Nig. J. Physiol. Sci. 26(June 2011) 007 – 010
www.njps.physocnigeria.org

Nig. J. Physiol. Sci.

Prevalence of left ventricular hypertrophy in hypertensive and normotensive type 2 diabetic females in Port Harcourt

Nworah DC [a], Chike CPR [a], Akpa MR [b], Nwafor A[a] , Dapper DV[a]

[a] Department of Human Physiology, Faculty of Basic Medical Sciences, [b]Department of Internal Medicine,Faculty of Clinical Sciences; College of Health Sciences, University of Port Harcourt ,Choba,Rivers State,P.M.B. 5323, Nigeria.

Summary: This study investigated the prevalence *of* electrocardiographically determined left ventricular hypertrophy in hypertensive and normotensive type 2 diabetic females who went for consultation at the University of Port Harcourt Teaching Hospital (UPTH), Rivers State, Nigeria. Two hundred participants mean age 52years, attending the medical outpatient clinic over a 6-month period were recruited for the study. Of the population studied, 16.5% of the hypertensive and 13.0% of the normotensive diabetics had left ventricular hypertrophy. Cardiovascular abnormalities notably bifascicular block, left atrial block, right ventricular enlargement, and right atrial enlargement were predominately among hypertensive diabetes and also notably was arrhythmia and atrial flutter among normotensive diabetes. The significance of these findings is discussed.

Keywords*:* Hypertension, Diabetes mellitus, Cardiovascular disease, Left ventricular hypertrophy

**Address for correspondence:* anwafor2000@yahoo.com

Manuscript Accepted: April, 2011

INTRODUCTION

It is well established that left ventricular hypertrophy (LVH) is of clinical significance as it is an independent cardiovascular (CV) risk factor. And is also known that diabetes, especially type 2 diabetes and raised blood pressure, more specifically, hypertension are among the main risk factors for cardiovascular disease (CVD) (Howard *et al* 1999*;* Zimmet *et al.*, 2001*:* Ciardullo et al 2004*;*Lozano *et al* 2006).Though left ventricular hypertrophy is a powerful predictor of cardiovascular morbidity and mortality , less is known about the prevalence of left ventricular hypertrophy and its relation to other cardiovascular risk factors in hypertensive and normotensive diabetes in Africa and in particular Nigeria. Studies in the general population (Levy *et al.* 1990; Ciardullo et al 2004**)** and in cohorts of hypertensive (Koren *et al.*, 1991**)** have documented a several-fold increase in the risk of cardiovascular events in subjects with left ventricular hypertrophy. There is evidence from large population based studies of an increased tendency to left ventricular hypertrophy in hypertensive blacks, independent of body composition (Kizer *et al.*, 2004). Data from population studies demonstrate that women with diabetes are at greater risk for cardiovascular disease, the leading cause of death among women and an independent risk factor for cognitive decline (Coker and Shumaker, 2003). However, previous studies have demonstrated conflicting results with respect to the prevalence of LVH on ECG in individuals with and without diabetes Okin *et al* (2006). Despite the growing importance of diabetes mellitus in Nigeria, few evidences support the related complications and particularly cardiovascular complications (Falase 1980). In a review, it has been suggested that although considered to be rare; cardiovascular disease was on the rise among people with diabetes in Nigeria and was regularly associated with classical risk factors (Ladipo *et al*., 1997).

Thus the objective of this study therefore, was to electrocardiographically determine the prevalence of left ventricular hypotrophy (LVH) and other related cardiovascular abnormalities in hypertensive compared to normotensive diabetes females which will be of medical interest.

MATERIALS AND METHODS

The study is a prospective hospital-based study carried out at the Department of Medicine, University of Port Harcourt Teaching Hospital (UPTH) Port Harcourt, Nigeria, from January 2009 to June 2009. A total of two-hundred (200) female patients, consisting of 98 (49%) hypertensive and 102 (51%) normotensive diabetes aged 20 to 91 years were recruited for the study.

Ethical Clearance:

The study design and the protocol were approved by the Medical Ethical and Research Committee of the University of Port Harcourt Teaching Hospital (UPTH) Port Harcourt. Informed consent was obtained from each participants employed for the study after considerable explanation.

Electrophysiology:

The participants were subjected to physical examination and their cardiovascular histories were determined from medical records. The diagnosis of LVH was assessed electrocardiographically by cardiologist using standard 12 lead electrocardiogram (ECG) machine based on Minnesota criteria.

Selection of Subjects:

The Socio-economic class of the subjects was determined by comparing subjects in regular employment with those not in regular employments. Hypertension was defined according to WHO definition as "systolic blood pressure $\geqslant$ 140 mm Hg, and/or diastolic blood pressure $\geqslant$ 90 mm Hg, and/or currently under antihypertensive drug treatment" (Chobanian *et al.*,2003).

Diabetes was defined as a fasting blood glucose concentration >7.0 mmol/l or as the administration of insulin or oral hypoglycaemic drugs.

Statistical Analysis:

Data from the standard questionnaire were entered into a Microsoft Excel (2000) spreadsheet for statistical analysis. Measure of central tendency using range, means and median, measure of spread using standard deviation and variance were calculated for quantitative and qualitative data. Continuous variables were expressed as mean ± SD (standard deviation) and categorical variables expressed as percentages. A p value <0.05 was set as statistically significant. The student's *t*- test was used as appropriate. Correlation analysis was also used as appropriate.

RESULTS

The mean age of 200 participants was 52 years. The age of the hypertensive diabetes was 52.95±14.21years and was statistically significantly higher ($p< 0.05$) than that of the normotensive diabetes 50.14±14.25 years with variance 202.93 and 201.91 respectively and X^2 value=10.133; p=0.1811.

Table 1:
Percent characteristics of ECG abnormalities in normotensive and hypertensive diabetes females

Specific abnormality	Total population	Normotensive diabetics	Hypertensive diabetics
Normal ECG pattern [With no detectable abnormality]	58(29%)	29(14.5%)	29(14.5%)
Left ventricular hypertrophy	59(29.5%)	26(13 %)	33(16.5%)
Right ventricular hypertrophy	54(27%)	21(10.5%)	33(16.5%)
Hypertensive heart disease & ischemic changes	51(25.5%)	26(13%)	25(12.5%)
ST elevation + T inversion	42(21%)	21(10.5%)	21(10.5%)
Left atrial deviation	40(20%)	17(8.5%)	23(11.5%)
Left atrial enlargement	21(10.5%)	15(7.5%)	6(3%)
Unifocal premature ventricular complexes	17(8.5%)	11(5.5%)	6(3.3%)
Prolonged QT interval	16(8%)	9(4.5%)	7(3.5%)
Left bundle branch block	15 (7.5%)	7(3.5%)	8(4.0%)
Sinus tachycardia	15(7.5%)	4(2.0%)	11(5.5%)
Poor R wave progression	14(7.0%)	8(4.0%)	6(3.3%)
Sinus bradycardia	12(6.0%)	11(5.5%)	1(8.3%)
Atrial fibrillation	12(6.0%	6(3.3%)	6(3.3%)
Right atrial deviation	11(5.5%)	7(3.5%)	4(2.0%)
Right atrial enlargement	9(4.5%)	-	9(4.5%)
First A-V block	8(4.0%)	1(12.5%)	7(3.5%)
Right bundle branch block	6(3.3%)	3(50%)	3(50%)
Flattened T wave	6(3.3%)	1(0.5%)	5(2.5%)
Bifascicular block	4(2.0%)	-	4(2.0%)
Left atrial block	2(1.0%)	-	2(1.0%)
Right ventricular enlargement	1	-	1(0.5%)
Arrhythmia	1	1(0.5%)	-
Atrial flutter	1	1(0.5%)	-

Of all participants, 29.5% individuals had a documented left ventricular hypertrophy with normotensive diabetes 13% and hypertensive diabetes 16.5% respectively. The characteristics of cardiovascular abnormalities recorded in normotensive compared to hypertensive diabetes are described in Table 1.

Most of the ECG abnormalities were significantly worse for hypertensive diabetes individuals when compared with normotensive diabetes.

There was an association between the age of the participants and ECG characteristics in normotensive and hypertensive diabetes females. Using Pearson's correlation coefficient analysis, significant positive correlation ($p<0.05$) were obtained for Age: QRS voltage($X^2 = 0.0959$) in normotensive diabetes while for the hypertensive diabetes significant positive correlations were found for Age: QRS axis ($X^2 =0.2786$), Age: QT interval ($X^2=0.2045$), Age: QTCB interval ($X^2 =0.2126$), Age: RR interval ($X^2 =0.2179$), Age: PP interval ($X^2 =0.2198$)

DISCUSSION

Certain chronic diseases, especially heart disease, are often viewed as primarily affecting men. However, chronic diseases, including heart disease, according to WHO, affect women and men almost equally. A projected global coronary heart disease death by sex, for all ages, by the year 2005 was women 47% and men 53% (WHO, 2002). The present study attempts mainly to describe and document the complications in a cohort of susceptible ECG changes in hypertensive diabetes compared to normotensive diabetes females. Evidence to support the related complications and particularly the cardiovascular complication of diabetes and/or hypertension amongst Nigerians are still relatively few and not well documented (Falase 1980). Recently it has been suggested that although initially thought to be rare, cardiovascular disease (CVD) and associated complications was on the rise among Nigerians with diabetes and is regularly associated with other classical risk factors (Ladipo *et al.*,1997) nonetheless, these risk factors and the associated complications have yet to be fully described.

Our study demonstrated the presence of left ventricular hypertrophy on ECG among both hypertensive and normotensive diabetes and conforms with the previous suggestions that the diagnosis of left ventricular hypertrophy on ECG is associated with a high cardiovascular risk (Ciardullo et al., 2004). The diagnosis of LVH in both hypertensive and normotensive diabetes as observed in this study might perhaps be a reflection of environmental –associated fat inducing increases in diabetes as well as in individuals with heart diseases. Furthermore, our studies showed that the body mass index (kg/m^2) of the normotensive and hypertensive diabetes 25.90±3.60 and 26.17±3.47 respectively were above normal and were also not statistically significantly different ($p= 0.219$) an indication that the participants were obsess. In a study, both the ratio of total to HDL cholesterol and the non-HDL cholesterol were significantly higher in 'LVH' individuals than in the 'non-LVH' cases (Ciardullo et al., 2004). Hypertensive diabetes has higher prevalence and greater severity of left ventricular hypertrophy than those without diabetes (Bella *et al.,* 2001, Palmieri *et al.*, 2001).

Studies have shown that both hypertension and left ventricular hypertrophy are associated with increased risk for cardiac arrhythmias (Koren *et al.,* 1991) and this study has also confirmed that the majority of the hypertensive diabetes had common co- morbid conditions.

Though the present study was conducted exclusively on females the findings are consistent with similar findings in the Framingham study that the presence of LVH on ECG was not a consistent feature in male hypertensive diabetes compared to female hypertensive diabetes (Kannel and Cobb 1992) or with the general population (Ciardullo et al 2004). In conclusion, both hypertensive and normotensive diabetes are at higher risk to developing cardiovascular disease complications and perhaps this might be a reflection of environmental – associated increases in body fat which may perhaps require further investigations. The observed prevalence in LVH on ECG among normotensive and hypertensive diabetes, together with the greater prevalence of LVH in the Nigerian population studied, might contribute to the understanding of the development of an increase in high risk of cardiovascular (CV) events with aging in women.

REFERENCES

Bella JN, Devereux RB, Roman MJ, Palmieri V, Liu JE, Paranicas M, Welty TK, Lee ET, Fabsitz RR, and Howard BV(2001). Separate and joint effects of systemic hypertension and diabetes mellitus on left ventricular structure and function in American Indians (the Strong Heart Study). *Am J Cardiol.*; 87: 1260–1265.

Chobanian AV, Bakris GL, Black HR, Cushman WC, (2003). The seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. *JAMA*; 289:2560-2571.

Ciardullo AV', Azzolini L , Bevini M , Cadioli T , Daghio MM , Guidetti P , Lorenzetti M , Malavasi P , Morellini A and Carapezzi C (2004). A diagnosis of left ventricular hypertrophy on ECG

is associated with a high cardiovascular risk: findings from a 40- to 69-year-old cohort in general practice. Family Practice, 21 (1), 63-65

Coker LH, Shumaker SA (2003): Type 2 diabetes mellitus and cognition: an understudied issue in women's health. J Psychosom Res. 54(2):129-39.

Falase AO. (1980) Heart Muscle Disease in adult Nigeria. Nig Med J . 10 (3 & 4) 89-97.

Howard BV, Lee ET, Cowan LD, Devereux RB, Galloway JM, Go OT, Howard WJ, Rhoades ER, Robbins DC, Sievers ML, Welty TK (1999). Rising tide of cardiovascular disease in American Indians: the Strong Heart Study. *Circulation* 99: 2389–2395.

Kannel WB, Cobb J. (1992); Left ventricular hypertrophy and mortality--results from the Framingham Study. *Cardiology*. 81(4-5):291-8

Kizer, JR, Arnett, DK, Bella, JN, 2004). Differences in left ventricular structure between black and white hypertensive adults: the Hypertension Genetic Epidemiology Network study. Hypertension; 43:1182.

Koren MJ, Devereux RB, Casale PN, (1991): Relation of left ventricular mass and geometry to morbidity and mortality in uncomplicated essential hypertension. *Ann Intern Med.*; 114: 345–352.

Ladipo GO, Fronde JR, Parry EH.(1997) Patterns of heart disease in adults of the Nigerian savanna: a prospective clinical study. Afr J Med Sci; 6 (4): 185-192.

Levy D, Garrison RJ, Savage DD, (1990). Prognostic implications of echocardiographically determined left ventricular mass in the Framingham heart study. *N Engl J Med.*; 322: 1561–1566.

Lozano JV, Redón J, Cea-Calvo L, Fernández-Pérez C, Navarro J, Bonet A, González-Esteban J (2006). Left ventricular hypertrophy in the Spanish hypertensive population. The ERIC-HTA;59(2):136-42

Okin, P M; Devereux, R B; Gerdts, E; Snapinn, S M.; Harris, K E; Jern, S; (2006). Impact of Diabetes Mellitus on Regression of Electrocardiographic Left Ventricular Hypertrophy and the Prediction of Outcome During Antihypertensive Therapy: The Losartan Intervention For Endpoint (LIFE) Reduction in Hypertension Study. Circulation. 113(12):1588-1596

Palmieri V, Bella JN, Arnett DK, Liu JE, Oberman A, Schuck MY, Kitzman DW, Hopkins PN, Morgan D, Rao DC, Devereux RB(2001). Effect of type 2 diabetes mellitus on left ventricular geometry and systolic function in hypertensive subjects: Hypertension Genetic Epidemiology Network (HyperGEN) study. *Circulation.* 103(1):102-7

The World Health Report– Reducing risks, promoting healthy life. Geneva, World Health Organization, 2002.

Zimmet P, Alberti K, Shaw J (2001): Global and societal implications of the diabetic epidemic. *Nature* 414: 782–787.