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CO-OCCURRENCE OF DIABETES AND HYPERTENSION: PATTERN AND FACTORS ASSOCIATED WITH ORDER OF DIAGNOSIS AMONG NIGERIANS

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ABSTRACT

***Background*: There is a high frequency of co-occurrence of diabetes and hypertension all over the world. Such association results in higher rate of cardiovascular complications. It is however not clear whether the order of occurrence distinguishes two different groups of patients and the implications of this on morbidity and mortality. The main objective of this study is to determine if there are any clinical and metabolic differences between those first diagnosed with diabetes (hypertensive diabetics) compared to those first diagnosed with hypertension (diabetic hypertensives).**

***Methodology*: A total of 124 patients with co-existent diabetes and hypertension were consecutively recruited into the study. Demographic and clinical history was captured on a semi-structured questionnaire, followed by measurement of anthropometry and blood pressure. Records of fasting plasma glucose, urinalysis and electrolytes, urea and creatinine were obtained from the case records.**

***Results*: There were 83 (66.9%) females and 41 (33.1%) males with mean age of 61.1 (SD 11.1) years. Sixty or 49.6% was hypertensive diabetics while 52 or 43% was diabetic hypertensive. The rest had simultaneous diagnosis of diabetes and hypertension. The diabetic hypertensive subjects significantly had higher BMI (p= 0.04) while the hypertensive diabetics group had higher hip/waist ratio (p = 0.01). The diabetic hypertensive group had higher waist circumference statistically significant only in women (p = 0.04). Also significantly more people (21 or 42%; p = 0.04) in the diabetic hypertensive group used table salt often. A logistic regression performed showed that only use of table salt was independently associated with order of diagnosis of diabetes or hypertension.**

***Conclusion*: There could be significant differences in some clinical characteristics of hypertensive diabetics and diabetic hypertensives, and use of table salt may be an important risk factor contributing to co-existence of both conditions.**

INTRODUCTION

Diabetes and hypertension are two non-communicable diseases that frequently co-exist. Several studies have shown that raised blood pressure is commoner among people with diabetes than in the general population.[1-3] Both diseases are independent risk factors for cardiovascular disease (CVD), and when they co-exist they multiply morbidity and mortality of CVD.[4] Hypertension in diabetes accelerates development and progression of microvascular and macrovascular complications in patients with diabetes.[5] Among Nigerians, mortality is increased in diabetic patients with hypertension compared to normotensive diabetics.[6] In clinical practice, usually patients present first with one condition followed by later discovery of the other, although both conditions may simultaneously be diagnosed at presentation. It is not clear whether the order of occurrence of hypertension and diabetes is important such as to make one group differ from the other clinically or/and metabolically. It is important to investigate this because, if established differences exist, there may be implications on morbidity and mortality.

The objectives of the study therefore, were to find out the commoner order of discovery of diabetes and hypertension among patients with co-occurrence of diabetes and hypertension, and to determine if there are any clinical and metabolic differences between those first diagnosed with diabetes (herein referred to as hypertensive diabetics) compared to those first

diagnosed with hypertension (herein referred to as diabetic hypertensives).

METHODOLOGY

A cross-sectional study was carried out at the Diabetes Clinic and Medical Wards of the University College Hospital, Ibadan, between June-July, 2009. The inclusion criteria were being type2 diabetes based on WHO definition[7], having been diagnosed as having hypertension, and consenting to participate in the study. A total of 124 subjects were recruited consecutively into the study. Patients who were moribund and those who did not give consent were excluded. A semi-structured pre-tested questionnaire was first administered to all subjects. Information sought included demography, duration of diabetes and hypertension, list of hypoglycaemic and anti-hypertensive drugs being used, family history of diabetes and hypertension, use of table salt (especially to an already cooked food), history of alcohol and smoking. The last 3 readings of their fasting blood glucose were obtained from their case records and the average calculated. Last electrolytes, urea and creatinine done as well as urinalysis (for evidence of proteinuria) were obtained from the case records. Also confirmation of the timing of diagnosis of hypertension and diabetes was checked in their case records. Thereafter the weight, height waist circumference (WC) and hip circumference of subjects were measured according to standard procedure. BMI (Body Mass Index) was calculated as Weight/Height^2, while ratio of hip/waist ratio (HWR) was also determined. The blood pressure was then measured in sitting position after 5 minutes of rest using a mercury sphygmomanometer and in accordance with standard technique.

Statistical Analysis

Data initially recorded in the questionnaire were transferred into and analysed using SPSS version 17. All quantitative variables were expressed as mean and standard deviation where these were normally distributed, and as median with range where not normally distributed. Chi-square was used to analyse group differences between categorical variables while independent t-test was used to compare group differences in continuous variables. Stepwise logistic regression was done to find out determinant of being first diagnosed as hypertensive or diabetic.

RESULTS

There were 83 (66.9%) females and 41 (33.1%) males with mean age of 61.1 (SD 11.1) years. The median duration of diabetes and hypertension was 6 years in

Characteristic	Frequency	Percentage
Gender: Male	41	33.1
Female	83	66.9
Education: None	40	32.8
Primary	30	24.6
Secondary	21	17.2
Post-secondary	31	25.4
Marital Status: Single	3	2.4
Married	95	76.6
Widowed/Separated	26	21
Table salt: Occasionally/None	39	32.8
Often	71	59.6
Very often	9	7.6
Family history: Diabetes	35	29.4
Hypertension	23	19.3
	Mean/Median	SD/Range
Age (in years)	61.1	11.6
Diabetic duration (in years)	6	(0.08-50)
Hypertension duration (in years)	6	(0.08-35)
Fasting Plasma Glucose	138.8	47.9
Systolic BP	141.3	23
Diastolic BP	82.7	16.3
BMI	28.3	9.0
Waist circumference: Males	94.1	11
Females	97.4	11.3
Hip Waist ratio	1.0	0.1

Order of diagnosis	Frequency	Percentage
Hypertensive diabetics	60	49.6
Diabetic hypertensives	52	43.0
Simultaneously diagnosed	9	7.4

Table 2: Order of diagnosis of diabetes and hypertension

Parameter	Frequency
	Mean (SD)/Median (Range)
Potassium	3.9 (1.8-38)
Sodium	137.0 (6.4)
Chloride	99.1 (17.4)
Bicarbonate	21.7 (3.2)
Urea	31.5 (10.0-93.0)
Creatinine	1.2 (0.4)
Proteinuria (Dip-stick)	33 (29.2%)

Table 3: Renal Biochemistry

each case. There were sub-optimal blood glucose and blood pressure control; the mean fasting plasma glucose (FPG) was 139 (48) mg/dl, the mean systolic BP and diastolic BP were 141.3 (23) mmHg and 82.7 (16.3) mmHg respectively. The group as a whole was generally overweight with mean BMI of 28.3 (9.0). The men had a higher waist circumference above cut-off point {94.1 (11.6)} while the women had a waist circumference of 97.4 (11.3). Table 1 shows details of the general characteristics of the subjects.

The median duration of diabetes and hypertension was each 6 years. As shown in table 2, 60 or 49.6% was hypertensive diabetics while 52 or 43% was diabetic hypertensive. The rest had simultaneous diagnosis of diabetes and hypertension.

Table 3 showed the mean/median values of electrolytes, urea and creatinine in the subjects. All are within normal limits according to local reference ranges in the central laboratory.

In order to determine possible differences between hypertensive diabetics and diabetic hypertensives, the two groups were compared in terms of certain demographic and clinical parameters. No significant difference in sexes. Although not statistically significant, the hypertensive group was older and had poorer fasting plasma glucose. There was almost no difference at all in the systolic and diastolic blood pressure of both groups. As shown in table 4, the diabetic hypertensive subjects significantly had higher BMI (p= 0.04) while the hypertensive diabetics group had higher hip/waist ratio (p = 0.01). In the case of waist circumference, the diabetic hypertensive group had higher values but this was only statistically significant in women (p = 0.04). Also significantly more people (21 or 42%; p = 0.04) in the diabetic hypertensive group used table salt often.

To determine factors associated with whether diabetic hypertensive or hypertensive diabetic, a multiple stepwise logistic regression was carried out. After adjustment for age, sex, BMI, waist circumference, family history, use of alcohol and hypertension, only use of table salt was independently associated with being hypertensive diabetics (p= 0.027) or diabetic hypertensive (p = 0.026).

Attribute	Hypertensive diabetics	Diabetic hypertensives	P value
Age	59.9 (11.9)	63.5 (11.2)	0.11
Sex: Female	37 (61.7%)	38 (73.1%)	0.20
Male	23 (38.3%)	14 (26.9%)	
BMI	26.4 (6.6)	30.4 (11.4)	0.04*
Mean FPG	137.8 (53.4)	140.8 (40.7)	0.78
WC: Males	92.0 (12.5)	97.1 (10.1)	0.26
Females	94.8 (11.0)	100.4 (10.0)	0.04*
Hip/waist ratio	1.03 (0.1)	1.01 (0.1)	0.01*
Systolic BP	141.9 (21.1)	141.1 (27.0)	0.85
Diastolic BP	82.6 (16.6)	82.5 (17.4)	0.98
Table salt often	14 (23.7%)	21 (42.0%)	0.04*
Took Alcohol	7 (12.1%)	7 (13.7%)	0.80
Smoked	2 (3.4%)	1 (2.0%)	1.00
Took Thiazide	5 (8.3%)	10 (20.0%)	0.76
Proteinuria	15 (27.3%)	9 (18.8%)	0.31
Creatinine	1.20 (0.5)	1.15 (0.4)	0.48

Table 4: Differences between first-diagnosed diabetic and hypertensive

DISCUSSION

In this study, there was a higher frequency of hypertensive diabetics than diabetic hypertensive (49.6% versus 43%), while marginal number had both conditions diagnosed simultaneously. There were some clinical and metabolic differences between patients who were first diagnosed with diabetes and those first diagnosed with hypertension. There were differences in their age, gender distribution, BMI, hip/waist ratio, waist circumference, mean FPG, use of table salt and proteinuria. However only in terms of BMI, hip/waist ratio, waist circumference (females only) and use of table salt were they significantly different. Moreover after adjustment for possible confounders, only use of table salt was independently associated with whether diabetic hypertensives or hypertensive diabetics.

Hypertension and diabetes frequently coexist. Our study is probably the first to explore the order of discovery of these chronic conditions and their possible clinical, phenotypic and biochemical differences. Most researches till date usually only report that both hypertension and diabetes are associated. For example, in the US population, Movahed and co-workers using a large database recently reported a strong association between hypertension and diabetes, independent of co-morbid conditions[8]. They also showed that this association is independent of co-morbid conditions and was persistent with similar odds ratio over a period of 10 years. Workers in Nigeria have reported between 30 to 50% of clinical patients have associated diabetes and hypertension.[9-11]

A number of possible reasons have been adduced for this association. Both share common factors such as insulin resistance, aging, obesity, use of thiazide diuretics in subjects initially with hypertension and development of nephropathy in those initially with diabetes, especially type 1.[12-13] Diabetes may also be associated with systolic hypertension secondary to atherosclerosis.[12-13] In addition both conditions are familial, which is likely to be polygenic in origin, although the underlying mechanism is still unclear.[14-15] Our subject population was relatively older (above 60 years) with a short diabetes and hypertension duration of 6 years, implying these conditions occurred when they were in their 5th decade. Obesity and insulin resistance has consistently been shown to be a precursor for both hypertension and diabetes.[16-17] For unclear reason, our data showed that the diabetic hypertensive subjects significantly were heavier and the women had higher truncal obesity than the hypertensive diabetic subjects. Kolawole *et al* [6] had alluded to important gender differences between normotensive diabetics and hypertensive diabetics. There is need to investigate this finding further as the cross-sectional design of our study limited the knowledge of when the hypertensive subjects gained the weight- before or after diagnosis of diabetes, a question better answered by a longitudinal study. If anything, higher anthropometry in hypertensive diabetics may occur, and perhaps would not be surprising considering that some of them might have been using weight-promoting hypoglycaemic agents such as insulin and sulphonylureas before diagnosis of hypertension. It is however interesting from the logistic regression analysis that none of the anthropometric measures had independent association with whether being diagnosed first with hypertension or diabetes, implying they could be confounders. The only factor found to be independently associated was use of table salt. It is a well established fact that black patient are particularly sensitive to salt,[18-19] hence it was not surprising to find that diabetic hypertensive subjects have used table salt more. The role of salt in the development of diabetes has largely not been investigated. Isezuo and co-workers[20] compared salt taste perception among Nigerian patients with type 2 diabetes, hypertension and patients with concurrent hypertension and diabetes. They reported no difference between these groups. However normotensive diabetic subjects demonstrated impaired salt taste sensitivity compared to controls, and so they concluded that salt taste acuity is impaired in type 2 diabetics and could be a contributory factor to the high prevalence of hypertension in the diabetic population. Furthermore in diabetic patients with hypertension, unrestricted salt intake could worsen blood pressure control and attenuate effects of antihypertensive drugs.[21-22]

Besides limitation of cross-sectional design and need for a longitudinal study, a larger sample size is also needed to confirm, as suggested by our study that there is a higher frequency of hypertensive diabetics than diabetic hypertensive (as defined above), and the role of anthropometry in possible phenotypic description of the diabetic hypertensives compared to hypertensive diabetics.

In conclusion, our study, perhaps for the first time at least in Nigeria, has sensitized physicians that there could be significant differences in some clinical characteristics of hypertensive diabetics and diabetic hypertensives, and use of table salt may be an important risk factor contributing to co-existence of both conditions. It will also be interesting to find out in future studies the morbidity and mortality patterns of these two groups of patients.

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