Original Article / Orijinal Araştırma

Intraventricular conduction blocks and microalbuminuria in Nigerians with essential hypertension
Esansiyel Hipertansiyonu olan Nijeryalılarda İntraventriküler İletim Blokları ve Mikroalbüminüri

Olusegun Adesola Busari[1], Timothy Segun Olarewaju[2], Segun Matthew Agboola[1], Ahmed Kayode JImoh[1]

[1]Federal Medical Centre, Ido-Ekiti, Nigeria

[2] University of Ilorin Teaching Hospital, Ilorin, Nigeria

Corresponding Author:
Olusegun Adesola Busari

Federal Medical Centre, Ido-Ekiti, Nigeria

Email:
(olubusari@yahoo.com)

Başvuru Tarihi/Received :
29-12-2012
Düzeltme Tarihi/Revised:
29-03-2013
Kabul Tarihi/Accepted:
31-03-2013

ABSTRACT

Objective: The objective of this study was to examine the prevalence and pattern of intraventricular conduction blocks in adult Nigerians with newly diagnosed essential hypertension and to determine the relationship between microalbuminuria and intraventricular conduction blocks.

Methods: It was a cross-sectional study with nested case control. Ninety six patients were consecutively enrolled and compared with age- and sex-matched ninety six healthy normotensive individuals. Pre-tested questionnaire was used for data collection. The data collected was doubly entry into SPSS 20.0 software and analysed. P value < 0.05 was accepted as significance.

Results: There were 52 (54.2%) male and 46 (45.8%) female hypertensive patients. Twenty one patients (21.9%) had intraventricular conduction blocks compared with 4 (4.2%) among the normotensive controls (21.9% versus 4.2%, P = 0.001) and left anterior fascicular block was the most frequent (38.1%). The prevalence of microalbuminuria was 32.3% in the hypertensive patients. Intraventricular blocks were significantly more common in hypertensive patients with microalbuminuria than in those without it (32.3% versus 16.9%, P=0.01).

Conclusion: This study reveals that there is a high prevalence of intraventricular conduction blocks in adult Nigerians with newly diagnosed essential hypertension and left anterior fascicular block is the most common type. It also shows that the subset of hypertensive patients with microalbuminuria is more likely to have intraventricular blocks than those without it.

Key words: Hypertension, Intraventricular conduction blocks, Microalbuminuria.

Introduction

Hypertension (HT) remains the leading cause of cardiovascular disease globally (1, 2). The prevalence has been increasing worldwide and it has been estimated to increase to 29.2% by 2025 (2). In Nigeria, studies have reported prevalence from 12% to 36.6% (3-6). Hypertensive heart disease is a common early complication of HT and may manifest as conduction system abnormalities (7, 8). Studies have reported increased cardiovascular events and poorer prognosis in hypertensive heart disease (HHD) patients with intraventricular conduction blocks (IVCB) (9-11). Several mechanisms have been thought to play a role in the pathogenesis of conduction system diseases in HT and they include: altered cellular structure and metabolism, inhomogeneity of the myocardium, ischaemia, and myocardial hypertrophy and fibrosis (12). Microalbuminuria (MA) is an indicator of generalised vascular damage and a marker of cardiovascular complication in HT. MA is associated with electrocardiographic abnormalities in essential HT (13). IVCB represents distal blocks occurring in the bundle branch and divisions or fascicles of the conducting system of the heart. The common types include left anterior fascicular block (LAFB), left posterior fascicular block (LPFB), right bundle branch block (RBBB), left bundle branch block (LBBB) and combinations of these in the form of bifascicular block (BFB) and trifascicular block (TFB) (14, 15). Although there have been studies on IVCB in HT and HHD, the objective of this study was to examine the prevalence and pattern of IVCB in adult Nigerians with newly diagnosed HT and to determine the relationship between MA and IVCB.

Materials and Methods

It was a cross-sectional study with nested case control. The study population was the newly diagnosed adult hypertensive patients attending the Cardiology clinic of the University of Ilorin Teaching Hospital, Nigeria. Ninety six patients were consecutively enrolled and compared with age- and sex-matched ninety six healthy normotensive individuals. The research protocol was reviewed and approved by the research ethics review committee of the aforementioned hospital. Both oral and written consent was obtained from all the participants. The exclusion criteria were: previous use of antihypertensive drugs, diabetes mellitus (DM), renal or endocrine diseases, overt proteinuria (as demonstrated by conventional urinalysis dipsticks), abnormal urinary sediments on microscopy, congestive heart failure, myocardial infarction, obesity and use of drugs that can cause electrocardiographic changes.

Table 1: Criteria for defining intraventricular conduction blocks (19-21)

Electrocardiographic features	LAFB	LPFB	RBBB	LBBB
QRS axis	-45^0 to -90^0	[1] $+90^0$ to $+180^0$	Usually normal	Left axis deviation
QRS duration	<120ms	<120ms	≥120ms	≥120ms
QRS morphology: Leads V1 Leads I,V6 Leads II, III, aVF	Normal qR rS	Normal rS qR	R, rR´, rsR´,qR qRS, slurred S	QS, rS RsR, RR
T wave			Appropriate discordant T wave deflection	Appropriate discordant T wave deflection
Intrinsicoid deflection(R-peak time) in lead aVL	Delayed (≥0.045s)	Delayed (≥0.045s)		

[1] In the absence of an alternative explanation for the right axis deviation

LAFB-Left anterior fascicular block; LPFB-Left posterior fascicular block; LBBB-Left bundle branch block; RBBB-Right bundle branch block

All the participants had a detailed history taking and a thorough physical examination including anthropometry. Blood pressures were measured using a mercury column sphygmomanometer and a cuff of appropriate size for each participant. A standardized protocol was followed, in which systolic (SBP) and diastolic (DBP) blood pressures were measured on the left arm after participants had been seated for at least five minutes. The cuff was positioned at the heart level and deflated at 2 mm/s and the blood pressure was measured to the nearest 2mmHg. Three measurements

were done after five minutes of rest and at least five minutes apart using standardized protocol. The average of second and third measurements was recorded for the study. Hypertension was defined as SBP ≥ 140mmHg and/or DBP ≥ 90mmHg, or use of antihypertensive medications. Laboratory assessment of conventional cardiovascular risk factors was done (16, 17). Blood samples were analysed for fasting plasma glucose (FPG), serum total cholesterol (TC), triglyceride (TG), low density lipoprotein cholesterol (LDL), high density lipoprotein cholesterol (HDL) and serum creatinine. The glomerular filtration rate was estimated using Cockroft Gault formular (18).

Table 2: Clinical characteristics of patients and controls

	Patients			Controls			P
	Male	Female	Total	Male	Female	Total	
	(n = 52)	(n = 44)	(n = 96)	(n = 49)	(n = 47)	(n =96)	
Mean age (yr)	51.2±10.1	48.2±8.8	49.7±12.3	49.6±12.3	42.6±10.4	46.1±13.0	0.20
Mean SBP (mmHg)	164.5±14.2*	155.5±15.1*	160.0±15.0	132.4±9.7*	125.6±8.2*	129.0±10.0	0.01
Mean DBP (mmHg)	111.5±10.1*	103.3±11.8	107.4±10.5	82.1±5.9*	78.3±7.1	80.2±6.9	0.01
TC (mmol/l)	4.55±0.76*	4.37±0.81*	4.46±0.79	3.50±0.38*	3.28±0.38*	3.39±0.42	0.02
LDL (mmol/l)	3.29±0.68*	3.11±0.79*	3.20±0.77	2.52±0.42*	2.36±0.39*	2.44±0.38	0.03
HDL (mmol/l)	1.10±0.22*	1.02±0.26*	1.06±0.25	1.27±0.17*	1.21±0.19*	1.24±0.13	0.05
TG (mmol/l)	1.28±0.27	1.24±0.29	1.26±0.32	1.23±0.12	1.17±0.11	1.20±0.18	0.40
eGFR (ml/min)	81.5±19.4	73.3±16.7	77.4±20.7	88.7±14.2	79.9±13.8	84.3±17.1	0.06
IVCB	12 (23.1%)	9 (19.6%)	21 (21.9%)*	3 (6.1%)	1 (2.1%)	4 (4.2%)*	0.001
MA	18 (34.6%)	13(28.3%)	31 (32.3%)*	4 (8.2%)	2 (4.3%)	6 (6.3%)*	0.001

*p <0.05, SBP – systolic blood pressure; DBP – diastolic blood pressure; TC – total cholesterol; LDL – low density lipoprotein cholesterol; HDL – high density lipoprotein cholesterol; TG – triglycerides; eGFR-estimated glomerular filtration rate; IVCB – intraventricular conduction block; MA – microalbuminuria.

Resting 12-lead ECG of all patients were recorded using 3-channel Schiller Cardiovit-10 machine at a sensitivity of 10mm/mV and a paper speed of 25mm/s. ECG tracings were read blindly using a manual calliper by one of the investigators. The criteria (19) used for defining the types of IVCB are highlighted in Table 1. BFB was defined as RBBB with either LAFB or LPFB; and TFB as a combination of RBBB, LAFB or LPFB and prolongation of PR interval (20-22).

MA was determined using the Micra Test II test strips (Boehringer Manneheim GMBh, Manheim, Germany). This dipstick has been found to be a fast and cheap method to screen patients for the presence of MA (23). There are four colour blocks on the test strip corresponding to negative (0), 20, 50 and 100mg/l of albumin. The test was done on three consecutive first morning voided urine samples collected at three weekly intervals. MA was considered to be present when two of the three urine samples tested produced a reaction corresponding to 20mg/l or more. The mean value of MA was also recorded for each participant.

Table 3: Clinical characteristics of patients with and without microalbuminuria (MA)

	Patients with MA			Patients without MA			P
	Male (n = 18)	Female (n = 13)	Total (n = 31)	Male (n = 37)	Female (n = 18)	Total (n =65)	
Mean age (yr)	54.9±8.8	50.6±9.2	52.5±11.9	49.5±10.1	47.8±8.7	48.3±13.0	0.10
Mean SBP (mmHg)	185.2±18.4	179.5±20.1	182.2±20.4	162.8±17.9	168.1±18.3	168.3±22.1	0.07
Mean DBP (mmHg)	120.3±20.5*	119.7±17.0*	20.5±18.7	100.8±15.1*	100.4±12.1*	102.0±14.9	0.03
TC (mmol/l)	5.05±0.87*	4.94±0.78*	5.0±0.56	4.11±0.62*	3.99±0.53*	4.05±0.5	0.04
LDL (mmol/l)	4.08±0.51*	3.90±0.49*	3.99±0.49*	2.52±0.42*	2.36±0.39*	2.44±0.38	0.001
HDL (mmol/l)	0.93±0.18*	0.89±0.17*	0.91±0.16	1.27±0.17*	1.21±0.19*	1.24±0.13	0.01
TG (mmol/l)	1.47±0.21	1.35±0.24	1.41±0.35	1.39±0.25	1.25±0.29	1.32±0.29	0.20
eGFR (ml/min)	68.7±12.5*	62.3± 10.8*	63.6±11.5	79.7±13.1*	71.5±11.4*	72.5±12.6	0.02
IVCB	7 (38.9%)	3 (23.1%)	10 (32.3%)	5 (13.5%)	6 (33.3%)	11 (16.9%)	0.01

*p < 0.05; SBP – systolic blood pressure; DBP – diastolic blood pressure; TC – total cholesterol; LDL – low density lipoprotein cholesterol; HDL –high density lipoprotein cholesterol; TG – triglycerides; eGFR-estimated glomerular filtration rate

Statistics

The data collected was doubly entry into SPSS 20.0 software (IBM, Chicago, Il, US) and analysed. Variables were described as means and standard deviations, frequencies and proportions as appropriate. Hypothesis testing was done by student *t* test for continuous variables and Fisher exact test for categorical variables. The Mann-Whitney *U* nonparametric statistical hypothesis test was also used as appropriate. A P value < 0.05 (two-sided test) was accepted as indicative of statistical significance.

Table 4: Distribution of intraventricular blocks in patients

	Male (n = 55)	Female (n = 41)	Total (n = 96)
LAFB alone	4 (7.3%)	4 (9.8%)	8 (8.3%)
LPFB alone	1 (1.8%)	-	-
RBBB	3 (5.5%)	4 (9.8%)	7 (7.3%)
LBBB	3 (5.5%)	1 (2.4%)	4 (4.2%)
RBBB+LAFB	1 (1.8%)	-	-
RBBB+LPFB	-	-	-
TFB	-	-	-

Results

Nine six hypertensive patients were studied. There were 52 (54.2%) males and 46 (45.8%) females. The mean age for the patients and controls are shown in Table 2. Twenty one patients (21.9%) had IVCB compared with 4 (4.2%) among the normotensive controls (21.9% versus 4.2%, p = 0.001). In the patients LAFB was the most frequent (38.1%) IVCB followed by LBBB (19%). The distribution of the types of IVCB is shown in Tables 4 and 5. The prevalence of MA was 32.3% in the hypertensive patients and 6.3% in the normotensive controls. Other clinical characteristics of the patients and controls are shown in Table 2. IVCB was significantly more common in hypertensive patients with MA than in those without MA (32.3% versus 16.9%, p =0.01). However, it was only LBBB that was significantly more frequent in patients with MA than in those without MA (9.7% versus 1.5%, p = 0.01). Except for the serum TG, patients with MA had statistically significant higher TC and LDL and lower HDL than patients without MA.

Discussion

The study shows that there is a high prevalence (21.9%) of IVCB in adult Nigerians with HT. However, this finding is lower than 51.7% reported by Omotoso *et al* (24). This variance might be due to the different study populations. While our study was conducted among newly diagnosed hypertensives, the other study was done among adult Nigerians with hypertensive heart disease (HHD). The most frequent type of block was LAFB (38.1%). This is similar to the findings in previous studies (9, 24-26). LPFB was very rare in our study similar to the finding reported by Omotoso *et al* (24). The more frequent pathological involvement of the left anterior fascicle compared with the posterior fascicle could be due to their different anatomy. The left anterior fascicle is long and fans out early. It crosses the left ventricular outflow tract and can be damaged by high flow, high pressure, and turbulence as occurs with HT. In the contrary, the left posterior fascicle is the first branch of the left bundle and is large in its initial course. It then fans extensively throughout the posterior and inferior left ventricle. The left posterior fascicle is exposed to lower pressures and less turbulence than the left anterior fascicle and it also has a dual blood supply. These characteristics probably explain why isolated LPFB is a rare finding (27). LAFB is the most common conduction defect in acute myocardial infarction and the left anterior descending artery is usually the culprit vessel. It is also associated with HHD and degenerative fibrotic diseases of the cardiac skeleton (28). The association of left fascicular block with RBBB is frequently considered as sign of poor prognosis. This is true in the setting of acute myocardial infarction where it accompanies large infarcts (29).

The prevalence of MA (32.3%) in HT is also high in this study. Intraventricular blocks as a whole were significantly more common in hypertensive patients with MA than in those without MA. MA is an indicator of generalised vascular damage and a marker of cardiovascular complication in HT. It has been associated with increased risk of end organ damage and cardiovascular events in HT (30, 31). Klausen *et al* (32) reported that MA was associated with increased risk of coronary heart disease and death irrespective of renal function, HT and DM. That is, MA, may be an independent cardiovascular risk factor. However, the increased risk of cardiovascular events in HT with MA may also be due to increased prevalence of other cardiovascular co-morbidities such as dyslipidaemia. Our study corroborates this by showing that patients with MA had statistically significant higher TC and LDL and lower HDL than patients without MA.

Opadijo *et al* (9), in a cohort study, reported that IVCB in adult Nigerians with HHD signified high morbidity and mortality comparable to the same effect in patients with acute myocardial infarction (9). They reported increased risk of cardiovascular events such as hypertensive heart failure, cardiac arrhythmia and stroke in hypertensive patients with IVCB.

In our study LBBB was the only type of IVCB that was significantly more frequent in patients with MA than in those without MA. Unlike RBBB, LBBB has been associated with organic heart diseases caused by HT, CAD, aortic valve stenosis, and cardiomyopathy since its first description (33, 34). LBBB heralds a much more unfavourable cardiovascular prognosis than RBBB. However, the pathophysiological relationship between LBBB and organic heart disease remains largely superficial. For example, it is unknown whether LV dysfunction precedes LBBB or whether the reversed course is the case (34, 35).

Conclusion

This study reveals that there is a high prevalence of IVCB in adult Nigerians with newly diagnosed HT and LAFB is the most common type. It also shows that the subset of hypertensives with MA is more likely to have IVCB than those without MA. However, it could not determine which of the observation precedes the other. Prospective cohort studies are important to throw light on the pathophysiological relationship between MA and IVCB. Finally, periodic screening for MA could allow early identification of IVCB.

References

1. Kearney PM, Whelton M, Reynolds K, Whelton PK, He J. Worldwide prevalence of hypertension: a systematic review. J Hypertens 2004; 22(1):11–19
2. Kearney PM, Whelton M, Reynolds K, et al. Global burden of hypertension: analysis of worldwide data. Lancet 2005; 365(9455):217–223
3. Adedoyin RA, Mbada CE, Balogun MO, et al. Prevalence and pattern of hypertension in a semiurban community in Nigeria. Eur J Cardiovasc Prev Rehabil 2008, 15(6)**:**683-687
4. Ofuya Z: The incidence of hypertension among a select population of adults in the Niger Delta region of Nigeria. Southeast Asian J Trop Med Public Health 2007; 38(5)**:**947-949
5. Oladipo B, Akinkungbe. Current epidemiology of hypertension in Nigeria. Archives of Ibadan Medicine 2001; 1(1): 4- 8
6. Oladapo OO, Salako L, Sodiq O, et al. A prevalence of cardiometabolic risk factors among a rural Yoruba south-western Nigerian population: a population-based survey. Cardiovasc J Afr. 2010 Jan-Feb; 21(1):26-31.
7. Aje A, Adebiyi AA, Falase AO. Hypertensive heart disease in Africa. S A Heart 2009; 6:42-51
8. Mensah GA, Barkley NL, Cooper RS. Spectrum of hypertensive target organ damage in Africa: a review of published studies. J Hum Hypertens 1994; 8: 799-808
9. Opadijo OG, Omotoso ABO, Araoye MA. Prognostic significance of intraventricular conduction blocks in adult Nigerians with hypertensive heart disease. N J M 2000; 9(4): 130-133
10. Mullins CB, Atkins JM, Prognosis and management of ventricular conduction block in acute myocardial infarction. Mod Concepts Cardiovasc Dis 1976; 45(10): 129-133
11. Dubois C, Pierard LA, Smeets JP, et al. Short and long term prognostic importance of complete bundle branch block complicating acute myocardial infarction. Clin Cardiol 1988; 11: 292-296
12. Kahn S, Frishman WH, Weissman S, et al. Left ventricular hypertrophy on electrocardiogram: prognostic implications from a 10-year cohort study of older subjects: a report from the Bronx Longitudinal Aging Study. J Am Geriatr Soc 1996; 44(5): 524-9
13. Busari O, Opadijo G, Olarewaju T, et al. Electrocardiographic correlates of microalbuminuria in adult Nigerians with essential hypertension. Cardiol J 2010; 17(3): 281-287
14. Chandrashekhar Y, Kalita HC, Anand IS. Left anterior fascicular block: an ischaemia response during threadmill testing. Br Heart J 1991; 65(1): 51-52
15. Ma FS, Ma J, Tang K, et al.. Left posterior fascicular block: a new endpoint of ablation for verapamil sensitive idiopathic ventricular tachyarrhythmia. Chin Med J 2006; 119(5): 367-372
16. Chobaman AU, Bakris GL, Black HR, et al. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure: JNC 7 report. JAMA 2003; 289: 2560-2572
17. 2003 World Health Organization (WHO)/International Society of Hypertension (ISH) statement on management of hypertension. J Hypertens 2003; 1983-1992
18. Michels WM. Grootendorst DC. Verduijn M, et al. Performance of the Cockcroft-Gault, MDRD, and New CKD-EPI Formulas in Relation to GFR, Age, and Body Size. CJASN 2010; 5 (6): 1003-1009
19. Surawicz B, Childers R, Deal BJ, et al. AHA/ACCF/HRS recommendations for the standardization and interpretation of the electrocardiogram: part III: intraventricular conduction disturbances: a scientific statement from the AHA Electrocardiographic AND Arrythmias Committee, Council on Clinical Cardiology: the American College of Cardiology Foundation; and the Heart Rhythm Society. Endorsed by the International Society for Computerized Electrocardiology. J Am Coll Cardiol 2009; 53: 976
20. Marti-Almor J, Cladellas M, Bazan V, et al. Long term mortality predictors in patients with chronic bifascicular block. Europace 2009; 11: 1201-1207
21. Smith S, Hayes WL. Prognosis of complete left bundle branch block. Am Heart J 1995; 70: 157-159
22. Araoye
23. Tiu SC, Lee SS, Cheng MW. Comparison of six commercial techniques in the measurement of microalbuminuria in diabetic patients. Diabetes Care 1993; 16: 616-620
24. Omotoso ABO, Opadijo OG, Araoye MA. Intraventricular conduction blocks in adult Nigerians with hypertensive heart disease. Cardiologie Tropicale 1999; 29(113): 9-12
25. Cole TO, Falase AO. Fascicular conduction blocks and their relationship to complete heart block in Nigerians. Cardiology 1975: 60: 236-246
26. Fadayomi MO, Stephens MR. Left anterior hemiblock in adult Africans. Euro J Cardiol 1978; 7(1): 35-39
27. Elizari MV, Acunzo RS, Ferreiro M. Heart blocks revisited. Circulation 2007; 115: 1154
28. Horwitz S, Lupi E, Hayes J, et al. Electrocardiographic criteria for the diagnosis of left anterior fascicular block, left atrial deviation and delayed intraventricular conduction. Chest 1975; 68(3): 317-320

29. Kwbertus HE, Demoulin JC. The left hemiblock: significance, prognosis and treatment. Schweiz Med Wochenschr 1982; 112(45): 1579-1584

30. Busari OA, Opadijo OG, Omotoso AB. Microalbuminuria and hypertensive retinopathy among newly diagnosed nondiabetic hypertensive adult Nigerians. Niger J Clin Pract 2011;14:436-9

31. Busari OA, Opadijo OG, Olarewaju TO. Microalbuminuria and its relations with serum lipid abnormalities in adult Nigerians with newly diagnosed hypertension. Annals of African Medicine 2010; 9 (2): 62-67

32. Klausen K, Borch-Johnsen K, Feldt-Rasmussen Bo, et al. Very low levels of microalbuminuria are associated with increased risk of coronary heart disease and death irrespective of renal function, hypertension and diabetes mellitus. Circulation 2004; 110: 32-35

33. Flowers NC. Left bundle branch block: a continuously evolving concept. J Am Coll Cardiol 1987;9:684–697

34. Eriksson P, Wilhelmsen L, Rosengren A. Bundle-branch block in middle-aged men: risk of complications and death over 28 years. The Primary Prevention Study in Go¨teborg, Sweden. European Heart Journal 2005; 2: 2300–2306

35. Toquero J, Geelen P, Goethals M, et al. What is first, left bundle branch block or left ventricular dysfunction? J Cardiovasc Electrophysiol 2001; 12:1425–1428