(RESEARCH ARTICLE)

Glaucoma in self-reported relatives and non-relatives of Igbo glaucoma patients in Enugu, Nigeria

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Abstract

Purpose: To compare proportion of glaucoma and the associated factors among self-reported relatives and non-relatives of predominantly Igbo glaucoma patients

Methods: An analytical cross-sectional survey of participants attending a free eye screening dedicated to relatives of glaucoma relatives in Enugu, Nigeria was carried out in July 2017. Non-relatives of glaucoma patients were expected to present for the free screening hence they were allowed to participate to prevent false claims. All participants were interviewed and underwent ophthalmic examinations. Glaucoma diagnosis was based on the ISGEO classification criteria adapted for Nigeria. Participants were subsequently grouped as glaucoma relatives and general population.

Results: Forty-two and 56 participants were included in the relatives and general population groups respectively. The proportion of glaucoma in the relatives and general population groups was 43% and 20% respectively. The odds of having glaucoma was three times higher in relatives of patients than in general population (OR= 3.07, 95% CI; 1.25 – 7.5 p=0.013). About 52% of first-degree relatives were diagnosed with glaucoma. In the relatives' group, 100% of siblings, 40% of children and 0% of parents had glaucoma. Proportion increased with age. Relatives were significantly younger than their probands at diagnosis (16years, p= 0.000). Only 5.6% of the relatives' group were previously aware of diagnosis. Intraocular pressure and central cornea thickness were similar in both relatives and general population groups.

Conclusions: In this screened Igbo population, over one-third of the relatives' group and about one fifth of general population had glaucoma. Relatives were diagnosed at an earlier age. These findings will aid the advocacy for routine glaucoma family screening services.

Keywords: Glaucoma; Family history; Igbo; Enugu; Nigeria

1. Background

Glaucoma is the leading cause of irreversible blindness worldwide with Africa having the highest prevalence [1, 2]. Apart from black African descent being a risk factor, positive family history of glaucoma is also a significant risk factor for the development of glaucoma [3, 4]. Relatives of glaucoma patients are therefore a high risk group.

Higher prevalence of glaucoma diagnosis has been found among relatives of glaucoma patients compared to the general population [5, 6, 7, 8]. From different studies, the risk ratio of relatives of persons with primary open angle glaucoma (POAG) developing POAG was estimated to be 9.2 [7, 8]. A >10% risk of developing glaucoma was reported among siblings of primary angle closure/primary angle closure glaucoma patients [8]. The risk of a positive family history in

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glaucoma has been associated with degree of relationship with an affected relative [9,10]. The Blue mountains, Barbados and Baltimore eye studies found a 2.5 to 4.4 increased odds in first degree relatives of POAG patients [11, 12, 13]. Similarly, other studies reveal that over half of persons with POAG were from families where a family member was affected with highest prevalence among first degree relatives [7, 8, 14]. The Rotterdam population based study revealed a 22% lifetime risk of developing glaucoma in relatives of patients as against 2.3% lifetime risk in normal controls [7].

Population screening for glaucoma is often discouraged but encouraged in high risk group such as family members of glaucoma patients [15, 16]. Such screenings enhance early detection [17, 18]. Early detection is an effective driver for reduction of visual impairment and blindness from glaucoma [19]. It also drives down the cost burden for glaucoma treatment [20, 21]. Dedicated screening amongst this high risk group is not common in most part of the country likewise family screening in glaucoma clinics. Recent local data is therefore required for advocacy to encourage the establishment of glaucoma family screening clinics and services.

Aim: To compare proportion of glaucoma and the associated factors among self-reported relatives and non-relatives of glaucoma patients.

2. Materials and methodology

This was a cross-sectional survey of participants of a dedicated free glaucoma screening exercise for glaucoma patient's relatives in July 2017 at the premises of the Eye Specialists Hospital, Enugu Nigeria. Glaucoma patients' relatives were invited through their probands who attended eye clinics prior to the screening date. Invitations were also made through the media using radio broadcasts, posters, church announcements and bulletins. The awareness campaigns over the radio entailed health education on glaucoma: its prevalence, risk factors, natural history, treatment options, follow-up care and the need for regular screening.

Information regarding demographics, relationship with proband and age of proband at diagnosis were recorded in an interviewer-administered questionnaire. Questionnaire was administered in English language and interpreted in the local dialect where necessary. Clinical assessment included visual acuity with snellen's chart, intraocular pressure measurement(IOP) using Huvitz Non-contact Tonometer (HNT) -7000 US Ophthalmic FL; anterior and posterior segments examinations with the pen torch light and direct ophthalmoscope respectively; pachymetry using Pac Scan 300+ AScan/Pachymeter, Sonomed Escalon, NY. Visual fields and gonioscopy were not assessed due to the logistic constraint. Though it was a targeted screening for relatives of glaucoma patients, all who came were examined to prevent false claims of having a relative with glaucoma.

Participants were thereafter grouped as relatives of glaucoma patients based on self-report. First degree relatives of probands included parents, siblings and children while other relatives of probands included aunties, uncles, cousins and grandparents. Participants who reported no history of a glaucoma relative were grouped as general population.

Participants were diagnosed with glaucoma based on the criteria set forth by the International Society for Geographical and Epidemiological Ophthalmology (ISGEO) modified by the Nigeria National Blindness and Visual Impairment Survey [4]. Glaucoma was categorized as one of four categories based on examination with direct ophthalmoscope and intraocular pressure measurement therefore Glaucoma category 1(structural and typical visual field defect) was not included as visual fields were not assessed. Glaucoma category 2(based on structural damage): vertical cup–disc ratio (VCDR) >0.75 (99.5th percentile) or VCDR asymmetry >0.2 (99.5th percentile). Glaucoma category 3 (no fundus view/ no visual field): VA <3/60+intraocular pressure (IOP)>28mmHg (99.5th percentile) or VA <3/60 +evidence of glaucoma filtering surgery or medical records showing visual glaucomatous morbidity. Glaucoma suspects{GS}-Disc suspects: VCDR >0.7 (97.5th percentile) or VCDR asymmetry >0.1 (97.5th percentile); GS-IOP suspect: IOP >20mm Hg (97.5th percentile);GS-IOP + disc suspect: for combined criteria.

The study abided by the guidelines of the declaration of Helsinki for a study with human subjects. All analyses were performed using IBM Statistical Package for Social Sciences (SPSS) version 22. Data on means were presented as mean ± SD. Ages of probands and relatives were compared using the independent samples T-test. The presence of association between variables was tested using Pearson Chi-square and the T-test. Odds ratios were explored. All p-values were two-sided and were considered statistically significant when the values were less than 0.05.

3. Results

One hundred and three participants attended the free screening exercise; of which 47 were self-reported glaucoma patients' relatives. Five of the 47 participants left without completing the clinical assessment and were excluded from the analysis (Figure 1).
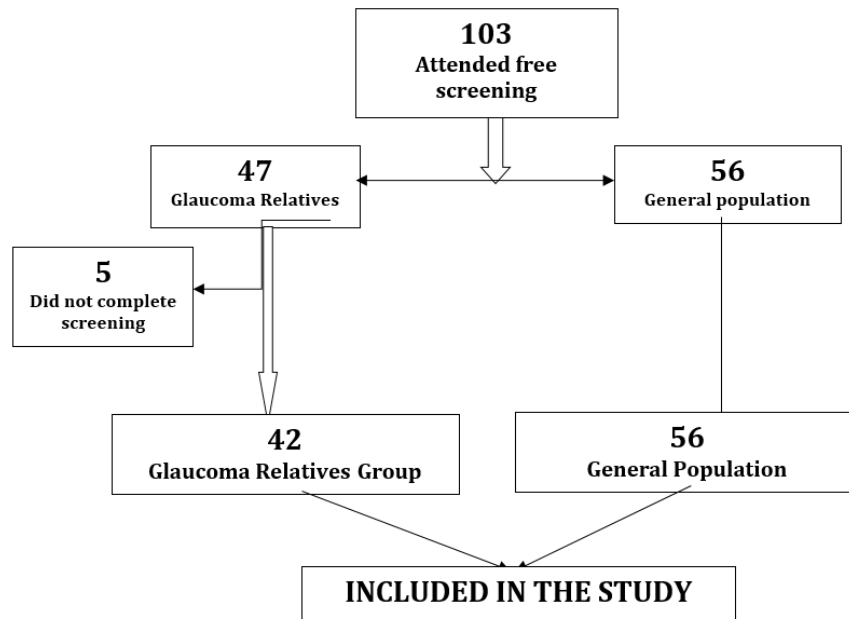
Figure 1 Flow chart showing study population

In the self-reported glaucoma patient relatives group, there were more males 27(64.3%), mean age was 42± 15.0 years (range 18 – 71years)'. Similarly, in the general population group, there were also more males 34(60.7%), mean age was 46 ± 11.7years (range20 -70years). In the patient relatives' group, 27(64.3%) of the participants were self-reported first-degree relatives (parents, siblings, children) while 15(35.7%) were other relatives (uncles, aunts, grandparents, cousins) (Table 1).

Table 1 Socio demographics of Participants

Feature		Glaucoma Relative Group N = 42	General Population Group N=56
		Frequency (%)	Frequency (%)
Sex	Male	27(64.3%)	34(60.7%)
	Female	15(35.7%)	22(39.3%)
Age in years	<20	6(14.3%)	2(3.6%)
	21-40	15(35.7%)	16(28.6%)
	41-60	16(38.1%)	31(55.4%)
	61-80	5(11.9%)	7(12.5%)
Degree of relationship	First degree	27	Not applicable
	Other relatives	15	Not applicable

Of the 42 self-reported glaucoma patient relatives', 18(42.9%) were diagnosed with glaucoma (8 definite cases and 10suspects).Only one of them (1/18; 5.6%) had a previous diagnosis of glaucoma. Among 56 participants in the general population group, proportion of glaucoma was found to be 11(11/56; 19.6%) - 6 suspects and 5 definite cases. Five (5/11; 45.5%) were previously diagnosed. The odds of having glaucoma was three times higher in the patient relatives' group compared to the general population group (OR= 3.07, 95% CI: 1.25-7.54, p=0.013).

Table 2 Determinants of glaucoma diagnosis among relatives group

Feature		Glaucoma Status According To Isgeo			
		No Glaucoma	Confirmed/Suspected cases	Total	P-Value
Age(years)	<20	6(100%)	0(0%)	6(100%)	0.007
	21-40	10(66.7%)	5(33.3%)	15(100%)	
	41-60	8(50%)	8(50%)	16(100%)	
	61 – 80	0(0%)	5(100%)	5(100%)	
Degree of relationship	1st Degree	13(48.1%)	14(51.9%)	27(100%)	0.114
	Other relatives	11(73.3%)	4(26.7%)	15(100%)	
Sex	Male	14(51.9%)	13(48.1%)	27(100%)	0.353
	Female	10(66.7%)	5(33.3%)	15(100%)	

Among relatives diagnosed with glaucoma, self-reported first degree relatives accounted for (14/18; 77.8%) compared to self-reported second degree relatives (4/18; 22.2%).Among all self-reported first degree relatives, 51.9% (14/27) had glaucoma while 26.7% (4/15%) in second degree relatives had glaucoma. The odds of developing glaucoma was four times higher with self-reported first degree relatives compared to other relatives (OR =4.02, 95% CI:1.56 -10.35 p=0.003),and three times higher than the general population. Though other relatives were found to have higher proportion of glaucoma (4/15; 26.7%) compared to the general population group(11/56; 19.6%),this was not statistically significant. (p=0.554)(Table 2).Of the 42 relatives, 6 were siblings and 20 were children of glaucoma patients. All the 6 siblings (100%) were found with glaucoma while only 8(40%) children had glaucoma. Other relatives made up the remaining proportion. (Table 3)

Table 3 Relationship to the Probands

Probands	Total number of Relatives	Glaucoma status		
		Suspected	Confirmed	No Glaucoma
Mothers	7	3(42.9%)	1(14.3%)	3(42.9%)
Fathers	13	2(15.4%)	2(15.4%)	9(69.2%)
Maternal Grandparents	3	0(0%)	1(33.3%)	2(66.7%)
Paternal Grandparents	5	2(40%)	0(0%)	3(60%)
Maternal Uncles	1	0(0%)	1(100%)	0(0%)
Paternal Uncles	4	0(0%)	0(0%)	4(100%)
Paternal Aunts	2	0(0%)	0(0%)	2(100%)
Brothers	5	3(60%)	2(40%)	0(0%)
Sisters	1	0(0%)	1(100%)	0(0%)
Daughters	1	0(0%)	0(0%)	1(100%)
Total	42	10(23.8%)	8(19.1%)	24(57.1%)

Of all 18(42.9%) diagnosed with glaucoma, proportion increased significantly with age, ranging from 0% in age group 0-20years to 100% in age group 61-80years [X^2 (3, n=42)=12.1, p=0.007]. (Table 2)

Of the 8 persons confirmed to have glaucoma, 7(87.5%) self-reported being aware at what age their probands with glaucoma were diagnosed. Relatives confirmed with glaucoma and suspects had mean ages of 51.4years and 45.4years respectively compared to their probands mean age 67.1 ± 7.9 years(50 -75years). Relatives of patients were diagnosed at a significantly younger mean age difference of 15.7years (p=0.000) (Table 4)

Table 4 Age of Relatives and Proband matched at diagnosis

Age of relatives (years)	Age of proband (years)	Difference	Significance
67	50	+17	0.000
43	75	-32	
50	70	-20	
69	70	-1	
40	67	-27	
26	70	-44	
65	68	-3	

There was no significant difference in mean intraocular pressures (IOP) in both right/left eyes of relatives with glaucoma (15.17mmHg/14.83mmHg) and those without glaucoma (14.18mmHg/15.48mmHg) p=0.386/0.679 respectively.

Mean central corneal thickness (CCT) values in right/left eyes of relative with and without glaucoma was 0.540/0.539 and 0.526/0.521 respectively (p=0.248/0.135).

Table 5 Mean intraocular pressures among groups

Relatives confirmed/suspected of glaucoma		Relatives with no glaucoma		General population	
Right eye	Left eye	Right eye	Left eye	Right Eye	Left Eye
15.17mmHg	14.83mmHg	14.18mmHg	15.48mmHg	14.76mmHg	14.74mmHg

4. Discussion

Large population studies reveal that a positive family history of glaucoma is an important risk factor in the development of glaucoma with higher risk in first degree relatives [7, 22, 23].

Proportion of glaucoma in this all black Igbo study population was found to be higher among self-reported relatives of glaucoma patients (n=18/42; 42.9%) than in the general population group(11/56; 19.6%).This proportion is higher than 23% reported by the Barbados family study which was also carried out in a predominantly black community [24]. Unlike our study which was a small study which was among an outreach population, the Barbados Family study was a large population study among blacks. The proportion of glaucoma in the Barbados study was significantly higher than the proportion among Caucasians (8.6% -16.8%) and Asians (12.6-13.3%) [7, 13, 25, 26, 27, 28]. Being black is a known risk factor for developing glaucoma apart from being a relative of a glaucoma patient. Also the prevalence of glaucoma is highest among the Igbo ethnic group.

In this study, 51.9% of self-reported first degree relatives were found to have glaucoma similar to 56.9% seen among first degree relatives accompanying probands in Portharcourt Nigeria [29]. The study in Portharcourt was among a clinic population who had standardized glaucoma examination, however similarities in findings with ours may be because both studies were carried out in same country. Nguyen et al found a 77.9% proportion of glaucoma in first

degree relatives (siblings and children) of a mixed population compared to other relatives (22.1%). This is similar to the findings of this study where first-degree relatives in this study accounted for 77.8% of all glaucoma diagnosis. From different studies, siblings have been found to have higher risk of developing glaucoma compared with other blood relatives [8, 11]. All 6 siblings (100%) in this study were diagnosed with glaucoma (either as suspects or cases) while only 40% (n=8/20) of off-springs were found with glaucoma. However the Blue mountain eye study and an Indian population study found higher prevalence among parents than siblings [13, 26].

There was a significant difference in the mean age of relatives and their probands at diagnosis (p=0.0007). Participants diagnosed with glaucoma in this study were younger, with a mean age of 51 years, while that of the probands was 67years at diagnosis, a difference of approximately 16years.This is consistent with findings of other studies [11, 30, 31]. In the Barbados family study, difference in mean age of probands and their relatives was 21years while studies among the whites revealed a difference of 5-7years. Glaucoma among blacks is aggressive and presents at a younger age [32, 33]. Glaucoma patients' relatives would therefore need to commence regular eye checks for glaucoma at an earlier age especially among blacks. Older age is a known risk factor for glaucoma evident in the findings of this study as proportion of glaucoma increased from 0% in age group <20years to 100% in age group 61-80years.

In this study, gender was not significantly associated with the development of glaucoma though 13(72.2%) of persons with glaucoma were males. Some studies also reported higher risk in males than females [22, 29, 34] unlike the Blue Mountains Study which had more reported female glaucoma relatives [13]. Females are generally found to be more at increased risk for primary angle closure glaucoma [10].

Mean intraocular pressures and central corneal thickness (CCT) were similar in the glaucoma relatives' group and general population group. Therefore, these alone should not be instruments of conclusive diagnosis.

Only one of the relatives diagnosed with glaucoma was previously aware of the diagnosis in this high- risk group (n=1/18; 5.6%). The Glaucoma inheritance study in Tasmania, Australia found up to 13% awareness of previous diagnosis while in Port Harcourt, Nigeria awareness was 7.4% [23, 29]. Lack of awareness of disease diagnosis has been found to be about 90-95%in population studies in the developing world leading to late presentation [35, 36, 37]. Screening of this high risk group will aid earlier diagnosis. In the general population group, 5(45.5%) out of 11persons diagnosed with glaucoma were previously aware of diagnosis. This level of awareness of previous diagnosis is high compared to other studies. These 5 persons were those confirmed with glaucoma based on the ISGEO classification. Possibly these persons came for a second opinion utilizing the opportunity of a free screening resulting the high awareness of diagnosis.

5. Conclusion

Greater than one-third of the relatives' group and more than half of first-degree relatives were found to have glaucoma in this study population. Relatives were diagnosed at an earlier age with about 95% previously unaware of diagnosis. Education of probands, opportunistic screenings and establishment of family glaucoma screening services in this high risk group will aid earlier detection.

Limitation of the study

Gonioscopy was not done so angle closure suspects may have been missed out.
Glaucoma imaging was not used for diagnosis which could exclude some early glaucoma.
The general population group may also have relatives with glaucoma without their knowledge.

Recommendations

Encourage establishment of glaucoma family screening services as part of routine eye clinic service especially in black African communities.
Do the study on a larger scale.

Compliance with ethical standards

Disclosure of conflict of interest

The author have no conflicts of interest related to this submission.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study

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