ORIGINAL ARTICLE

Evaluation of Cardiovascular Risk Factors in Patients with Hypertension

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ABSTRACT

Background: Hypertension is a major health concern in developed and developing countries. Its prevalence is high in Nigeria and accounts for a great percentage of hospital visits and admissions. Hypertension is a chief risk factor for cardiovascular events. Independent risks factors, some of which are implicated in the pathogenesis and aetiology of hypertension also affects cardiovascular outcomes.
Objective: To assess some individual cardiovascular risk factors in hypertensive patients on treatment at the medical outpatient of the University of Port Harcourt Teaching Hospital.
Methodology: This was an analytical cross sectional study. One hundred and fifty patients and controls were recruited. Fasting venous blood specimens were obtained for analysis. Blood pressure, weight, height and waist circumference were measured. Age and gender were noted.
Results: The hypertensive patients had increased Body Mass Index, central obesity, increased fasting plasma glucose and dyslipidaemia when compared to the controls.
Conclusion: Majority of patients in this study had multiple cardiovascular risks and are therefore prone to cardiovascular events.

Key words: *Independent risks, Dyslipidaemia, Obesity, Hyperinsulinaemia, Cardiac dysfunction, High Blood Pressure*

INTRODUCTION

Hypertension is a major health concern in both developed and developing countries including Nigeria. Africa bears a high burden of people living with uncontrolled hypertension. [1]

The prevalence of hypertension in the Nigerian population is high with increasing figures found among those in the urban areas, though the rural communities are not spared.[2] A community based study in Ibadan revealed a prevalence rate of 33.1%.[3] Hypertension is the singular greatest modifiable cardiovascular risk factor, a major risk factor for stroke and renal disease as well as the leading non communicable disease in Nigeria.[3,4] It is a major contributor to

morbidity and mortality in Nigeria.[2] A study done in Port Harcourt revealed a prevalence of 40.8%.[5] Another study showed that hypertension accounts for 28.2% of medical admissions and 43.7% of geriatric admissions in the University of Port Harcourt Teaching Hospital (UPTH).[6]

Besides hypertension, there are many other risk factors for cardiovascular diseases. Cardiovascular risk should be evaluated in every hypertensive patient at presentation and at regularly determined intervals. Patients with multiple risk factors have a higher overall risk for cardiovascular events.

The aetiologic risk factors implicated in hypertension involve biochemical processes that result in dyslipidaemia, impaired glucose tolerance and vascular wall dysfunction. Dyslipidaemia and insulin resistance have been implicated in the pathogenesis and pathophysiology of hypertension.[7] Up to 50% of hypertensive patients were found to have concomitant insulin resistance.[7] Insulin has haemodynamic properties and its resistance leads to altered blood flow in peripheral tissues which plays a role in atherogenic dysglycaemia and dyslipidaemia.[8] Hypercholesterolaemia worsens the effect of some vasoconstrictors on the endothelium such as angiotensin II thereby aiding hypertension.[9]

Hypertension causes endothelial injury. This arises as a result of modification in oxidative stress. The vascular response to nitric oxide induced muscle relaxation is diminished and there is enhanced lipoprotein permeability.[10]

The interrelationship between hyperglycaemia, diabetes and hypertension has been established since the 1980's.[8] It has been documented that hyperglycaemia, in the absence of diabetes can add to the risk of diastolic heart dysfunction. Impaired diastolic function has been shown to have associated high mortality, even when there is no obvious heart failure.[11] A cross sectional study done in an urban community in India found that the incidence of coronary artery disease increases in patients with multiple risk factors such as Diabetes Mellitus, dyslipidaemia and hypertension. In Enugu, South East Nigeria, 27% of hypertensive patients had cardiac arrhythmias at first presentation as evidenced by changes on electrocardiography (ECG).[12]

The complications of hypertension have been documented to account for 9.4 million deaths worldwide every year.[1] Low and middle income countries account for four-fifths of the deaths from cardiovascular disease.[1] It has been found in previous studies that reducing some modifiable risk factors like: increased blood pressure, plasma glucose, BMI, total cholesterol, smoking, inappropriate diet, inactivity and consumption of large amounts of alcohol would increase the world wide life expectancy by 5 years.[1]Treatment of hypertension has moved beyond lowering the blood pressure to preventing cardiovascular risks and this is to minimize the incidence of cardiovascular disease.[10]

This study assessed some independent risk factors such as diabetes, obesity, central obesity, low HDL (High Density Lipoprotein), high LDL (Low Density Lipoprotein) hypertriglyceridaemia and hypercholesterolaemia in hypertensive patients undergoing treatment at the medical outpatient clinic in UPTH.

METHODOLOGY

Sample Size and Study Design

The study was an analytical cross sectional study done in the medical outpatient clinic of the University of Port Harcourt Teaching Hospital (UPTH) Port Harcourt in Southern Nigeria. The medical outpatient department has two cardiology units and one endocrine unit that attend to hypertensive patients.

The sample size was calculated using this formula,

$$\text{Sample size (n)} = \frac{(1.96)^2 \times p\,(1-p)}{D}$$

1.96= Confidence interval

P= prevalence rate

D = Desired degree of accuracy; here taken to be 0.1

Using a prevalence of 40.8% [5]

$$\text{Sample size (n)} = \frac{(1.96)^2 \times p\,(1-p)}{D}$$

Sample size (n) = $\frac{3.8416 \times 0.4(1-0.4)}{0.01}$

=92.2

An allowance of 10% was given for attrition. A minimum of 101 patients was required.

Our target population was hypertensive patients attending the outpatient clinics. The cut off taken was a blood pressure greater than 140/90 mmHg on more than one occasion. One hundred and fifty hypertensive patients were recruited by systematic random sampling method. Every third patient that presented at the clinic was recruited for the study if they gave consent. Afterwards on another appointment a fasting venous blood specimen was obtained for analysis of glucose, triglycerides, high and low density lipoprotein and total cholesterol. One hundred and fifty controls were also recruited. They were healthy adults without any apparent disease, chosen from the geographical location of the hospital by purposive sampling method.

The specimens, from both patients and controls were analysed by the same investigator in the same batch along with the quality control. The investigator was blinded during the analysis. The specimens were labelled with numbers before being sent for analysis with the laboratory investigator not being aware of the sequence of the numbering. The primary researcher had a book that could connect the numbers to the results which were given to their respective owners. The participants were examined, their blood pressure was taken using a mercury sphygmomanometer and their weight and height were measured as well. Their waist circumference was taken at the level of the umbilicus. The body mass index (BMI) was calculated. Their age and gender were noted.

Patients with obvious complications from prolonged hypertension such as those with renal disease or cardiac symptoms and those unwilling to participate were excluded from the study. The patients with complications were referred to the endocrinologists for further management.

Ethical Issues

Verbal consent was obtained from both the patients and the controls after explaining to them in detail about the study, and assuring them that refusal to consent to the study will not in any way alter the attention they receive in the course of their treatment. Ethical clearance was obtained from the ethical committee of the University of Port Harcourt Teaching Hospital.

Data Analysis

Statistical analysis was done using the Statistical Package for Social Sciences (SPSS) version 20.0 (SPSS Inc. Chicago, Illinois U.S.A.). Frequencies and percentages were obtained for categorical variables. Differences in proportions were analysed using the Chi-square test. The means of continuous variables were compared using unpaired students t test and expressed as mean ± standard deviation (SD). *P*-values ≤ 0.05 were considered significant in all analyses.

RESULTS

There were 150 hypertensive patients made up of 45 (30.0%) males and 105 (70.0%) females; and 150 control subjects consisting of 71 (47.3%) males and 79 (52.7%) females. Demographic and anthropometric characteristics of patients are compared with that of controls in Table 1. Hypertensive patients were older and had significantly higher blood pressure values and BMI, and larger waist circumference than controls.

Details of the biochemical parameters of patients and controls are summarized in Table 2. All the parameters were significantly higher in the patients. Prevalence of all the various cardiovascular risk factors was also significantly higher in hypertensive patients than in controls (Table 3).

Table 1. Comparison of Clinical Characteristics of Patients and Controls

Characteristic	Patients (n=150) Mean (SD)	Controls (n=150) Mean (SD)	*P*
Age (years)	59.5 (10.3)	42.7 (15.3)	<0.001*
Waist circumference (cm)	102.1 (14.1)	89.9 (13.5)	<0.001*
Body mass index (Kg/m²)	28.8 (4.2)	27.2 (5.4)	0.004*
Systolic blood pressure (mmHg)	137.6 (21.7)	117.7 (10.1)	<0.001*
Diastolic blood pressure (mmHg)	82.5 (11.4)	75.0 (7.6)	<0.001*

* Statistically significant ($P \leq 0.05$)

Table 2. Biochemical Parameters of Patients and Controls

Parameter	Patients (N=150) Mean (SD)	Controls (N=150) Mean (SD)	*P*
Fasting plasma glucose(mmol/L)	8.3 (4.1)	4.2 (0.7)	<0.001*
Triglyceride (mmol/L)	1.5 (1.2)	0.9 (0.3)	<0.001*
High density lipoprotein (mmol/L)	1.2 (0.6)	1.5 (0.4)	<0.001*
Low density lipoprotein (mmol/L)	3.5 (1.1)	2.6 (0.8)	<0.001*
Total cholesterol (mmol/L)	5.4 (1.3)	4.3 (0.7)	<0.001*

* Statistically significant ($P \leq 0.05$)

Table 3. Prevalence of Cardiovascular Risk Factors in Hypertensive Patients and Controls

Risk Factor	Patients (n=150) Frequency (%)	Controls (n=150) Frequency (%)	*p*
Diabetes	93 (62.0)	0	< 0.001*
Central obesity (High WC)	120 (80.0)	65 (43.3)	< 0.001*
Obesity (High BMI)	63 (42.0)	40 (26.7)	0.007*
Dyslipidaemia	129 (86.0)	54 (36.0)	< 0.001*
Hypercholesterolaemia	69 (46.0)	15 (10.0)	< 0.001*
Hypertriglyceridaemia	35 (23.3)	1 (0.7)	< 0.001*
Low HDL	90 (60.0)	34 (22.7)	< 0.001*
High LDL	80 (53.3)	29 (19.3)	< 0.001*
Smoking	9 (6.0)	0	0.005*

*Statistically significant ($P \leq 0.05$); WC = waist circumference; BMI= body mass index; HDL = high density lipoprotein; LDL=low density lipoprotein

DISCUSSION

Cardiovascular risks should be assessed in every hypertensive patient routinely. Necessary changes should be put in place to modify the risks. To the best of our knowledge, information on cardiovascular risks in patients in southern Nigeria is scanty and we want to assess the risks in the patients who attend our outpatient clinics.

The incidence of primary hypertension increases with age. Blood pressure has been found to rise progressively with age among Nigerians irrespective of sex.[4,13] The hypertensive patients were older than those in the control group.

Blood pressure values were higher in hypertensive patients than in controls. This is expected. There is a "rule of halves" for hypertension that says that half of the patients with known hypertension under treatment are poorly controlled. Blood pressure has a constant positive association with the risk of developing cardiovascular events such as coronary heart disease whose occurrence is multiplied by the presence of hypertension.[7,13,14] A study done in eastern

Nigeria had a similar finding.[15] Increased blood pressure value has been implicated in increased mortality in the elderly.[13] This is because arterial wall changes occur with age and there is also modification of the renin aldosterone system as well as a heightened effect of sympathetic stimulation.[13] These lead to stiffening of the arterial walls making them less flexible and elastic. The net effect is increased work load on the cardiac muscles.

The BMI and waist circumference were found to be higher in patients than controls. Obesity and hypertension have long been associated, and obesity itself is an independent risk for cardiovascular events. A previous study observed that obese individuals had the highest prevalence of hypertension.[5] Obesity has been associated with high cardiovascular disease mortality.[16] Increased waist circumference is more specific for cardiovascular risk than BMI, especially among those above 60 years of age.[16,17,18] This is because the waist circumference is usually a truer representation of the presence of intra-peritoneal adipose tissue. This has been proven by use of computed tomography and dual energy X-ray absorptiometry. Increased visceral fat has been strongly connected with the aetiogenesis of insulin resistance, dyslipidaemia and hypertension.[17]

Adiposity is a strong independent risk factor for hypercholesterolaemia and diabetes; each of these is associated with subsequent development of cardiovascular disease.[16] Mechanisms of action have not been clearly defined but chronic inflammation and secretion of cytokines by the adipose tissue have been implicated. These cytokines stimulate insulin resistance and other related complications.[18] Both men and women with abdominal obesity have been found to have an increased risk of cardiovascular events. In General the risk is higher in females.[17] An increase in waist circumference as low as 1cm has been found to correlate with a 2% increased risk of cardiovascular disease CVD.[17]

Mild to moderately increased triglycerides have been associated with a risk of atherosclerotic cardiovascular disease as well as ischaemic heart disease. Though this was previously controversial, it has been agreed that the risk is higher when there are other dyslipidaemias such as reduced HDL-C.[15] Overweight and obese people have a higher level of triglycerides.[19] Some researchers have suggested that non fasting values of triglycerides give a better indication of cardiovascular risk as it tends to reflect the predominant state of the patient.[20]

Low HDL-C level is an independent cardiovascular risk. It is associated with increased atherosclerosis and increased mortality after cardiovascular events.[21] HDL has been proposed to have anti-inflammatory properties and confirmed to have strong antioxidant effects in 'well' as opposed to sick individuals. It has the ability to limit the formation of mildly oxidized LDL and encourage the function of many enzymes with antioxidant effect.[21]

It has been postulated that raising the HDL levels would improve outcome, though another study disproved this notion.[21] They proposed that isolated increase in HDL would not improve myocardial outcome. Correction of other dyslipidaemias is necessary for an overall positive effect.[22] The presence of increased triglycerides occurring concurrently with low HDL has been associated with major adverse cardiovascular events (MACE's) and increased total mortality in patients with essential hypertension. It is a stronger predictor of cardiovascular events than triglyceride alone, independent of other factors such as race, DM and age.[23]

Total cholesterol was increased in patients as compared to controls in this study with a mean above 5.0mmol/L. Hypercholesterolaemia increases the risk of cardiovascular events.[14] In these individuals, treating the hypertension alone reduces the risk by just a quarter, while correcting the cholesterol level reduces the risk by more than a third. This means that cholesterol control plays a major role in reducing cardiovascular risk.[14] It has been proposed

that cholesterol levels above 5.0 mmol/L in hypertensive individuals should be treated to enhance the efficacy of the overall therapy.[15]

Plasma glucose plays a predictive role independent of diabetes in heart failure.[11] Hyperglycaemia affects the cardiac muscle in many ways: it can stimulate inflammation, alter nitric oxide metabolism, heighten oxidative stress as well as activate factors involved in endothelial apoptosis. Some affected individuals have hyperinsulinaemia and some level of insulin resistance which worsens hypertension.[24] The prevalence of hypertension is higher among people with diabetes mellitus.[11] Insulin resistance is a common denominator in metabolic syndrome, type 2 diabetes mellitus and familial combined hyperlipidaemia. A study done to assess cardiovascular risk observed that hyperglycaemia was common in subjects with the above three conditions.[20] The presence of either hyperinsulinaemia or diabetes mellitus increases the overall cardiovascular risk.

Limitation

A limitation of the study is that the risk was not adjusted for age of the patient.

CONCLUSION

Hypertension has a deleterious effect on the heart. Most of the patients in this study had multiple cardiovascular risk factors even though they had regular hospital visits and were on treatment. These patients are at risk of worsening morbidity and increased mortality due to cardiovascular events. This is preventable.

RECOMMENDATIONS

Adequate attention and resources should be devoted to the prevention and treatment of hypertension. The mode of treatment may have to be revised to make it more holistic, effective and location specific to aid compliance. Health education and psychotherapy may have to be employed to encourage life style changes in addition to what is being currently practised.

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