ORIGINAL ARTICLE
PREVALENCE AND RISK FACTORS OF ADULT ONSET GLAUCOMA IN RURAL COMMUNITIES OF BAYELSA STATE, NIGERIA

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ABSTRACT

Background: *Glaucoma is the commonest cause of irreversible blindness in Nigeria. Knowledge of its prevalence is important in planning for interventions aimed at ameliorating the burden of blindness due to the disease. Unfortunately, there is dearth of information on prevalence of glaucoma in Bayelsa State. The study aimed to determine the prevalence and risk factors associated with glaucoma in some rural communities of Bayelsa State.*

Methods: *An analytical cross-sectional study was carried out in five selected communities in Yenagoa Local Government Area of Bayelsa State. An interviewer-administered questionnaire was used by trained assistants to collect data on the socio-demographic characteristics of the study population. Respondents were subjected to ocular examination, blood pressure measurement and glucose analysis. Data was entered and analyzed using IBM SPSS Statistics Version 20.0. Continuous and discrete variables were presented in frequencies and proportions. Chi-square test was used to determine association between presence of glaucoma and risk factors*

Results: *A total of 323 persons aged 40 years and above participated in the study. There were more females (54.2%) than males (46.8%). Farming (39.9%), civil service (17.0%) and trading (16.7%) were their predominant occupations. Majority of the respondents (87.9%) were of the Ijaw ethnic group. The prevalence of glaucoma in the study population was found to be 11.8%. Family history of glaucoma, diabetes mellitus and raised intraocular pressure were found to be associated with glaucoma ($p < 0.253$, 0.003 and 0.0001 respectively). There was no statistically significant relationship between glaucoma and systemic hypertension ($p > 0.6.87$).*

Conclusion: *The prevalence of glaucoma in Bayelsa State was higher than the Nigeria national glaucoma prevalence and raised intraocular pressure, family history of glaucoma and diabetes mellitus were the associated risk factors.*

INTRODUCTION

Glaucoma is a common ocular morbidity worldwide and a public health problem in Sub-Saharan Africa.[1,2] The global burden of glaucoma was 64.3 million in 2013 and was predicted to surge to 76.0 million in 2020 and 111.8 million by 2040.[3] It is the second leading cause of blindness globally accounting for 8% of world's blindness[4], and 15% of blindness in Africa.[2] From 8.4 million in 2010, the burden of bilateral blindness due to glaucoma was projected to reach 11.1 million in 2020.[4] Glaucoma is the leading cause of irreversible visual impairment worldwide.[5] Unfortunately, 45.6 - 82% of people in rural areas are unaware of the existence of the disease.[7,8] Primary open angle glaucoma is the commonest type of glaucoma among blacks (84.7%) followed by secondary glaucoma (11.9%) and primary angle closure glaucoma (3.4%).[9]

Comparatively, the prevalence of primary open angle glaucoma among black adult population is higher than that of their white counterpart (4.2-7.3%)[9-12] versus (1.29-3.4%).[13,14] The prevalence of primary open angle glaucoma increases with aging and the increase tend to be more in people of African descent.[14] Optic disc damage and visual field loss at diagnosis also tend to be comparatively more severe in black patients and the damage tend to progress faster in blacks who also tend to present with the disease at a younger age in comparison with whites[15-17]. While the aetiology of glaucoma remains obscure, several risk factors including age and raised intraocular pressure have been described.[14,18] Family history is an important risk factor for development of glaucoma. The risk is higher among siblings of glaucoma patients than his/her parents and children.[19]

Several studies have suggested an association between moderate and high myopia with increased risk of development of primary open angle glaucoma.[20, 21,22] The Beaver Dam eye study[22] and Malayi eye study[23] have shown that patients with myopia were 3-6 times more likely to develop primary open angle glaucoma in comparison with their emmetropic counterparts. Meta-analysis of studies evaluating the relationship between diabetes mellitus and risk of development of open angle glaucoma revealed that diabetes mellitus increases the risk of development of primary open angle glaucoma.[24]

Since glaucoma causes slowly progressive irreversible visual loss, early detection and treatment is required to avert its visual consequences. Early detection and treatment can be facilitated by available information on the prevalence and risk factors of the disease in a particular environment. Such information on prevalence and risk factors of glaucoma is presently not available in Bayelsa State to the best of our knowledge. The aim of this study therefore was to bridge this gap in knowledge to the benefit of clinicians and the larger society.

METHODOLOGY

Study area: The study was conducted in Yenagoa Local Government Area (YELGA) of Bayelsa State. YELGA is one of the eight LGAs in Bayelsa State. The LGA is made up of 15 political wards and has an estimated population of 470, 275 (projected from 2006 census).[9] Three wards were purposively selected out of the 15 wards; they were Gbarain I consisting of three communities – Agbia, Nedugo and Ogboloma; Gbarain III made of two communities – Koroama and Polaku and Ekpetiama II comprising three communities – Tombia, Gbarantoru and Akaibiri. The wards were selected because of their closeness to Niger Delta University

Teaching Hospital, Okolobiri where the researchers work for ease of treatment and follow up of cases that may be discovered during the survey.

Study design: An analytical cross-sectional study was carried out.

Study population: The study population consisted of adult males and females 40 years and above residing in the selected communities.

Sample size estimation: Based on recent epidemiological studies in West Africa, the prevalence of Glaucoma stands at 7.0%.[10,11] Using the formula for estimation of sample size for descriptive study, $n = z^2pq/d^2$ where z =1.96, p = 7%, q = 0.93 (1-p), d = 0.05, n = 100.03. With an assumed non-response rate of 10%, n = 111.15, approximated to 120 respondents per community.

Sampling technique: Three wards were purposively selected out of the 15 wards in Yenagoa LGA. The wards were Ekpetiama II, Gbarain I, and Gbarain III. Five communities namely Tombia, Gbarantoru, Nedugo, Ogboloma and Polaku were randomly selected by balloting from their respective wards. A mapping/enumeration and household listing was done to identify households that had eligible subjects (adults 40 years and above). Based on the estimated sample size, systematic sampling method was used to select respondents from eligible households. The sampling interval varied from community to community depending on the number of eligible households. Participants were identified in their houses, given a slip to show that they have been selected and were then directed to the town hall where the interview and examination were done.

Data collection: Data collection took place from September 2018 to August 2019. An interviewer-administered questionnaire was used by trained assistants to collect data on the socio-demographic characteristics of the studied population. Respondents were subjected to ocular examination, blood pressure measurement and glucose analysis. Blood pressure examination was done using Omron digital sphygmomanometer. Random plasma glucose was measured using Accucheck blood glucose monitor. Random blood sugar was used because of its convenience in community setting and its lower cost. In addition, many participants came for examination in late morning/ Afternoon making fasting blood sugar measurement impossible.

Case definition: A case of glaucoma was diagnosed if: {1} The vertical cup: disc ratio was ≥ 0.6, {2} There was vertical disc: cup asymmetry ≥0.2, {3} The IOP was ≥21mmHg. At least 2 of the above criteria established a diagnosis of glaucoma.

Ocular examination: Visual acuity estimation was done using the Snellen acuity E-chart by two residents in Ophthalmology department of the Niger Delta University Teaching Hospital on different study days according to study schedule. Visual acuity was determined using day light illumination at 6 meters away or closer to subjects as necessary. Tonometry was carried out by an Ophthalmologist using I-tell rebound tonometer (which measures the IOP six times and displays the average) who also carried out external eye examinations, anterior segment examinations (using pen light) and undilated Fundoscopy using the Heine direct ophthalmoscope. Where small pupil size and presence of some medial opacity precluded clear fundus examination, patients

were directed to another Ophthalmologist for dilated Fundoscopy using 1% Tropicamide and Heine direct Ophthalmoscope. Glaucoma cases were screened out of the study population. The glaucoma subjects were directed to a chemical pathologist who supervised the blood sample collection, storage and transport to the Chemical Pathology Department of the Niger Delta University Teaching Hospital for testing. Due to unavailability of slit lamp bio- microscope and visual field analyser, gonioscopy and visual field assessments were not carried out.

Ethical Consideration: The research protocol was submitted and ethical approval was obtained from the Research and Ethics Committee of the Niger Delta University Teaching Hospital, Okolobiri. Communal permission was obtained from the heads of the studied communities and written informed consent was obtained from all respondents. The benefits and the risks associated with participation in the study were explained to the participants. All information provided by research participants were kept confidential. To this end, names were not written on the questionnaire, but numbers were assigned to participants to ensure correct linkage of the questionnaires with the specimen collected.

Data Analysis: Data was entered and analyzed using IBM SPSS Statistics Version 20.0. Discrete variables were presented in frequencies and proportions. Chi-square test was used to determine the level of significance of the relationship between risk factors and glaucoma. The level of statistical significance was set at p-value of < 0.05.

RESULTS

A total of 323 persons participated in the study. The socio-demographic characteristics of respondents are as shown in table 1.

Table 1: Sociodemographic characteristics of Respondents

Characteristic	Frequency (N = 323)	Percent (%)
Gender		
Female	175	54.2
Male	148	45.8
Age of Participants		
40 - 49 years	118	36.5
50 - 59 years	82	25.4
60 - 69 years	61	18.9
70 - 79 years	44	13.6
≥ 80 years	18	5.6
Marital Status		
Single/Separated	47	14.6
Married	211	65.3
Widowed	65	20.1
Religion		
Christianity	318	98.5
Others	5	1.5
Occupation		
Farming	129	39.9
Fishing	14	4.3
Trading	54	16.7
Civil servant	55	17.0
Unemployed	35	10.8
Others*	36	11.1
Ethnicity		
Ijaw	284	87.9
Delta/Ibo	22	6.8
Others	17	5.3

There were more females (54.2%) than males (46.8%) and farming (39.9%), civil service (17.0%) and trading (16.7%) was their predominant occupations. Majority of the respondents (87.9%) were of the Ijaw ethnic group. The prevalence of glaucoma in the study population was found to be 11.8% (Fig. 1). The risk factors of glaucoma in the study population are as shown in table 2.0.

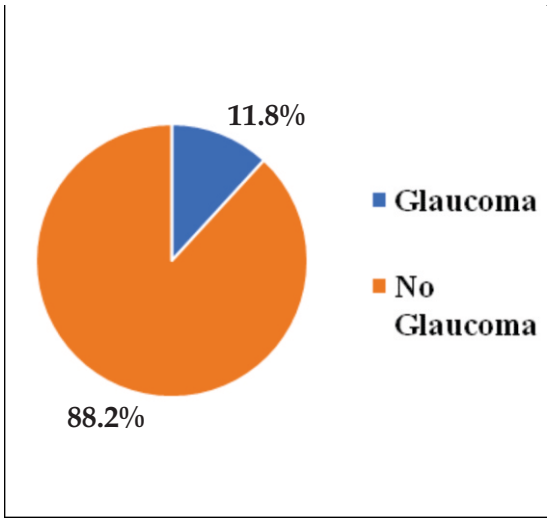

Fig 1: Prevalence of glaucoma in the study population

Diabetes mellitus and raised intraocular pressure were found to be associated with glaucoma (p = 0.003 and 0.0001 respectively). There was no statistically significant relationship between family history, systemic hypertension and glaucoma (p =0.253, 0.6.87 respectively).

Table 2: Risk factors of Glaucoma in the study population

Variables (Reference category)	B coefficient	OR	95%CI		pValue
			Min	Max	
Family History of Glaucoma (Absent)					
Present	0.86	2.36	0.52	10.24	0.253
Hypertension (Absent)					
Present	0.15	1.16	0.56	2.41	0.687
Diabetes mellitus (Absent)					
Present	2.16	8.71	2.07	36.57	0.003*
Intraocular Pressure (8 – 20mmHg)					
< 21 mmHg	0.20	1.22	0.15	10.10	
≥ 21 mmHg	1.58	4.85	2.30	10.25	0.001*

DISCUSSION

To the best of our knowledge this is the first population-based study on the prevalence of glaucoma in Bayelsa State, South, Southern Nigeria. The multistage stratified sampling technique employed in the conduction of this study ensured that the studied population was a good representation of the total population of Gbarain kingdom in Bayelsa State.

The prevalence of glaucoma (all types) in this study was 11.8%. This is similar to the overall glaucoma prevalence of 12% and 12.4% respectively reported by the Tema Eye Survey in Ghana[25] and Durowade et al in North-Central Nigeria.[28] Our report differs from those of Ashaye et al[9] in South Western Nigeria, Burhman et al[10] in East Africa, Kyari et al[26] in the Nigeria National Blindness and Visual Impairment Study and that of Gupta et al[27] in

United States of America which reported overall glaucoma prevalence of 7.3%, 4.2%, 5.2% and 2.1% respectively. The prevalence of glaucoma is higher in blacks in comparison with white populations of equivalent age (4.74% versus 1.29%).[12,13] Even among blacks, the prevalence of glaucoma varies from one ethic group or region to the other. The Ijaw ethic group in Niger Delta region of Nigeria constituted 88% of our study population. The high prevalence of glaucoma among our study population may be due to racial influence. However comparative study of the prevalence of glaucoma among different ethnic groups in Nigeria and factors responsible for any variation is required to shed more light on the observation of this study. This study found that the prevalence of glaucoma in men (6.5%) was higher than that of women (5.3%), giving a male to female ratio of 1.3:1, which was not statically significant. This is similar to the findings of Budenz et al[25] in Ghana (1.9:1) and Ashaye et al[9] in Oyo, South, Western Nigeria (1.1:1) but it is at variance with the report of Buhermann et al[10] (1:1.7) in East Africa and that of Durowade et al[28] in North-Central Nigeria (1:2.4). These divergent reports on the relationship between glaucoma and gender point to the fact that the relationship between gender and development of primary open angle glaucoma is not clear. Unlike the findings of several studies,[12,13,30,31,32,33] this study was unable to demonstrate increase of prevalence of glaucoma with advancing age. The discrepancy may be attributed largely to our study methodology which did not segregate the different types of glaucoma into their various types to enable determination of risk factors exclusively for primary open angle glaucoma. The younger age group (40-59 years) constituted 63.4 % of our study population. Participation of the elderly population was relatively scanty (36.6%) due to the study location and the fact that the selected participants were not transported to the study location in the respective communities due to paucity of funds.

Raised intraocular pressure (IOP) was a statistically significant risk factor for the development of glaucoma in the study population. This is similar to the findings of some previous studies. [10, 11, 12, 34, 35] Family history of glaucoma has been severally reported to be positively associated with occurrence of primary open angle glaucoma with higher risk in siblings of glaucoma patients and their parents especially their mothers.[12,13,36,37] Family history of glaucoma was not a statistically, significant risk factor for the development of glaucoma in our study population. The disparity between our study and previous ones may be due to poor awareness of glaucoma among the respondents.[38,39]

This study was unable to elicit any positive correlation between systemic hypertension and glaucoma unlike the findings of previous studies including meta-analysis.[40,41,42]The disparity may be due to the fact that our study included all types of glaucoma as against only primary open angle glaucoma studied by precious authors.

Diabetes mellitus was a statistically significant risk factor for development of glaucoma in this study population. This is consistent with results of several studies including Meta-analysis. [12,43,44,45] Our finding is at variance with some previous studies where diabetes mellitus was not reported as a risk factor for primary open angle glaucoma.[46,47] However, preponderance of reports supported diabetes mellitus as a risk factor for primary open angle glaucoma.[12,43,44,45,48,49]

Limitation: This study was unable to segregate glaucoma into its various components due to unavailability of slit lamp biomicroscope.

Therefore, risk factors of glaucoma as discussed in this research may not be a true reflection of the situation in primary open angle glaucoma as applied.

Conclusion: The prevalence of glaucoma in the Gbarian kingdom of Bayelsa State was higher than the Nigeria national glaucoma prevalence and raised intraocular pressure and diabetes mellitus were the statistically significant risk factors. Health education and regular ocular screening is recommended to mitigate blindness due to glaucoma in this population.

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Conflict of Interest: The authors have no conflict of interest in executing this research.

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