

# Intraventricular Conduction Blocks in Nigerians with Hypertensive Heart Disease

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## ÖZET

Hipertansif kalp hastalığı olan Nijeryalılar'da intraventriküler iletim blokları

**Amaç:** Hipertansiyon tüm dünyada olduğu gibi Nijerya'da da yüksek prevalansa sahiptir. İntraventriküler iletim bloklarının hipertansiyonda morbidite ve mortaliteye katkıda bulunduğu bilinmektedir. Bu çalışmanın amacı, hipertansif kalp hastalığı olan erişkin Nijeryalılar'da intraventriküler iletim blok prevalansı ve kalıbının belirlenmesidir.

**Gereç ve Yöntem:** Bu retrospektif çalışma, Ido-Ekiti, Nijerya'daki Federal Tıp Merkezi'nin Kardiyoloji Birimi'ne başvurmuş olan, hipertansif kalp hastalığına sahip erişkin hastaların istirahat halindeki 12-derivasyonlu elektrokardiyogramlarının değerlendirilmesini kapsamaktaydı. Toplanan veriler SPSS 20.0 yazılımı ile analiz edilmiştir.

**Bulgular:** Hipertansif kalp hastalığı olan 543 erişkin Nijeryalı'nın istirahat halindeki elektrokardiyogramları çalışıldı. 336'sı (%61.9) erkek ve 207'si (%38.1) kadın olan hastaların ortalama  $\pm$  standart sapma yaşları 61.3 $\pm$ 9.7 yıl idi. Hastaların yaklaşık dörtte birinde (%24.7) intraventriküler iletim blokları vardı. Sol ön fasiküler blok tek başına ya da diğer bloklar ile kombinasyon halinde en sık gözlenen (%52.2) blok türüydü. İntraventriküler ileti blokları hipertansif kalp yetmezliği olan hastalarda istatistiksel olarak anlamlı olmasa da daha sık görülmekteydi (%23.9'a karşı %31.0, p=0.24).

**Sonuç:** Bu çalışma hipertansif kalp hastalığı olan erişkin Nijeryalılar'da intraventriküler iletim blok prevalansının yüksek olduğunu göstermektedir. Kalp yetmezliği olan alt-grup, kalp yetmezliği olmayanlara göre daha yüksek bir prevalansa sahipti. En sık görülen blok tip sol ön fasiküler bloktu.

**Anahtar sözcükler:** Hipertansiyon, kalp yetmezliği, intraventriküler ileti blokları, yetişkin Nijeryalılar

## ABSTRACT

Intraventricular conduction blocks in Nigerians with hypertensive heart disease

**Background:** Hypertension is highly prevalent in Nigeria and globally. Intraventricular conduction blocks contribute to morbidity and mortality in hypertension. The objective of the study was to determine the prevalence and pattern of intraventricular conduction blocks in adult Nigerians with hypertensive heart disease.

**Materials and Methods:** This was a retrospective study of the resting 12-lead electrocardiograms of adult patients with hypertensive heart disease attending the Cardiology Unit of the Federal Medical Centre (FMC), Ido-Ekiti, Nigeria. The data collected was doubly entry into SPSS 20.0 software.

**Results:** Resting electrocardiograms of 543 adult Nigerians with hypertensive heart disease were studied. There were 336 (61.9%) males and 207 (38.1%) females. Mean age and standard deviation of the patients was 61.3 $\pm$ 9.7 years. About a quarter (24.7%) of the patients had intraventricular conduction blocks. Left anterior fascicular block was the most common (52.2%) occurring singly or in combinations with other blocks. Intraventricular conduction blocks were more prevalent in patients with hypertensive heart failure (31.0% versus 23.9%, p= 0.24) although not statistically significant.

**Conclusion:** This study shows that there is a high prevalence of intraventricular conduction blocks in adult Nigerians with hypertensive heart disease. The subset with heart failure has a higher prevalence than those without heart failure. Left anterior fascicular block is the most common type.

**Key words:** Hypertension, heart failure, intraventricular conduction blocks, adult Nigerians

## INTRODUCTION

Hypertension (HT) is a disease of public health importance and the leading cause of cardiovascular disease

globally (1-5). The prevalence has been increasing worldwide and it has been estimated to increase to 29.2% by 2025 (5). In Nigeria, studies have reported prevalence ranging from 12% to 36.6% (6-9). Hypertension causes both

**Table 1:** Criteria for defining intraventricular conduction blocks

Electrocardiographic features	LAFB	LPFB	RBBB	LBBB
QRS axis	-450 to -900	+900 to +1800	Usually normal	Left axis deviation
QRS duration	<120 ms	<120 ms	≥120 ms	≥120 ms
QRS morphology:				
Leads V1	Normal	Normal	R, rR', rsR', qR	QS, rS
Leads I, V6	qR	rS	qRS, slurred S	RsR, RR
Leads II, III, aVF	rS	qR		
T wave			Appropriate discordant T wave deflection	Appropriate discordant T wave deflection

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

structural and functional changes in the heart that affect the atrial and the ventricular myocardium, as well as the epicardial and intramural coronary arteries (10-14). These changes give rise to hypertensive heart disease (HHD). The relationship between HT and intraventricular conduction blocks (IVCB) has been, and continues to be, a subject of controversy (15). While this relation has been reported in several studies in patients with HT (16-20), data from studies by Eriksson et al (15) and Ostander (21) have shown a lack of significant relation between them. Intraventricular conduction blocks represent distal blocks occurring in the bundle branch and divisions or fascicles of the conducting system of the heart. The objective of the study was to determine the prevalence and pattern of intraventricular conduction blocks in adult Nigerians with hypertensive heart disease in a rural tertiary hospital in Nigeria.

## MATERIALS AND METHODS

This is a retrospective study, the resting 12-lead electrocardiograms (ECG) of adult patients aged 18 years and above with HHD attending the Cardiology Unit of the Federal Medical Centre (FMC), Ido-Ekiti, Nigeria were reviewed. Hypertensive heart disease was diagnosed based on clinical criteria listed in the 1993 World Health Organization (WHO)/International Society for Hypertension (ISH) guidelines for the management of mild HT (22). The FMC is a tertiary hospital situated in rural Ido-Ekiti, southwest Nigeria. The hospital serves the population of Ekiti state and four other adjoining states. The study protocol was reviewed and approved by the institutional review board of the hospital. The information on the ECG request and report card included age, sex, ethnicity, blood pressure, clinical diagnosis and the drugs

the patient was currently on. Excluded from the study were patients with incomplete or lost data, diabetes mellitus (DM) and those with previous myocardial infarction. The criteria (23) used for defining the types of IVCB are shown in Table 1. Bifascicular block (BFB) was defined as right bundle branch block (RBBB) with either left anterior fascicular block (LAFB) or left posterior fascicular block (LPFB); and trifascicular block (TFB) as a combination of RBBB, LAFB or LPFB and prolongation of PR interval (24-26). SPSS 20.0 software (IBM, Chicago, IL, US) was used for the statistical analyses. Variables were described as means and standard deviations, frequencies or percentages. Univariate analysis was done using Student's t test and Fischer's exact test to compare groups with continuous variables and categorical variables, respectively. Multivariate analysis was also done to show factors that increased the frequency of IVCB (as dependent factor). P value <0.05 (two-sided test) was considered statistical significant in the hypothesis testing.

## RESULTS

Resting ECG of 543 adult Nigerians with HHD were studied. Fifty eight (10.7%) of the patients were found to have hypertensive heart failure (HHF). There were 336 (61.9%) males and 207 (38.1%) females with a male to female ratio of 1.6:1. The mean age of the patients was 61.3±9.7 years. One hundred and thirty four (24.7%) patients had IVCB. Mean ages of patients with and without IVCB were 65.5±13.8 years and 59.4±11.2 years, respectively (z= 2.28; p0.03). Other characteristics of patients with and without IVCB are shown in Table 2. The patterns and percentages of IVCB are shown in Table 3. The LAFB was the most common one constituting 52.2% of IVCB occurring

**Table 2:** Characteristics of patients with and without intraventricular conduction blocks

	Patients with IVCB (n= 134); n (%)	Patients without IVCB (n= 409); n (%)	P values
Mean age (year); mean $\pm$ SD	65.5 $\pm$ 13.8	59.4 $\pm$ 11.2	0.03
Sex			
Male	90 (67.2)	246 (60.1)	0.14
Female	44 (32.8)	163 (39.9)	0.14
SBP (mmHg)	180.7 $\pm$ 22.3	165.4 $\pm$ 16.6	<0.001
DBP (mmHg)	106.5 $\pm$ 14.7	101.8 $\pm$ 13.2	0.006
PP (mmHg)	74.2 $\pm$ 10.8	63.6 $\pm$ 11.3	<0.001
Heart failure	13 (13.4)	40 (9.7)	0.24

IVCB: Intraventricular conduction blocks; SD: standard deviation

**Table 3:** Patterns and proportions of intraventricular blocks

	Male (n= 90); n (%)	Female (n= 44); n (%)	Total (n = 134); n (%)	P value
LAFB	31 (34.4)	13 (29.5)	44 (32.8)	0.57
LPFB	6 (6.7)	4 (9.1)	10 (7.5)	0.62
RBBB	24 (26.7)	6 (13.6)	30 (22.4)	0.09
LBBB	8 (8.9)	4 (9.1)	12 (8.9)	-
RBBB+LAFB	13 (14.4)	11 (25)	24 (17.9)	0.14
RBBB+LPFB	1 (1.1)	5 (11.4)	6 (4.5)	0.01
TFB	3 (3.3)	1 (2.3)	4 (2.9)	0.75

LAFB: Left anterior fascicular block; LPFB: Left posterior fascicular block; RBBB: Right bundle branch block; LBBB: Left bundle branch block; BFB: Bifascicular block; TFB: Trifascicular block

**Table 4:** Age distribution of patients with intraventricular blocks

Age (years)	Frequency (%)
18-29	4 (3.0)
30-39	5 (3.7)
40-49	12 (8.9)
50-59	34 (25.3)
60-69	29 (21.6)
$\geq$ 70	50 (37.3)

singly as in LAFB alone or in combinations in bifascicular and trifascicular blocks. The combination of LAFB and RBBB

constituted 17.9% of IVCB. The age distribution of patients with IVCB is shown in Table 5. Although IVCB were more prevalent in patients with HHD compared with those without HHD, this was not statistically significant (31.0% versus 23.9%,  $p=0.24$ ). However, the LPFB and LBBB occurring singly or alone were statistically more prevalent in HHD with HHD than those without HHD. Table 5 shows and compares the patterns and percentages of IVCB in patients with or without HHD. Using multivariate analysis, the study also showed that older age,  $\geq 65$  years and HHD were independent predictors of IVCB.

**Table 5:** Intraventricular blocks in patients with and without heart failure

	HHD without HF (n= 485); n (%)	HHD with HF (n= 58); n (%)	P value
LAFB	46 (9.5)	2 (3.4)	0.12
LPFB	5 (1.0)	5 (8.6)	0.001
RBBB	29 (5.9)	1 (1.7)	0.18
LBBB	5 (1.0)	7 (12.1)	0.001
RBBB+LAFB	23 (4.7)	1 (1.7)	0.29
RBBB+LPFB	5 (1.0)	1 (1.7)	0.63
TFB	3 (0.6)	1 (1.7)	0.58

LAFB: Left anterior fascicular block; LPFB: Left posterior fascicular block; RBBB: Right bundle branch block; LBBB: Left bundle branch block; BFB: Bifascicular block; TFB: Trifascicular block

## DISCUSSION

As this study shows, IVCB is highly prevalent (24.7%) among adult Nigerians with HHD. This finding is in contrast to 51.7% reported by Omotoso et al (27) also among adults Nigerians with HHD. Our finding is also at variance with the one found in a study in the United States which showed prevalence of 8.6% and 15.2% among African American and Caucasians, respectively (28). However, the contrast with the later study may be due to differences in the study design and study population. While we retrospectively studied the ECG archive of patients with HHD, the other study was prospective and was on consecutive hospital patients who underwent resting ECG. In our study, although there was a bimodal pattern of age distribution among patients with IVCB with two peaks in the 50-59 year and  $\geq 70$  year range, generally, IVCB become more frequent with advancing age. The mean age was also significantly higher in patients with IVCB than in those without it. Thus, our findings concur with studies showing that IVCB are associated with older age (29-31). In the Framingham study (29), the finding of IVCB were rare in individuals under 50 years, but reached a prevalence of almost 11% in men in the 8th or 9th decade of life. Advancing age worsens the myocardial response to HT and may cause increased fibrotic changes with greater possibility of damage to the intraventricular conducting fibres (18,27,32). The higher prevalence of IVCB in males in our study is also similar to findings in previous studies (27, 33), although the difference was not statistically significant. IVCB were more prevalent in patients with HHF but the difference was not statistically significant. This is consistent with the findings reported by Opadijo et al (27) and Scheinman et al (31). However, a 5-year cohort study of adult Nigerians with HHD and IVCB showed that cardiovascular events such as HF was

significantly higher in patients with IVCB than in those without it (18).

In our study, LAFB was the most frequent type of blocks (52.2%) with isolated LAFB representing about two-thirds. This concurs with the findings in previous studies (27,34,35). LPFB and LBBB were rare corroborating the findings reported by Omotoso et al (27). However, isolated LPFB and LBBB were significantly more frequent in HHF. The presence of LBBB most often indicates the presence of underlying heart disease. However, the pathophysiological relationship between LBBB and organic heart disease remains largely superficial (36). For example, it is unknown whether LV dysfunction precedes LBBB or whether the reversed course is the case (35-37). LBBB heralds a much more unfavourable cardiovascular prognosis than RBBB. It is a poor prognostic indicator in congestive heart failure (36).

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 (27,38). 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 (39,40).

Summarily, this study shows that there is a high prevalence of IVCB in adult Nigerians with HHD. The subset with HHF has a higher prevalence than those without it. Although, LAFB is the most common pattern in HHD, LPFB and LBBB are significantly more frequent in patients with HHF. We recommend larger prospective cohort studies.

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