**Research Article**

# Clinical features of Primary Open Angle Glaucoma at initial presentation: Experience at a tertiary eye care center in Nigeria

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## Abstract

**Introduction:** Glaucoma is a group of optic neuropathies and the leading cause of irreversible blindness worldwide. Primary open angle glaucoma is the commonest type of glaucoma. In affected people, optic nerve fibres are damaged with ensuing loss and raised intraocular pressure in some sufferers.

**Aim/objectives:** To increase knowledge and understanding for improved care of primary open angle glaucoma patients.

**Method:** This was a retrospective study of consecutive 167 hospital patients presenting in Guinness Eye Center Onitsha over a period of February to December 2018 who were diagnosed as having primary open angle glaucoma. Relevant clinical data were studied. Descriptive and correlation statistics were used to ascertain significance of features detected.

**Results:** The patients were 87 (52.1%) males and 80 (47.9%) females. The age range was 17 to 76 years (Mean of 56.4 ± 3.02 years). Mean duration of disease

before presentation was 30.4 ± 5.9 months. Visual acuity at presentation was less than 3/60 in 121 (36.2%) eyes. Intra-ocular pressure mean was 26.6 ± 1.6mmHg. The mean of Cup to optic disc ratio is 0.77 ± 0.2. The visual field loss was total or advanced in 69.6%. Using Pearson's correlation 2-tailed test: cup/disc ratio correlates with duration of presenting symptoms in months at p=0.05, and with intra-ocular pressure at P= 0.01 On non-parametric correlation, using Spearman's rho 2-tailed test, at p= 0.5, duration of presenting symptoms correlates with age; and at P = 0.01 cup/disc ratio correlates with level of intraocular pressure

**Conclusion:** Primary open angle glaucoma present at an advanced stage of the disease. Advocacy is needed for dissemination of information about this disease and where to get care.

**Keywords:** Glaucoma; Features; Demographics; Initial; Presentation

**Abbreviations:** POAG-Primary open angle glaucoma, IOP- Intraocular pressure, CVF- Central visual field (CVF), CDR- Cup to optic disc ratio.

## 1. Introduction

Glaucoma is a group of eye diseases in which the ganglion cells of the retina are progressively destroyed in a distinctive pattern [1,2]. This leads to increasing loss of optic nerve fibers in a typical pattern, resulting in a distinctive pattern of optic nerve head cupping and visual field loss [2]. Among the risk factors, raised intraocular pressure (IOP) is significant [3]. This disease is a leading cause of blindness world wide [4,5]. Primary open angle glaucoma (POAG), a variant of this disease, in addition to risk factors has also genetic predisposition [6-10]. Risk factors for the

disease include age, gender, race, systemic diseases like hypertension and diabetes mellitus, and ocular conditions like myopia and nevus of ota [7-9]. Evaluation determines the severity of the disease in terms of extent of damage to the eye and how high the IOP is: the main modifiable risk factor [10-12]. The degree of damage to the eye among patients on their first diagnosis and presentation to an eye hospital is the subject of this study. The markers for assessing these include the visual acuity, IOP, Central Visual Field (CVF), Cup to optic disc ratio (CDR), and presenting complaint and its duration. Although normal visual field extends on average 100 degrees temporally, 70 degrees inferiorly, 60 degrees nasally and 50 degrees superiorly. The central 30 degrees of the visual field in all directions is referred to as the central visual field (CVF), and is the area of most concern in glaucomas [11,13]. CVF analysis is important for diagnosis of POAG. IOP alone as criterion for diagnosis discloses prevalence of POAG by 33% lower than when combined with CVF [14]. The disease is classified as early, moderate, advanced and end stage depending on the degree of vision loss [2,10,15,16]. Among Caucasians who had early POAG and were undergoing treatment, total loss of visual field/sight occurred over 33-38 years span [15,17]. Burr et al in a literature survey in 2007 found onset to total loss of vision to be 23 years in untreated people [19]. In black people, it has been asserted that the disease runs a more aggressive route and blindness occurs early [7]. Intraocular pressure (IOP) in normal eyes may vary at different times in the day but ranges from 10-21mmHg using applanation method [2,11,16,20,21]. Raised IOP above 22mmHg as the only criterion is a poor diagnostic tool for POAG. Only 33% of such people found to have elevated IOP on routine screening develop POAG later in life [22] About 33% of people with the disease do not have elevated IOP on repeated

measurements and phasing [23] However, since raised IOP is found in about 66% of POAG and its reduction serves to ameliorate the disease, it is regarded as the most important risk factor in developing POAG, and also the most convenient modifiable of the risk factors for management of the disease [24]. Optic nerve head evaluation shows that normal optic nerve head is pink in color, the margin is distinct, and the central slightly deeper area called the optic cup measures about 20-50% of the total diameter of the optic disc [25]. Investigators have described various changes that manifest on and around the optic disc [2,16,26,27,28]. Observations of the fundus could be done subjectively with direct and indirect ophthalmoscopes, and with biomicroscope and fundal viewing lenses. An objective method utilizes Optical Coherence Tomography (OCT), in which images and quantitative scores of observations are obtained utilizing installed programs [29]. Objective methods are expensive, more accurate, but less available. The degree of vertical optic disc cupping is assigned value as a fraction of the total diameter of the disc viz Cup/Disc ratio (CDR) [28]. This is a tool for describing the degree of damage or severity of the disease. It is an important record to be obtained and recorded at presentation and at different points in the evaluation of the progression of the disease. Other useful data include central corneal thickness [30]. A high volume of patient load in low-income countries, coupled with few eye care specialists make detailed examinations of patients a challenge [31]. Important in evaluation of POAG patients is visual acuity evaluation [8,18,32]. This test has been shown that in POAG, low visual acuity is predictive of advanced disease. This test measures central vision. In glaucoma however the peripheral vision is affected initially so that there is no reduction of visual acuity at first. By the time central vision is affected, much loss of visual field has occurred.

**Justification of this study:**

POAG is an important cause of blindness and sub-normal vision worldwide. The disease is not preventable and blindness resulting from POAG is not reversible. Measures available are mostly secondary prevention, which means preventing people who have the disease from going blind by halting or reducing progression of the disease, but this is an expensive and life-long undertaking. Nigeria has a high burden of glaucoma, therefore knowledge about it, and various aspects of its manifestation is necessary for effective amelioration.

## 2. Aim and objectives of the study

This study aims to determine the clinical features of POAG at first presentation and their correlation with time of presentation and other demographic factors in order to improve knowledge and care, thereby preventing blindness from glaucoma.

## 3. Materials and Methods

This study was conducted in Guinness Eye Center Onitsha, a stand-alone tertiary eye care center of Nnamdi Azikiwe University Teaching Hospital. This center subserves the five eastern states of Nigeria with some patients from across the Niger. Permission to embark on this study was obtained from the Health Research Medical and Ethics committee of the Nnamdi Azikiwe University Teaching Hospital, Nnewi (Approval number NAUTH/CS/66/VOL.13/VER III/05/2020/01). All aspects of consideration on using human subjects and data were respected. Sample size was determined from the multicenter study to detect blindness among glaucoma patients, in which 11% prevalence of unilateral blindness at onset of the observation were disclosed [19]. Using $N=(1.96)^2pq/(E)^2$ to calculate sample size [33], a calculated sample size of 150 patients were minimum

sample size required. In which N is sample size, p is prevalence, q is 1-p, E is precision of 5%, and 1.96 is confidence interval of 95%. Attrition was added to make it up to 167.

**Study duration:** February to December 2018.

**Inclusion criteria:** Patients with a diagnosis of POAG, with IOP measurement and optic nerve examination done on presentation, and CVF done within one week of presentation.

**Exclusion criteria:** Patients with POAG whose evaluation of any of the parameters could not be done.

**Data analysis:** Data generated was analyzed using SPSS version 23. Descriptive and correlation statistics were used to ascertain significance of findings. Statistical significance was placed at P value of <0.05.

## 4. Results

The total number of patients is 167 consisting of 87 (52.1%) males and 80 (47.9%) females. Age range was 17 to 76 years, mean of $56.4 \pm 3.02$ years, and mode is 61 years. Majority, 146 (87.4%) were above 40 years of age. There was significant association between age and duration of presenting complaint at $X^2$ P<0.05. There is no association between age and degree of

CVF loss at $X^2$ P<0.05. Among the patients, 60(35.9%) had no primary education, 19 (11.4%) had only primary school education, 41 (24.5%) stopped at secondary school education, while 36 (21.5%) had different forms of post-secondary school training. Information was not available for educational status of 11 (6.6%) patients.

Occupations of the patients were trading 42 (25.1%), farming 26 (15.6%), different professions 20 (12.0%), unskilled 11 (6.6%), artisan 8 (4.8%), retired 23 (13.8%), student 9 (5.4%), and unemployed 28 (16.8%). $X^2$ at P< 0.05, shows no association between occupation and diagnosis of POAG; no association between gender and duration of presenting complaints, and no associations between educational attainments and POAG diagnosis, CVF loss, IOP level, and CDR.

There was a positive family history of glaucoma or non-traumatic blindness in first degree relatives in 21 (12.6%); however, 56 (33.5%) gave a negative family history, and in 90 (53.9%) patients, no record on family history was obtained. Table 1 shows the presenting complaints on presentation to the clinic.

| Presenting symptoms | Frequency/Percentage |
|---|---|
| Defective vision for far, near or both | 143 (85.6%) |
| Eye pain/discomfort | 22(13.2%). |
| Flashes of light | 1 (0.6%) |
| Routine patient relation screening exam | 1 (0.6%) |
| **Total** | **167 (100%)** |

**Table 1:** Presenting complaints of patients with POAG on first presentation

Duration in months of presenting complaints ranged from 0.1 month, to 192 months, mode of 12 months, mean of 30.4 $\pm$ 2.8 months. Correlation study, using non parametric Spearman's rho 2-tailed test, discloses duration of presenting symptoms correlates with age at 95% confidence interval.

The visual acuity of the patients is depicted in Table 2.

| Visual acuity | UNAIDED (frequency/percentage) | AIDED (frequency/percentage) |
|---|---|---|
| 6/18 or better | 118 (35.3%) | 110 (32.9%) |
| Less than 6/18 to 6/60 | 81 (24.2%) | 71 (21.3%) |
| Less than 6/60 to 3/60 | 14 (4.2%) | 7 (2.1%) |
| Less than 3/60 to HM | 76 (22.8%) | 27 (8.1%) |
| PL | 16 (4.8%) | 1 (0.3%) |
| NPL | 29 (8.7%) | 10 (3.0%) |
| Not done* | 0 (0.0%) | 108 (32.3%) |
| **Total** | **334 (100%)** | **334 (100%)** |

**Table 2:** Visual acuity of patients (Eyes).

*In 108 eyes, refraction was not done because their visual acuity was reduced vision of HM, PL and NPL. 121(36.1%) eyes were blind using criteria of visual acuity of less than 3/60.

Table 3 shows the CDR of the patients' eyes at first presentation.

| Cup/disc ratio | Frequency/Percentage |
|---|---|
| 0.1 - 0.2 | 4 (1.2%) |
| 0.3 – 0.4 | 20 (6.0%) |
| 0.5 – 0.6 | 63 (18.9%) |
| 0.7 – 0.8 | 163 (48.8%) |
| 0.9 – 1.0 | 84 (25.1%) |
| **Total** | **334 (100.0%)** |

**Table 3:** CDR of the patient's eyes on first presentation

Cup/disc ratio statistics: range is 0.2 to 1.0, mean is $0.77 \pm 0.2$, mode is 0.8.

Correlation study using Pearson's correlation 2-tailed test: CDR correlates with duration of presenting symptoms in months at $P<0.05$, and with IOP at $P= 0.01$ at 95% confidence interval.

Table 4 shows the central visual field findings in the eyes of the patients.

| Visual field damage | Frequency/percentage |
|---|---|
| Total loss | 51 (15.3%) |
| Advanced | 182 (54.5%) |
| Moderate | 76 (22.7%) |
| Early | 16 (4.8%) |
| Normal | 9 (2.7%) |
| **Total** | **334 (100%)** |

**Table 4:** Central Visual Field (CVF) findings (Eyes)

| Intra-ocular pressure (mmHg)* | Frequency/percent |
|---|---|
| Oct-21 | 125 (37.4%) |
| 22-30 | 91 (27.2%) |
| 31-40 | 69 (20.7%) |
| 41-50 | 25 (7.5%) |
| 51-60 | 21 (6.3%) |
| 61-70 | 3 (0.9%) |
| **Total** | **334 (100.0%)** |

**Table 5:** IOP distribution at initial presentation (Eyes)

IOP statistics: range- 10mmHg to 68mmHg, mean-26.6±1.6mmHg.

On correlation, using non parametric Spearman's rho 2-tailed test P = 0.01, CDR correlates with level of IOP.

**Operational definitions:**

1. Normal visual field: no visual field loss.
2. Early visual field damage: scotomas in the Bjerrum area.
3. Moderate visual field damage: nasal steps or temporal wedge with scotoma within 10 degrees of central fixation.
4. Advanced visual field damage: scotoma within 5 degrees of fixation.
5. Total visual field damage: absence of perception of visual field test targets.

# 5. Discussion

Demographic consideration confirms that POAG is predominantly seen in older people as seen in this study with a mean age of 56.4 years. This pathology was noted to increase with increasing age as shown with majority (87.4%) being above 40 years of age. This agrees with data from a study in Barbados by Leske and co-workers, who found older age to be a risk factor for this disease [9]. Age group of 40 years and above should be targeted for public enlightenment and screening for glaucoma especially in low-resource countries. This will greatly enhance early detection and subsequent management of POAG. Educational status and occupation had no influence on POAG in this study. This is in keeping with other studies which did not find education and occupation among various risks for POAG [7-10]. The low educational attainment, and low earnings associated with the predominant occupation of the people in this study however may impose challenges on management of this disease where interventions may require substantial financial involvement of the patients, either in the form of disbursement directly to the care facilities or to Health Management Organizations/ insurance companies. There was no significant association between gender and POAG among these patients. This appears to agree with findings by Vajanarant et al [34]. In screening or other intervention programs for POAG in this environment it will not be worthwhile to target any gender. The most common presenting complaint was blurring of vision in 85.6% of the patients. This was present in these patients for an average period of 30.4 months prior to presentation. Indeed, majority of the eyes were blind on presentation based on criterium of visual acuity of less than 3/60. Late presentation of the disease as a risk factor for profound vision loss and blindness in glaucoma has been documented in other studies [2,10,15,16]. The long duration of blurry vision before presentation might appear to indicate a poor health seeking behavior coupled with numerous challenges that are encountered by the populace in developing countries in accessing eye care. Non-parametric correlation, using Spearman's rho 2-tailed

test, at P= 0.5, shows that duration of presenting symptoms correlates with age. POAG manifests defective vision when field loss has advanced, so the predominance of this complaint is an indication of advanced disease before patient presented for care. Positive family history of POAG present in a significant proportion of these patients (12.6%) substantiates already documented familial pattern of this condition [6]. People with no documented family history of POAG (53.9%) however were more than twice as those with a known positive family history. This does not indicate non-genetic factors in the families but simply that patients presenting are ignorant of the state of ocular health of other relatives. Studies describe inheritance pattern for the disease although the responsible genes were not identified among sufferers of the disease in a study in Ghana, Africa [6]. Genetics as a risk factor for the disease, suggests that family history of non-traumatic blindness should induce an eye care practitioner screen for POAG in such patients. This high proportion of no family history also implies that time should be spent counseling the patient with diagnosis of POAG on the familial pattern and the need for other relatives to be screened for the condition. The CDR findings in 'Table 3' showed a mode of 0.8 and a mean of 0.77. This means that advanced optic nerve loss had occurred before presentation. Although useful in characterizing damage from glaucoma, CDR rating could manifest inter-observer variations and even variations by the same observer in asserted value on repeat observations. Besides papillary and peri-papillary changes, CDR is the most important parameter in the evaluation of glaucoma [2,16,28]. Observable CDR by fundus viewing lens is useful in categorization of glaucoma disc changes especially in low-resource countries. Other sophisticated devices for glaucoma assessment are usually not available, and certainly not in rural communities. Although optic disc cupping of above 0.75 was commonly observed, Table 3 showed CDR of less than 0.6 in 25.7% of these patients. Therefore, whatever the assertion for the upper limit of CDR, it must be recognized that those with ratio less than this may manifest advanced diseases. Using Pearson's correlation 2-tailed test: CDR correlates with duration of presenting symptoms in months at P=0.05. There was no correlation between CDR and IOP, gender, educational status or occupation at P=0.05 Pearson's correlation 2-tailed test. CVF loss presented in 'Table 4' records that central visual field loss was advanced or total at initial presentation in 233 (69.8%) eyes, and had encroached up to central 5 degrees of fixation. Out of these, 51 (15.3%) had total loss of visual field. This correlates with the visual acuity losses in these patients. Poor visual acuity occasioned by central field affectation is thus understandably the most prominent characteristic of POAG seen amongst these patients presenting with advanced disease. This is in agreement with other studies [2,3, 10,15,16]. Intraocular pressure presented in 'Table 5' show high mean of 26.6mmHg. This agrees with findings on raised IOP as seen in other studies [22]. Among these POAG patients, with long disease duration, advanced disc damage was occurred more in eyes with higher IOP. Using Pearson's correlation 2-tailed test at P= 0.01, CDR correlated with level of intraocular pressure. On non-parametric correlation, using Spearman's rho 2-tailed test at P = 0.01, CDR also correlated with level of intraocular pressure. Eyes with IOP in the range of 10-21mmHg Goldman Applanation Tonometer or less at time of initial evaluation were 125 (37.5%), accounted for about one third of the patients. These could be normal tension glaucoma patients. These echoes the fact that a substantial proportion of patients with a diagnosis of POAG would manifest IOP in the normal range at time of initial evaluation and some may never

have raised pressure above normal.

## 6. Conclusions

Primary open angle glaucoma presents for care at advanced stages in our environment. There was significant correlation between age and cup to optic disc ratio with duration of presenting complaints. Late presentation was a risk factor for poor vision and advanced disease. It is therefore urgent and imperative that well-funded advocacy and public enlightenment be instituted to increase knowledge and understanding for improved care of primary open angle glaucoma.

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