Decreased or blurred vision _____
7. [__] Halos around light _____
8. [__] Photophobia _____
9. Onset [__] Sudden [__] Progressive

- **C.2.In case of late presentation list out reasons**

1. [__]Lack of awareness
2. [__]No physical complain (applicable/not applicable)
3. [__]Financial
4. [__] Herbal treatment
5. [__] away from medical facilities
6. [__]Others

- **C.3 Diagnosis:** -

  1. When (day/month/year) _____ 2. Where_____

  3. By whom _____

- **C.4. When was treatment initiated**

  1. On diagnosis [__] Yes [__] No

  2. Later (how long after diagnosis) _____

  3. Reasons for late administration [__] lack of awareness [__] lack of facilities [__] financial [__] Tried herbal treatment [__] other reasons_____

- **C.5 Type of treatment:**

  1. Conservative: [__] Oral+ topical [__] Topical

  2. Compliant [__] Yes [__] No

  3. Reasons for failure of complacency: [__] No improvement [__] Financial [__]Lack of awareness

  4. Laser: [__] ALTP [__] CPC

  5. Surgical: [__] TET [__] Valve [__] Others

- **C.6 Other investigations:**

  1. [__] Gonioscopy 2. [__] fundus exam

  3. [__] VF (type) 4. [__]IOP

- **C.7 Frequency of follow-up:**

  1. Weekly [__] Yes [__] No

2. Monthly [__] Yes [__] No

3. Every 3 months [__] Yes [__] No

4. Every 6 months [__] Yes [__] No

5. Annually [__] Yes [__] No

6. Lost to follow-up [__] Yes [__] No

Section D: Ocular examination

	RE	LE
1. VA (D.1.1 SC, D.1.2.CC)	_____	_____
2. IOP	_____	_____
3. Lid (Normal yes, no)	_____	_____
4. Conjunctiva (Injected yes, no)	_____	_____
5. Corneal oedema (yes, no)	_____	_____
6. A/C cells, flare (1.yes2.no)	_____	_____
7. Pupil .1.RRTL/2.RAPD/3.Block	_____	_____
8. IRIS Neovascularization	_____	_____
9. IRIS bombe	_____	_____
10. PEX 1. Central shield	_____	_____
2. Peripheral band	_____	_____
3. Partial on the pupil	_____	_____
11. LENS 1. Aphakia	_____	_____
2. Phacomorphic	_____	_____
3. Phacolytic	_____	_____

12. Nuclear/PSC/Cortical cataract (stage 1,2or3) _____ _____

13. Phacogenic uveitis (yes/no) _____ _____

14. Glaucomphleken lens _____ _____

15. Vitreous (clear, hemorrhage) _____ _____

16. CDR (Vertical dimension) _____ _____

17. Neuroretinal thinning _____ _____

    1. Position o'clock 5-7 _____ _____

    2. Position o'clock 11-1 _____ _____

18 .Notching (yes/no) _____ _____

19. Baring of circumlinear vessel (yes/no) _____ _____

20. Presence of Disc splinter hemorrhage _____ _____

21. Presence of nerve fiber layer loss _____ _____

22. Presence of parapapillary atrophy _____ _____

23. Difference in VCD ratio between RE/LE

    1. >0.3mm, 2. =0.3mm, 3. =0.2mm) _____ _____

24. HR _____ _____

25. CRVO _____ _____

26. BRVO _____ _____

27. DR _____ _____

28. Macular degeneration _____ _____

29. CCT _____ _____

30. Axial length _____ _____

31. A/C depth _____ _____

32. Iris whorling _____ _____

33. Gonioscopy (grade 4, 3, 2, 1, slit, 0) _____ _____

34. PAS≥270^{O} _____ _____

35. Hyperpigmentation on trabeculum _____ _____

36. Angle recession≥270^{o} _____ _____

37. Angle Neuvascularization _____ _____

38. HVF (1. Altitude _____ _____

2. Arcuate _____ _____

3. Nasal step _____ _____

4. Paracentral scotoma _____ _____

5. Cluster defect 5% _____ _____

6. Normal _____ _____

SECTION E: Diagnosis:-

1. Glaucoma suspect [__] Yes [__] No

2. Angle closure Glaucoma:

2.1 Primary angle closure [__] Yes [__] No

2.2 Primary angle closure suspect [__] Yes [__] No

2.3 Primary angle closure [__] Yes [__] No

2.4 Primary angle closure glaucoma [__] Yes [__] No

2.4.1 Acute Primary angle closure glaucoma [__] Yes [__] No

2.4.2 Chronic Primary angle closure glaucoma [__] Yes [__] No

2.2 Secondary angle closure glaucoma

2.2.1 Acute angle closure glaucoma [__] Yes [__] No

2.2.2 Chronic angle closure glaucoma [__] Yes [__] No

3. Open angle glaucoma

3.1 Primary open angle glaucoma [__] Yes [__] No

3.2 Secondary open angle glaucoma [__] Yes [__] No

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