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Prevalence of Hypertension in Glaucoma Patients Attending Eye Clinics in Two Teaching Hospitals in Enugu State Nigeria: A Descriptive Cross-Sectional Study

Alpha Madu[1,*], Omumuawuike Ebi[2], Emmanuel Ihekweazu[3], Valerie Chizelum Okosi[4]

[1]Department of Medicine, Kettering General Hospital NHS Foundation Trust, United Kingdom
[2]Department of Internal Medicine, University of Uyo Teaching Hospital, Akwa Ibom State, Nigeria
[3]Clinical Services Department, Planned Parenthood of Southern New England, New Haven, United States of America
[4]Department of Pediatrics, University of Nigeria Teaching Hospital, Enugu State, Nigeria
*Corresponding author: alphamadu@yahoo.com

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Abstract **Background:** Glaucoma and hypertension are chronic debilitating illnesses with serious complications. Glaucoma is the commonest cause of irreversible blindness worldwide while hypertension is the commonest cause of cardiovascular-related morbidity and mortality including sudden death. Very few papers have studied the association between these diseases in Nigeria. None of them however has been conducted in the South-Eastern part of the country. **Objectives:** The aim of this paper was to study the prevalence of hypertension in Glaucoma patients attending eye clinics in two tertiary hospitals in Enugu state, South-East Nigeria. **Methods:** A cross-sectional survey was conducted among glaucoma patients attending follow-up eye-clinics in two tertiary hospitals in Enugu state, Nigeria over a one-month period. Their blood pressures were measured using an automated blood pressure machine. Hypertension was defined as blood pressure greater than or equal to 140/90mmHg according to the British Hypertension Society classification of Hypertension. **Results:** 254 patients participated in the survey; 124 were males and 130 were females. Most participants, 91.7%, were aged 41 and above. More than three-quarters were educated up to at least primary school level. The prevalence of hypertension among the participants was 54.8%. **Conclusion:** We have described a simple prevalence of hypertension in glaucoma patients where slightly above half of the respondents were found to have elevated blood pressures at the time of questioning. Other studies have demonstrated a positive association between hypertension and glaucoma.

Keywords: *prevalence, hypertension, glaucoma, blood pressure, blindness, Nigeria*

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1. Introduction

Hypertension and glaucoma are two major chronic diseases of global health importance. They are both debilitating and very expensive diseases, taking their tolls on national health systems' finances.

Glaucoma is the commonest cause of irreversible blindness and second commonest cause of all blindness worldwide. [1,2] It is estimated that 80 million people will be affected by the disease by 2020 and almost 6 million will become bilaterally blind from open-angle glaucoma the same year. [1,2] It costs about 2.86 billion USD to treat glaucoma in the United States annually. [1] Africa has the highest prevalence of blindness in the world with 15% of this burden accounted for by glaucoma. [2] The disease tends to occur at a younger age and runs a more severe course in Africans. [2,3] In Nigeria, similar to global statistics, glaucoma accounts for 16.7% of the burden of blindness and is also the commonest cause of irreversible blindness. [3]

Hypertension on the other hand is the world's most common cardiovascular disease and is the highest risk factor for mortality from cardiovascular causes. [4] The prevalence of hypertension, and indeed other cardiovascular diseases, has increased in Nigeria (and other African countries) in the last few decades due to changing demographics and life-styles including increasing population and ageing, rising *urbanization* and increased uptake of *western* lifestyles such as increased consumption of tobacco and alcohol. [5] A sixth of the world's population (approximately 1 billion people) suffer from hypertension, two-thirds of which occur in low-and-middle income

countries. [6] 1 in 3 people in these countries are estimated to suffer from hypertension. [4] In 2010, there were 20 million people suffering from hypertension in Nigeria and this number is estimated to rise to 39 million by 2030. [7] It remains the commonest cause of sudden death and emergency medical admissions in the country. [7]

Raised intraocular pressure is the single most important risk factor for the development of glaucoma, although it can occur sometimes in the absence of elevated intraocular pressure. [8] It is suspected that other systemic factors, such as those that affect the micro-vasculature, by altering retinal blood supply and blood flow to the optic nerve head, may increase the risk of glaucoma. [8] Ocular perfusion pressure, the difference between the mean arterial pressure in the ophthalmic artery and the intraocular pressure, plays a more important role in the pathogenesis of glaucoma than raised intraocular pressure alone. However, it is difficult to ascertain the direct effect of systemic blood pressure in isolation, to the pathogenesis of glaucoma. What is known from previous studies though, is that both low and high blood pressures are associated with glaucoma by altering the ocular perfusion pressure. [8] However the relationship is complex.

This study was conducted to assess the prevalence of hypertension in glaucoma patients attending two tertiary hospitals in Enugu state, Nigeria. It adds to the body of evidence on what is already known about the topic such as those authored by Onakoya et al (2009) and Kyari et al (2016) and will be useful in directing future research for preventive medicine, health policy and planning. [9,10]

2. Methods

2.1. Study Setting

The study was conducted in two tertiary health institutions in Enugu metropolis, Enugu state, Nigeria. Enugu metropolis was the capital of the old Eastern-Nigeria region and currently the capital of Enugu state in South-East Nigeria. Enugu state has an estimated population of 3.3 million people (as at the last official national census in 2006). [11] It is known for its large coal deposits and hilly environs. Its residents are predominantly Igbo Christians. Most urban residents are public servants while rural dwellers are mostly farmers.

There are 4 tertiary health institutions in Enugu state; two are mono-specialty hospitals (neuropsychiatry and orthopedic) while two are multi-specialty hospitals.

2.2. Study Design

The study was a cross-sectional descriptive study conducted in the ophthalmology department of the two multi-specialty tertiary hospitals in Enugu state; University of Nigeria Teaching Hospital, Ituku-Ozalla and Enugu State University of Science and Technology Teaching Hospital, Parklane. These centres were chosen because they had busy ophthalmology clinics which served the whole South-Eastern region of the country. They also had dedicated ‘Glaucoma Clinic’ days.

2.3. Sampling Method

All patients who attended the glaucoma clinics in these hospitals in a one-month period were surveyed.

2.4. Inclusion and Exclusion Criteria

Patients of all ages and genders who already had a formal diagnosis of glaucoma made by their ophthalmologists and attending clinic for follow-up were included in the study. Patients with other eye diseases except glaucoma were excluded. Those without a formal diagnosis of glaucoma yet, were also excluded.

2.5. Data Collection

A simple self-administered questionnaire was used to obtain demographic information from the respondents. An automated blood-pressure machine manufactured by Omron® was used to check their blood pressures. Blood pressure was checked on the right arm, in the sitting position. Elevated blood pressure/hypertension was defined as systolic blood pressure (SBP) greater than 140mmHg and diastolic blood pressure (DBP) greater than 90mmHg, based on the classification by the British Hypertension Society. Respondents with isolated elevations of systolic blood pressure above 140mmHg were also classified as hypertensive.

2.6. Data Analysis

The data was analysed using simple mathematical calculations.

2.7. Ethical Clearance

Ethical clearance was obtained from the Ethics Committee of both hospitals and permission granted by the heads of department of Ophthalmology of both institutions. Verbal consent was sought from each respondent before their data was collected and their details were anonymized.

3. Results

A total of 254 patients participated in the study. 124 (48.8%) were males while 130 (51.2%) were females. Most of the patients (91.7%) were either middle-aged (41-60 years) or elderly (above 60 years) [Table 1]. The mean age of the participants was 58.8 years while the median age was 61.5 years.

Table 1. Age of Study Participants

Age range	Number	Percentage
< 20	4	1.6%
21 - 40	17	6.7%
41 - 60	96	37.8%
>60	137	53.9%
Total	254	100%

All respondents (n=254) were Igbos (one of the major ethnic tribes in Nigeria). Almost half of them were self-employed either as businessmen, traders, artisans or farmers [Table 2].

Table 2. Occupation of Study Participants

Occupation	Number	Percentage
Civil servants	76	29.9%
Self-employed (Businessmen, traders, artisans and farmers)	122	48.0%
Retired	33	13.0%
Clergy men	3	1.2%
Unemployed	11	4.3%
Students	9	3.5%
Total	254	99.9%

Just above a quarter (n=68) were educated up to tertiary level of education while only 4.3% (n=11) had a post graduate degree [Figure 1].

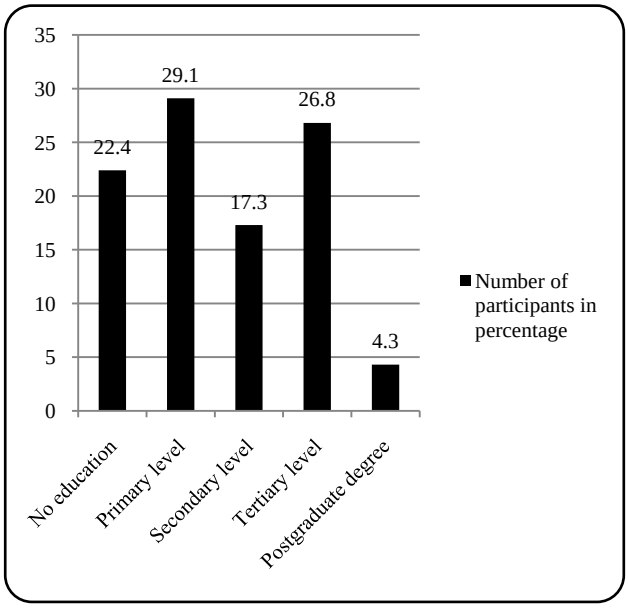

Figure 1. Highest educational qualification of respondents

Most respondents (n=239, 94.1%) reported being diagnosed with glaucoma after the year 2000. Less than half of the respondents (n=82, 32.3%) had other eye comorbidities [Figure 2]. Conjunctivitis and presbyopia in 37 and 34 participants respectively, were the most commonly reported eye co-morbidities.

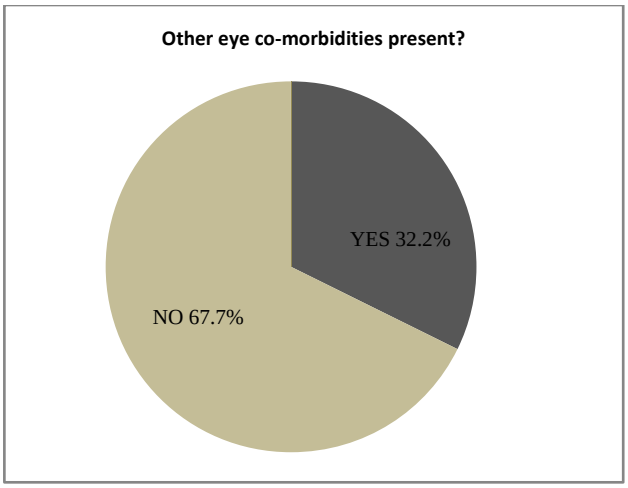

Figure 2. Presence of other eye co-morbidities

Most participants (n=241, 94.9%) had a basic awareness of 'Hypertension' as a disease [Figure 3]. We defined 'awareness' as having a basic knowledge of hypertension as a case of elevated blood pressure.

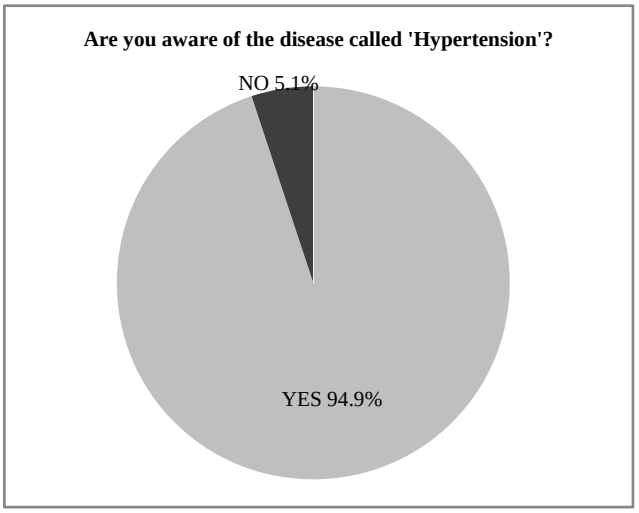

Figure 3. Awareness of Hypertension

About three-quarters of the participants had checked their blood pressures in the past 6 months (n = 187, 73.6%). 8 participants had never checked their blood pressure.

Blood pressure readings were classified according to the British Hypertension Society's classification of hypertension [Table 3]. Hypertension was defined as any blood pressure reading equal to or above 140/90mmHg.

Table 3. British Hypertension Society Classification of Hypertension and Blood Pressure Readings of Participants

Class	Blood pressure range	Number of participants	Percentage
Optimal	<120/<80	26	10.2%
Normal	<130/<85	44	17.3%
High Normal	130-139/85-89	45	17.7%
Grade 1 Hypertension	140-150/90-99	69	27.2%
Grade 2 Hypertension	160-179/100-109	33	13.0%
Grade 3 Hypertension >/=180/>/=110	≥180/≥110	37	14.6%
Total		254	100%

4. Discussion

The demography of the participants in our study is representative of that of Enugu State. The male to female ratio of the study participants was approximately 1:1, similar to that of Enugu state. [11] Most of the respondents were either middle aged (40-60 years) or elderly (above 60 years). This reflects the age group in which glaucoma is most likely to occur since the risk of glaucoma increases with age. [12] Similar findings by Kyari et al (2015) have also shown that glaucoma is predominant in those aged 40 and above in Nigeria. [3]

The prevalence of glaucoma in black population groups is estimated to be six times higher than in whites. [3] Igbo ethnicity has also been found to be an independent risk factor for open angle glaucoma [10]. All our participants were Igbos. The Igbo ethnic group is one of the major ethnic groups in Nigeria and resides predominantly in the south-eastern part of the country. 1.1 to 1.4 million Nigerians are estimated to suffer from the disease. This approximates to 1 in 200 Nigerians. Furthermore, 1 in 5 sufferers is blind showing a poor detection rate in the country. [3]

Some studies have previously reported poor awareness of hypertension in Nigerians and Africans while others have reported high awareness rates. [5,13,14] Our study showed a high level of awareness of hypertension. About 95% of the respondents showed a basic understanding of the disease as a case of elevated blood pressure and about three-quarters of them had checked their blood pressures in the preceding six months. Perhaps this may be due to the educational background of the respondents. About half of the respondents were educated up to at least secondary school level.

From our study, the prevalence of hypertension in patients suffering from glaucoma was 54.8%. This means that over half of our respondents had blood pressure measurements greater than 140/90 at the time of the study. Langman et al also found that systemic hypertension was significantly more common in the 27 080 glaucoma patients they studied (OR 1.29, 95%CI, $p<0.001$). [13] Other studies have also reported a positive association between systemic hypertension and glaucoma. [9,10,12,14,15] The relationship between systemic blood pressure and glaucoma is complex. Both systemic hypertension and acute hypotension are considered as potential risk factors for glaucoma. [12] However one study has attributed this association to the correlation between age and hypertension (both diseases, hypertension and glaucoma, are commoner in older populations). [12]

The association between both diseases has been thought to be related to altered sodium reabsorption in the epithelia of the distal nephron and ciliary body. Thus excessive reabsorption of sodium in the kidney and ciliary epithelium may be responsible for the pathogenesis of hypertension and glaucoma respectively. [13] This relationship is still undergoing clinical research.

Our study has been able to describe the prevalence of hypertension in glaucoma patients but cannot demonstrate an association. However, it becomes more useful when added to the body of knowledge on the subject matter. The determination of hypertensive patients in our study is exposed to two biases. Ideally, a diagnosis of hypertension should be made after three clinic readings on separate occasions or after ambulatory blood pressure measurements. This was not possible in our case as it was a cross-sectional survey and contact with respondents was made only once (that is, there was no chance for a follow-up). In this manner, possible white-coat hypertension may have been picked up in the hypertensive group. Also, hypertensive patients who had taken their anti-hypertensive medications before attending clinic, and other well-controlled hypertensives may have been lost to the non-hypertensive group. Our study also assumed the diagnosis of glaucoma was correct as we relied on the fact that the patients were attending a follow-up clinic in a dedicated glaucoma-clinic.

5. Conclusion

Glaucoma and hypertension remain global health problems and are more telling because of their chronic course, debilitating nature and cost of management. Several studies have shown an association between both diseases but there is no specific evidence yet of a causative link between both. We have described a simple prevalence of hypertension in glaucoma patients and this can help guide policy makers and research planners in the future.

6. Foot Notes

6.1. Funding

No funding was sought or received for this study

6.2. Competing Interests

None to declare.

6.3. Previous Presentation

This study was submitted to the Department of Community Medicine, College of Medicine, University of Nigeria Nsukka (Enugu Campus) in partial fulfilment for the award Bachelor of Medicine and Surgery to the Authors.

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