

PRESENTATION OF GLAUCOMA IN THE GREATER ACCRA METROPOLITAN AREA OF GHANA

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SUMMARY

Background: This study addresses the prevalence and clinical presentation of patients with primary open angle glaucoma (POAG) in the greater Accra metropolitan area.

Methods: This is a retrospective case series of 455 patients (813 eyes) at the Emmanuel Eye Clinic. Patients were diagnosed from May 2008 to Nov 2011. The definition of POAG conformed to the International Society of Geographical and Epidemiological Ophthalmology (ISGEO) criteria. Information collected included basic demographic data, distribution of glaucoma subtypes, measured intraocular pressure (IOP), best corrected visual acuity (BCVA) and optic disc measurements.

Results: Nearly 24% presented blind in at least one eye. The average age was 56.7 +/-16.7 years and the average IOP was 33.9 mmHg +/- 12.7 mmHg for right eyes and 33.5 mmHg +/-12.0 mmHg for left eyes. The mean vertical cup to disc ratio (vCDR) was 0.83 for right eyes versus 0.82 for left eyes. A total of 32 patients (53 eyes) were diagnosed with normal tension glaucoma (NTG). Statistically significant differences between the NTG and high tension groups included age (45.3 +/- 16.7 vs. 56.7 +/-16.7, $p<0.001$), mean IOP (19.1 mmHg +/- 4.5 mmHg vs. 33.7 +/- 12.4 mmHg, $p<0.001$) and mean vCDR (0.76 +/- 0.17 vs. 0.83 +/- 0.10, $p<0.01$). Comparing age-matched NTG patients with high tension glaucoma patients showed no significant difference in vCDR.

Conclusions: The clinical presentation of POAG at the Emmanuel Eye Center is characterized by elevated IOP and grossly advanced optic neuropathy. Significant differences between high tension glaucoma and NTG were identified.

Keywords: Primary Open Angle Glaucoma, Normal Tension Glaucoma, Ghana, Accra, Africa

INTRODUCTION

Primary open angle glaucoma (POAG) ranks as the second most important cause of blindness after cataract, but is the most common irreversible cause of blindness worldwide.¹ A 1996 estimate by Quigley et al. estimated that by the year 2000 approximately 66.8 million people would be affected by glaucoma with 6.7 million blind from the disease.² An updated study in 2006 by Quigley et al modified these figures and projected that by the year 2020 the global burden of glaucoma would exceed 79.6 million affected with 11.2 million blind from POAG and closed angle glaucoma variants alone.³ In Ghana, a 2004 population study estimated POAG afflicted 7.7% of the population over the age of 30 years and 8.5% over 40 years of age.⁴ Approximately 20% of POAG patients were diagnosed with normal tension glaucoma (NTG).⁴ The estimated prevalence of POAG in Ghana is comparable to other African-descended population studies such as those in St. Lucia and Barbados.^{5,6}

Population studies in Europe⁷, Southeast Asia^{8,9}, and studies in the United States in Latino¹⁰ populations have shown much lower prevalence rates ranging from 1.7 to 1.8% in South East Asia to 2.0% in Hispanic communities. The Baltimore Eye Survey conducted in the United States also definitely showed age-adjusted prevalence rates for POAG were four to five times higher in blacks as compared with whites.¹¹ In a previous study in the North Eastern Region of Ghana, records of 891 eyes of 446 patients were reviewed revealing 98.4% of patients suffered from POAG with 8.3% classified as NTG, or manifesting IOPs consistently below <22 mmHg.¹² In that study, more than one third of all patients presented bilaterally blind and nearly half were blind in at least one eye.

The pathophysiology of this disease continues to be studied, but is characterized by a progressive optic neuropathy with visual field loss and characteristic structural changes, including thinning of the retinal nerve fiber layer and excavation of the optic nerve head, with intraocular pressure (IOP) as the principle modifiable risk factor. This study aims to determine the presentation patterns of glaucoma in the densely populated urban capital of Accra, Ghana, which is home to about 4 million residents.

MATERIALS AND METHODS

Study Design

This study is a retrospective case series that involved a review of 455 patients (813 eyes) at the Emmanuel Eye Clinic, a large ophthalmology referral center in Accra, Ghana. All patients included were initially diagnosed from May 2008 to Nov 2011. Information collected included basic demographic data, distribution of glaucoma subtypes, measured intraocular pressures, visual acuity and optic disc measurements.

Outcome measures

The principal outcome measure was the diagnosis of POAG, which required meeting specific diagnostic criteria. For the purpose of this study, secondary open-angle and closed angle forms were excluded regardless of the mechanism as were patients with infantile or childhood glaucoma secondary to another inherited localized or systemic disease process.

Definitions and Diagnostic Criteria

The diagnosis of POAG conformed to the definition from the Working Group for Defining Glaucomas in Prevalence Studies, also referred to as the International Society of Geographical and Epidemiological Ophthalmology (ISGEO) (Table 1).¹³ For this study, NTG was considered a subset of POAG based on findings of glaucomatous optic neuropathy consistent with high tension glaucoma in the setting of IOP <22 mmHg.

Table 1 ISGEO Classification Criteria

Category	Description
(1): structural and functional evidence	A definite and reliable glaucomatous visual field defect was found in the presence of either vCDR ≥ 0.7 or a vCDR asymmetry ≥ 0.2 .
(2): advanced structural damage	Humphrey's 24-2 visual field testing not completed satisfactorily, but vCDR was ≥ 0.9 , or vCDR asymmetry ≥ 0.3 .
(3): media opacity obstruction	VA light perception or worse with IOP ≥ 30 mmHg and an afferent defect. VFT not possible based on vision loss due to blindness or visual impairment.

All cases were either examined or confirmed (having been previously diagnosed by other colleagues) by an experienced ophthalmologist with subspecialty training in glaucoma who performed Goldmann applanation tonometry (Haag-Streit, Mason, OH), gonioscopy and biomicroscopic disk assessment. All visual acuity data was recorded from a standard Snellen chart at 6 m (20 ft) using the patients best corrected visual acuity (BCVA) and converted to Logmar format for standardized comparisons.

Exclusion criteria

Patients already on glaucoma medical therapy, those with prior ophthalmologic procedures including cataract extraction, laser therapy for glaucoma, or any glaucoma filtering surgery were excluded from this study. A retinal disease that may cause visual field defects or macular disease which significantly impairs central vision was also an exclusion criterion.

Statistical Analysis

Data were entered and checked primarily with Microsoft Excel© Epi Info™ 3.4.1 with Stata™ 8.1 as a complimentary software agent. For continuous variables, the mean and the standard deviation were reported. For continuous variables with two groups, the Student's t-test was used. All statistical tests were two-sided and an alpha level <0.05 was considered a statistically significant result. The 95% confidence intervals and Fisher's exact test for cells with less than five entries were also used where appropriate.

RESULTS

Age and sex distribution is shown in Table 2. There was a clear association between increasing age and prevalence of POAG with the highest incidence occurring in the 6th through 8th decades. Of all patients diagnosed with POAG, 42.3% of men and 46.4% of women were diagnosed during the 6th through 8th decades.

Table 2 Age and Sex Distribution of All patients

Age	Males		Females		Total	
	No.	%	No.	%	No.	%
<21	6	2.7	4	1.7	10	2.2
21-40	40	18.0	33	14.2	73	16.0
41-60	78	35.1	78	33.5	156	34.3
61-80	94	42.3	108	46.4	202	44.4
>80	4	1.8	10	4.3	14	3.1
Total	222	100	233	100	455	100

There was no significant difference between the numbers of men or women afflicted by POAG in this study with 222 men (48.8%) versus 233 women (51.2%) affected. The average age of subjects was 56.7 years \pm 16.7 years. The age range was 11 to 96 years of age.

A total of 455 patients (813 eyes) met inclusion criteria for POAG. Of these, 32 patients (7.0%) had NTG. Nearly one fifth (18.5%) of all subjects were diagnosed with POAG at or before the age of 40 years. The number of patients who presented blind (defined as BCVA $<$ 3/60 in the better eye) was 23.95%. There was no statistically significant difference in right vs. left eyes diagnosed with POAG (49.4% vs. 50.6%).

The mean BCVA was between 6/24 and 6/36 (logmar 0.60-0.78). The average IOP measured prior to any application of therapy was 33.9mmHg \pm 12.7 mmHg for right eyes and 33.5mmHg \pm 12.0 mmHg for left eyes. This value did not include the measured IOP of NTG patients which was 19.1 mmHg. IOP ranged from 12 mmHg to 76 mmHg. There was no significant difference between the arithmetic mean IOP measurements for either eye. As a general non-specific measure of IOP severity, 25.7% of patients had IOP $>$ 40 mmHg at diagnosis, with no significant left or right eye predominance. The average measured vCDR for right eyes was 0.83 versus 0.82 for left eyes.

A total of 32 patients (53 eyes) were diagnosed with NTG, defined as IOP $<$ 22 mmHg prior to the use of ocular hypotensive medications. The average age was 45.3 years \pm 16.7 years, significantly lower than the average age of POAG patients ($p <$ 0.001). There was no right or left eye predominance (25 OD vs. 28 OS) or significant difference in gender (25 men vs. 28 women). The average BCVA at presentation was between 6/12 and 6/18 (logmar 0.3-0.47). The mean IOP was 19.1mmHg \pm 4.5 mmHg.

Table 3 Comparison of Normal Tension and Primary Open-Angle Glaucoma

	NTG	POAG	P value
Number (eyes)	32 (53)	423 (760)	-
Mean Age (years \pm SD)	45.3 \pm 16.7	56.7 \pm 16.7	$<$ 0.001
OD/OS (%)	47.2 / 52.8	49.4 / 50.6	not significant
M/F (%)	47.2 / 52.8	48.8 / 51.2	not significant
BCVA range (log-mar)	0.30 - 0.47	0.60 - 0.78	$<$ 0.01
mean IOP (mmHg \pm SD)	19.1 \pm 4.5	33.5 \pm 12.1	$<$ 0.0001
mean vCDR	0.76 \pm 0.17	0.83 \pm 0.15	$<$ 0.01

The mean vCDR for NTG patient was 0.76 \pm 0.17, which was significantly lower than for all POAG patients ($p <$ 0.01), but when compared to an age matched cohort of high tension glaucoma patients, the differ-

ence in vCDR did not meet statistical significance ($p = 0.07$). A comparison of NTG and POAG patients is shown in Table 3.

DISCUSSION

The challenge of preventing vision loss from POAG in African countries is complicated by an earlier onset, a more aggressive course, a higher presenting IOP and multiple socioeconomic barriers leading to rapid visual impairment before treatment can be initiated.¹⁴ The average IOP for subjects in this study was 33.9 mmHg for right eyes and 33.5 mmHg for left eyes and nearly 1 in 4 presented blind in at least one eye. These findings are actually somewhat better compared to similar studies in other regions^{12, 15, 16}, perhaps reflecting more convenient access to medical care in large urban areas versus rural settings. For example, in a previous study in the poorer North Eastern territories of Ghana, 34.1% of the patients were bilaterally blind and between 51.3 and 52.2% were blind in at least one eye on presentation.¹² Likewise, in a hospital-based study in Nigeria 53% of eyes treated for glaucoma were blind at the time of first diagnosis¹⁵ and in Tanzania¹⁶, 29% of patients were initially diagnosed blind.

The mean age of diagnosis in this study was 56.7 years, which closely resembles similar studies in the North Eastern region of Ghana (53.2 years),¹² Nigeria (52.7 years),¹⁵ Cameroon (53.3 years)^{17, 18} and Ethiopia (51.9 years).¹⁹ The percentage of young patients diagnosed at the age of 40 years or younger was 18.2% in this study. This was slightly lower than the 23.6% reported in the North Eastern region of Ghana, but continues to reflect the excessive burden this disease poses to younger individuals and the need for improved screening programs to identify at-risk individuals in heavily populated urban districts.

This study did not identify a significant difference in incidence by gender, however other hospital based studies previously mentioned in the North Eastern region of Ghana, Nigeria and Ethiopia have reported nearly a 2:1 male ratio. This may reflect an underreporting of women affected by the disease in these studies. The largest population study in Ghana to date reported no statistical difference in gender prevalence of POAG at any age.⁴

There is considerable controversy as to whether NTG represents a distinct disease entity or whether NTG is simply POAG with IOP measured in the statistically normal range. Total population surveys in Europe, North America and Australia report open-angle glaucoma with normal IOPs in 15-25% of the population surveyed²⁰.

This is considerably higher than measurements in this study (7.0%). No characteristic features exist to distinguish NTG from high tension glaucoma other than the level of IOP consistently measured below a standardized criterion.

Some authorities have reported that subjects with NTG are more likely to show focal notching and optic disc hemorrhages - with a possible classification into different subtypes based on appearance - with the explanation that case finding is delayed due to the IOP being measured in the normal range.^{20, 21} Further studies investigating optic disc characteristics in normal tension glaucoma patients Ghana would be a useful addition to the literature. The visual field has also been more likely to show defects close to fixation and evidence suggests the left eye is 2.5xs more likely to be affected first and the affected eye may display a slightly higher IOP, although with increasing age NTG becomes a bilateral symmetric disease.^{22, 23} In regards to treatment, the Collaborative Normal-Tension Glaucoma Study (CNTGS) found that lowering IOP at least 30% had a clear protective effect in NTG patients suggesting the responsible etiology may be a vascular insufficiency. Subjects with reduced IOP had reduced visual field progression from 35% versus 12% versus controls.²⁴ This confirmed that IOP plays a clear role in the pathophysiology of this disease, but this failed to explain why some patients continued to progress in spite of well-controlled IOP.

The clinical presentation of high tension glaucoma at the Emmanuel Eye Center is characterized by elevated IOP and grossly advanced optic neuropathy with significant differences between the clinical presentation of high tension glaucoma and NTG primarily in age and IOP. Further studies are needed to better characterize distinct differences between high tension glaucoma and NTG in West African populations.

LIMITATIONS

Evidence was drawn from a single large outpatient referral center and is not fully representative of the entire greater Accra metropolitan area. Central corneal thickness was not recorded and IOP averages may be under or overestimated. Perimetric findings were not standardized for this study or included. This study excluded ocular hypertension and secondary glaucoma patients. Inter-observer and intra-observer variations in vCDR measurements and IOP assessments were present since different ophthalmologists were involved. The availability of OCT or fundus photography may have reduced this bias. Diurnal variations in IOP measurement were not taken into account which may have affected the classification of the NTG or high tension glaucoma patients.

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