

# Timing of Opportunistic Check for Glaucoma in an Ophthalmology Clinic Setting in Ghanaians

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## Abstract

**Purpose:** To determine the age, timing and determining factors for the evaluation for glaucoma as part of medical eye evaluation in an ophthalmology clinic.

**Patients and Methods:** A cross sectional study in which patients with primary open-angle glaucoma (POAG) attending the ophthalmology clinic, Korle Bu Teaching Hospital, Ghana were recruited from 2004 to 2007. A historic control group of 253 normal samples was included in the data analysis of cup/disc asymmetry.

**Results:** Number of patients recruited was 390 with ages between 15 to 89 years (mean 54±14.86, median 56 and mode 65). Early-onset-glaucoma diagnosed before age 40 years occurred in 62 patients (15.89%) and adult-onset-glaucoma in 328 (84.10%). Fifteen (3.84%) people had positive family history of glaucoma; 13(3.33%) had diabetes mellitus; hypertension 38 (9.74%) and sickle cell disease, 1 (0.25%). Thirteen (3.33%) had myopia of >-4 dioptres (-4.25 to -14.5D). Eighty (20.51%) patients had visual impairment. Five (1.28%) were blind (no perception of light, NPL, bilaterally) from glaucoma. In the early-onset-glaucoma group, 2/62(3.23%) were blind.

Pretreatment intraocular pressure, IOP, was >35 mmHg in 46.18% of eyes. In the early-onset-glaucoma group, IOP ranged from 13-64 (mean 36) mmHg. There was cup/disc ratio of at least 0.7 in 99% of eyes. In the 15-24 year age group, 88.6% had cup/disc ratio of 0.7-1.0. Cup/disc asymmetry 0.2 or more was found in 32% (125/390) compared with 0.4% (1/253) in the Normal patients.

**Conclusions:** We suggest that routine measurement of intraocular pressure and evaluation of the optic disc biomicroscopically be carried out as screening for glaucoma every 2 years until age 30 years; in any African African patient aged 20 years and above with eye complaints attending an eye clinic, as well as those aged 25 years and above as part of comprehensive adult medical eye evaluation. However, after age 30 years and those with positive family history of glaucoma, screening should be yearly.

**Keywords:** Glaucoma; Blindness; Low vision; Visual impairment; Optic nerve

## Introduction

Major causes of visual impairment following cataract are, in order of importance, glaucoma, age-related macular degeneration, diabetic retinopathy and trachoma [1]. In Ghana and the West African region glaucoma is the most important cause of blindness after cataract and this blindness is irreversible. There has been progress in Ghana and the West African region in controlling blindness caused by cataract, onchocerciasis and trachoma but we have not made as much progress with glaucoma which is now the most important cause of irreversible blindness [2-4]. Primary open-angle glaucoma (POAG) is the most prevalent type of glaucoma in Ghana making up over 90% of glaucoma seen in the population. The 30-60 years age group prevalence was found to be 6.61% (95% CI 5.46-7.76) in this population [5]. The few numbers of recruits aged over 60 years for this prevalence study due to unavailability placed limitations on interpretation of the prevalence beyond 64 years.

Prevention of visual impairment and blindness from glaucoma is one of the major goals in Ophthalmology. Though the primary treatment for glaucoma is lowering of the intraocular pressure (IOP), some patients continue to lose vision despite aggressive treatment. Other strategies such as neuroprotection and optic nerve head perfusion have been heralded as an adjunctive approach to lowering of IOP and continue to engage the attention of researchers. The disease gets more expensive as it worsens. With effective treatments at earlier stages, the progression of disease can be slowed or halted [6],

saving both the patient and society from greater economic burden. Treating glaucoma early lowers economic burden. Dukes Eye Centre reports that the cost of treating end stage glaucoma quadruples as compared to the early stage of glaucoma [7]. It is therefore important to diagnose it early for treatment in Ghana, a developing country where the general economic burden is already challenging. The ophthalmologist/population ratio in Ghana has improved markedly over the last decade with local postgraduate training and is now about 1 : 440,000(50 ophthalmologists: 22,000,000 population). This falls short of WHO/ICO standard of a minimum of 1 : 250,000 population. In heavy eye clinics older people over 40 years are usually evaluated for Glaucoma. How early to start examination in the younger ages is guided by the knowledge that glaucoma occurs earlier and causes more visual loss in the African. We set out asking the following questions- at what age should evaluation for glaucoma form part of medical eye evaluation and how often must the evaluation be repeated to determine glaucoma? Whereas many research and publications are found in the

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literature on African Americans there is paucity of information in the literature about African Africans. Both come from the same ancestry but intermarriages and differences in lifestyles with the change in location of the African American may exert some influences on epidemiology of certain diseases and therefore we need evidence to base recommendations for the African African population too. It was considered necessary to assess the important factors that determine when and how often a patient should be examined to detect glaucoma. This would be used to identify which of our patients would benefit from a thorough glaucoma examination in the hospital setting as a means of enhancing opportunistic screening for glaucoma.

### Patients and Methods

The study was a cross sectional study in which previously diagnosed and newly diagnosed Ghanaian patients with POAG attending the ophthalmology clinic of the Korle Bu Teaching Hospital in Ghana from 2004 to 2007 were recruited. The diagnosis of POAG was made upon finding characteristic degenerative changes in the optic disc, along with a characteristic loss of visual field sensitivity.

Consecutive cases of glaucoma were recruited if they satisfied the following eligibility criteria.

### Criteria for eligibility

Patients with established bilateral glaucoma with pathological cupping of the optic discs and vertical cup/disc ratio 0.5 or more in at least one eye with corresponding visual field changes characteristic of glaucoma [8]. The usual history that was taken included basic demographic data, age at which glaucoma was diagnosed, previous diseases, eye surgery and medications. Also pertinent systemic and family history was recorded.

Positive history of hypertension, diabetes and sickle cell disease was found out and recorded. The blood pressure (BP), fasting blood sugar (FBS) and sickle cell status were also determined in patients with no history of hypertension, diabetes and sickle cell disease. Hypertension was defined as BP  $\geq$  140/90 mmHg [9] and Diabetes was defined as FBS  $>$ 8.00 mmol/l [10].

Full ocular examination was carried out including slit lamp examination, IOP measurement with applanation tonometer, biomicroscopy with 78D fundus lens, gonioscopy, and Humphrey visual field analyser.

In the analysis of cup/disc asymmetry, a historic control group of 253 normal sample (Data from Korle-Bu Teaching Hospital Glaucoma Clinic), was included for comparison.

### Results

The total number of patients recruited was three hundred and ninety. The ages ranged from fifteen to eighty nine years with mean age of fifty-four (54), median fifty-six (56), mode sixty-five (65) and standard deviation 14.86. The frequency distribution of patients showed an increase with ageing rising after 24 years of age until it reached the peak in the sixth decade and then fell, the only exception being the 30-34 age groups which showed a decrease in frequency (Figure 1). Patients aged fifteen to twenty four years formed 11.3% of the cases.

Early onset glaucoma diagnosed before age 40years occurred in 62 patients (15.89%). The rest of the patients, 328, were diagnosed as having adult onset glaucoma (84.10%). Only 15 (3.84%) people knew of a positive family history of glaucoma (first degree relation n=11,

second degree relation n=2, both first and second degree relations n=2). Thirteen (3.33%) had diabetes and 38 (9.74%) had high blood pressure. Only one person had sickle cell disease (0.25%). Thirteen (3.33%) people had myopia of more than -4 dioptres (-4.25 to -14.5D).

There was visual impairment (visual acuity of worse than 6/18 in the better eye) in 80 (20.51%) patients. Five (1.3%) of these patients were totally blind (no perception of light) from glaucoma. Analyses of individual eyes showed that one hundred and sixty-eight (21.53%) eyes had visual acuity worse than 6/18. These include eyes with visual acuity of Hand Movements (HM) to Perception of light (PL) in 111 (14.23%) eyes with Severe glaucoma (Severe glaucoma refers to optic nerve damage with loss of vision in both eyes or loss of vision in one eye that includes central vision loss on plotted visual field). There was no perception of light (NPL) in 56 (7.175%) eyes. Among those with NPL it was bilateral in 5 people (1.28% eyes), and the better eyes had Counting Fingers (CF) to PL. Those who had some residual vision were referred for low vision care.

Further analysis of those with impaired vision in one or both eyes

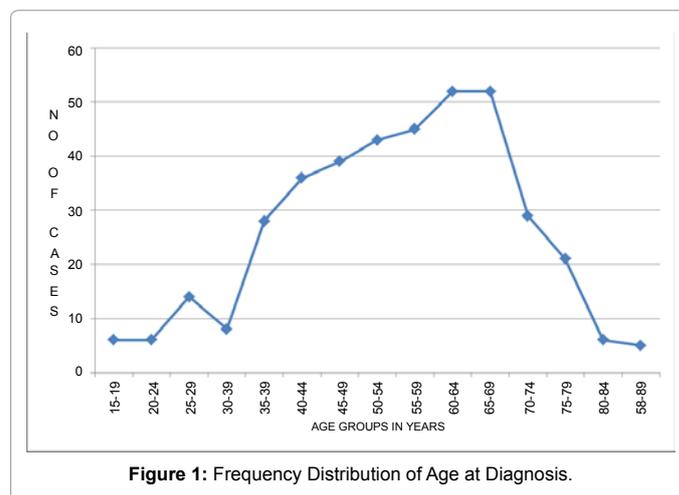


Figure 1: Frequency Distribution of Age at Diagnosis.

AGE GROUP-YEARS	OD	OS
20-24	NPL	CF*
	NPL	6/6
	NPL	6/18
	6/60	CF
25-29	6/5	CF
	6/36	HM
	6/6	6/60
	NPL	6/5
30-34	6/5	HM
	6/12	NPL
	6/24	6/24
	6/18	6/24
35-39	6/9	NPL
	6/36	6/5
	6/5	6/36
	NPL	CF
40-44	6/36	HM
	NPL	6/5
	6/24	NPL
	6/24	NPL

CF: Counting fingers, HM: Hand movements, NPL: No perception of light

Table 1: Visual Acuity in Under Forty with Visual Impairment.

when diagnosis of glaucoma was made before age of 40 years is given in table 1. Two patients were blind, 3.23% of early onset glaucoma ages 21 and 36 years. Seven other patients had NPL in one eye. Pretreatment intraocular pressure (IOP) was Mild (IOP <35 mmHg) in 53.84% of the eyes, moderate (36-50 mmHg) in 28.97%, and severe (>50 mmHg) in 17.17%. In the early onset patients IOP ranged from 13-64 with the mean IOP 36 mmHg (Table 2).

The cup/disc ratio is displayed in figure 2. There was cupping with cup/disc ratio of at least 0.7 in 99% of eyes. Among the patients in the 15-24 year age group, 88.6% had cup/disc ratio of 0.7-1.0. Cup/disc asymmetry 0.2 or more was 32% (125/390). In a historic control group of Normal patients with no evidence of glaucoma, included only for the analysis of cup/disc asymmetry, cup/disc asymmetry was found in 0.4% (1/253). Other retinal vascular pathology found were central retinal vein occlusion and branch retinal vein occlusion in two patients each.

### Discussion

Glaucoma remains an important cause of visual impairment and blindness in Africa and late diagnosis is a major contributory factor. Finding the patient while there is still some useful vision to save is one of the major challenges in the management of glaucoma in Africa [11].

In this study 1 in 5 patients diagnosed with glaucoma had visual impairment from glaucoma and thirteen in every thousand glaucoma patients were also totally blind from glaucoma. At least 7 eyes in a hundred eyes could not perceive light (NPL). In the under forty age group, 2 patients aged 21 and 36 years were also blind and seven patients had no perception of light in one eye. In an earlier Ghanaian study comparing visual loss in an urban and a rural clinic it was found

AGE -YEARS	IOP Range	IOP mean
15-19	19-34	26
20-24	22-69	44
25-29	13-47	33
30-34	21-59	43
35-39	19-64	37
15-39	13-64	36

Table 2: Pretreatment Intraocular Pressure by Age.

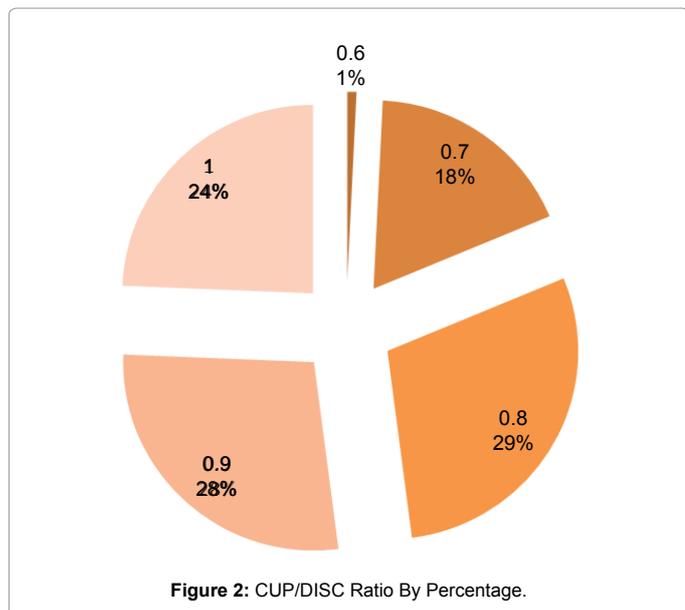


Figure 2: CUP/DISC Ratio By Percentage.

that there was more visual loss in the rural group. This finding was attributed mainly to earlier diagnosis in the urban group as part of routine medical examination for employment and costs involved was also often borne by the employer [12]. Hospital based reports have shown that 29% of glaucoma patients (Dar es Salaam, East Africa) and 53 per cent of eyes (Kano, West Africa) present to hospital blind. Seventy per cent of patients had cup/disc ratios of more than 0.8 in their better eye in Dar es Salaam, and 63 per cent of eyes in Kano had cup/disc ratios of more than 0.8 [13]. This situation certainly attracts attention and action for improvement. Population-based glaucoma screening is not advocated because there is no good screening test and it is impractical. However, there are many community outreach programs targeting those with treatable cataract and other diseases that cause visual impairment, which also refer glaucoma patients earlier than they might present themselves to hospital. These also pose several challenges compounded by limited resources in developing countries. Some patients rely on relatives and friends to cover their hospital costs [14]. It has been found out earlier that late presentation was common [15,16] and this study also did not contradict other observations. Late presentation in general is documented in Africans [5]. As glaucoma is asymptomatic until well advanced it is therefore beneficial to take advantage of every opportunity that presents itself to examine a patient at risk for glaucoma.

In practice in a busy eye clinic the clinical examination tends to be directed by the symptoms and differential diagnosis entertained. In the middle aged and the elderly patients glaucoma is often examined for but there is no clear evidence as to how far to go in the younger age groups in our African population. Evidence is necessary to guide eye care providers to extend examination for glaucoma to younger patients. Glaucoma evaluation in the younger patients will help early detection of glaucoma so as to achieve better control and avoid unnecessary irreversible visual impairment. The factors considered were age, family history of glaucoma, medical history of hypertension, and diabetes mellitus. Sickle cell disease was also considered as it is an important vascular disorder in our West African sub-region that produces important retinopathy similar to Diabetes mellitus but does not appear to have been investigated in relation to glaucoma.

### Age

The graph showing the frequency distribution of glaucoma patients with age rises after 24 years of age, reaches a peak at 60 years and falls after 70 years, the only exception being the 30-34 age group which showed a decrease in frequency (Figure 3) the reason for this decline is not clear but could also be due to the small number enrolled. The life expectancy is about sixty in our part of the world and few patients over 60 years and even fewer over 70 years attend the clinic. The fall in the graph after 60 years is therefore due to the observation that few persons over sixty attend the eye clinic and therefore those with glaucoma would be few too. There was remarkable glaucoma optic neuropathy in patients by 24 years of age indicated by 88.6% of that age group having vertical cup/disc ratios of 0.7-1.0. Considering the rise in frequency of glaucoma after 24 years it appears that 25 years would be a reasonable age at which medical evaluation for detection of glaucoma would be beneficial. Although this study is hospital based this age is consistent with some population studies. Ages recommended in the literature range from 20-40 years; African Americans at the lower age range and Caucasians on the higher side of the age range [16-19].

Increase in cup/disc ratio is a useful clinical sign for the diagnosis of glaucoma. In the absence of a previous clinical photograph of the optic disc to compare or when the size of the disc is not known it is difficult

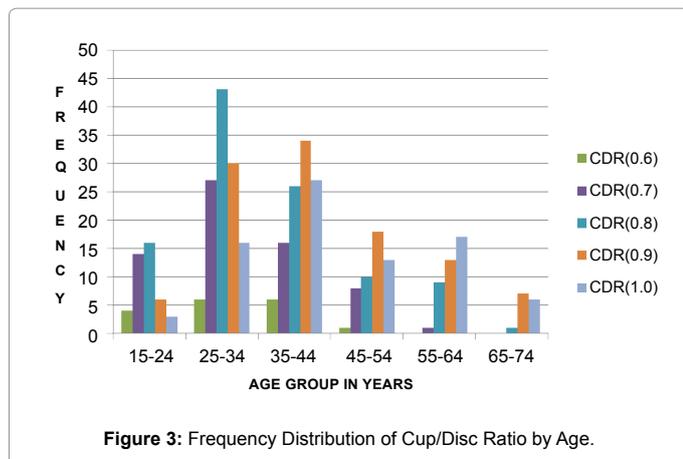


Figure 3: Frequency Distribution of Cup/Disc Ratio by Age.

for the clinician examining the patient for the first time to determine whether there has been a recent enlargement or not. This issue should not be much of a limitation in this study because cup/disc ratios found in the patients recruited were marked vertical cup/disc ratio 0.7 to 1.0, in 99% of total recruits (88.6% in the 15-24 age group). Furthermore abnormal visual field defects characteristic of glaucoma confirmed the clinical impression of glaucoma optic neuropathy.

Cup to disc ratio asymmetry is a recognized feature strongly associated with primary open angle glaucoma, this was present in 32% in the cases as compared to 0.4% in normal controls when the degree of asymmetry allowed was  $\leq 0.2$ . This further strengthened the diagnosis [20].

The mean intra-ocular pressures for the age groups (Table 2) was 26 mmHg in the 15-19 age group and higher 33-44 in the older age groups and did not show any relation with age. In an earlier study we found that IOP > 31 mmHg was more likely to present with advanced features of glaucoma (OR 2.66) than IOP below 31 mmHg [15]. The highest IOP of 44 was found in the 20-24 year age group. The primary risk factor for developing POAG is increased intraocular pressure (IOP) above 21 mm Hg; however, 25 to 50 percent of those with glaucoma have normal IOP measurements [21] and affected individuals have no symptoms to alert them of the level of IOP that starts causing the optic neuropathy. The ocular hypertension treatment study however, demonstrated the benefit of treatment for ocular hypertension in preventing or delaying onset of POAG [22], hence underscoring the importance of IOP measurement in early detection and management of POAG. It may be useful to measure intraocular pressure in the African African patients from age 20years, once in two years at least.

### Family history of glaucoma

A positive family history of glaucoma is a known important risk factor in examination for glaucoma if present. However in our society a negative family history is not a reliable factor to consider. There is a general culture of keeping diseases as personal and people are generally reserved about letting other family members know about their ailments. Some who have glaucoma and are on therapy may also not be aware [23,24]. Therefore it is not surprising that less than 4% knew of a family history of glaucoma. We attempted to find out if people would mind letting relatives know if they have glaucoma but it appeared most people were polite about it and answered yes but did not mean it. A population study on awareness and knowledge of glaucoma showed that at best people would know medical conditions in their

parents or children but not in other members of the extended family and only 1% of the total population knew that POAG runs in families [25]. This further might have contributed to the low positive family history of glaucoma given. Other studies have also showed less than 50% awareness of glaucoma in the population [26].

### Diabetes

Thirteen (3.33%) of the glaucoma patients had diabetes. A study has determined the prevalence of Diabetes in persons aged 25 years and above in Ghana to be 6.3% [27]. Since fasting blood sugar was done in all patients who did not have a history of diabetes mellitus we can certainly say that our evidence of diabetes is as close to the actual as possible. Our results do not confirm the view that there is a higher incidence of glaucoma in our patients with diabetes mellitus than the normal population as usually found in the literature from elsewhere [28]. There is no study in our sub-region to compare with as there is a limitation of previous work on this observation.

### Hypertension

It has been proposed that concepts of common causal mechanisms through modulation of sodium transport at receptors in the ciliary and renal tubular epithelia make it plausible for the tendency for glaucoma and hypertension to co-exist [29].

Thirty-eight (9.74%) of the glaucoma patients had high blood pressure. The prevalence of Hypertension in Ghana was found to be 28.4% for Urban and 25% for rural in the Greater Accra region where our study was done [30]. Our study therefore did not find an increase incidence of glaucoma in hypertensives compared with the normal population. Some studies have supported coincidence of glaucoma and systemic hypertension [31,32].

### Sickle cell disease

Only one person had sickle cell disease (0.25%). Two independent studies in Accra and Kumasi in Ghana found prevalence of sickle cell disease of 1.5 and 2.06 respectively from newborn screening [33,34]. The prevalence of sickle cell disease in the adult population is likely to be lower than in neonates. This is because of relatively higher mortality. Should this prevalence fall to half of what it is in the newborns this study has not found a higher incidence of glaucoma in those of sickle cell disease than the normal population. We have not found any studies in the literature to determine the association between sickle cell disease and glaucoma.

### Refractive error

Thirteen (3.33%) people had myopia of more than -4 dioptres (-4.25 to -14.5D). Studies have showed that Myopia is a recognized association of glaucoma. We are not aware of the prevalence of myopia in our population to compare.

### Conclusion

We suggest that routine measurement of intraocular pressure and evaluation of the optic disc biomicroscopically should be carried out as screening for glaucoma every 2 years in any African-African aged 20 years and above with eye complaints attending an ophthalmology clinic as well as in those aged 25 years and above coming for comprehensive adult medical eye evaluation, until the age of 30 years. However those with a positive family history of glaucoma should be evaluated for glaucoma once a year. After 30 years glaucoma screening should be done yearly for all attendants.

## Strengths and limitations

The main strength of this study is that to our knowledge this is the first attempt to provide an evidence-based recommendations for screening for glaucoma as part of medical eye evaluation in an ophthalmology clinic setting, in African Africans.

The patients recruited could only be patients who attended Korle-Bu Teaching Hospital glaucoma clinic and may not produce a representative population sample as would have been obtained from a population-based epidemiological survey. On the other hand this sample produced a much higher yield of the targeted glaucoma cases than would have been obtained from a population sample.

We have also generalized based on personal communication with other ophthalmologists in the West Africa sub-region but did not recruit glaucoma patients outside Ghana.

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