

Left Ventricular Hypertrophy and Predictive Factors among Congolese Hypertensive Patients

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Abstract

A cross-sectional study of hypertensive patients was carried out in Brazzaville between January 2011 and December 2013. The objectives of the present study are to determine the different types of left ventricular hypertrophy (LVH) and to identify the predictive factors of LVH. It included 556 hypertensive patients with LVH, characterized by left ventricular mass index (LVMI) > 135 g/m² in men, and > 111 g/m² in women. Patients' sociodemographic data and echocardiographic parameters were gathered and analyzed. There were 342 males (61.5%) and 214 females (38.5%), with mean age 53.5 ± 11.5 years. The indications of the test were hypertension initial evaluation in 402 cases (72.3%), investigation of ischemic stroke in 62 cases (11.2%), heart failure in 58 cases (10.4%), dyspnea and chest pain in respectively 22 and 12 cases. Hypertension, old of 5.2 ± 4.5 years, was associated with overweight/obesity in 408 cases (73.4%), physical inactivity in 325 cases (58.5%), hypertension family history in 274 cases (49.3%), diabetes mellitus in 76 cases (13.7%), dyslipidemia in 63 cases (11.3%), tobacco use in 9 cases (1.6%). The prevalence of LVH was 49.4% and consisted into concentric LVH in 470 cases (84.5%), eccentric LVH in 70 cases (12.6%), and in 16 cases (2.9%), it was a concentric left ventricular remodeling. Age, male gender, seniority of hypertension and treatment were predictive factors of LVH. The latter is the most predominant abnormality in the echocardiographic profile of Congolese hypertensive patients. Efficient management on hypertension will lead to reducing its morbidity and mortality.

Keywords

Arterial Hypertension, Left Ventricular Hypertrophy, Predictive Factors, Congo

1. Background

Arterial hypertension (HTN) is a major problem of public health in the world, and more particularly in sub-Saharan Africa, with a persistently increasing prevalence, forecast of almost 150 million cases by 2025 [1]-[7]. In Congo, its prevalence was estimated at 32.5% in Brazzaville [8]. In sub-Saharan Africa, the management of HTN remains difficult because of its ignorance and the modest social conditions of the populations [9] [10] [11]; its severity exposes to many complications including left ventricular hypertrophy (LVH) [12]. Left ventricular hypertrophy constitutes an independent risk factor of cardiovascular and cerebrovascular complication. LVH is measured by electrocardiography, echocardiography, and magnetic resonance imaging. In order to improve the management of the Congolese hypertensive patients, we carried out this study to determine the different types of left ventricular hypertrophy (LVH) among Congolese hypertensive patients, and to identify the predictive factors of LVH.

2. Patients and Methods

It was about a cross-sectional study, analytical, carried out with Brazzaville between January 2011 and December 2013, that is to say 36 months. It included a consecutive series of 556 of the 1.125 hypertensive, known and treated patients, having had a left ventricular hypertrophy (LVH), diagnosed at the transthoracic echocardiography (TTE) either within the framework of an initial evaluation of hypertension, or for any symptom such as dyspnea, thoracic pain, or at the time of a complication (heart failure, stroke). The examinations were carried out with echographs of the brand Medical Kontron (ImagicMaestro, 2009) and Esaote (MyLab Class, 2012). The probe phased array of 2.5 MHz was used. The sociodemographic data of the patients as well as the associated cardiovascular risk factors, the data related to the hypertension, and the echocardiographic parameters were collected by using a questionnaire, and were analyzed. Thus, several variables studied, in particular:

1) sociodemographic data: age, gender, socioeconomic level (weak, average, high according to ECOM investigation [13]);

2) associated cardiovascular risk factors: diabetes, overweight/obesity, tobacco addiction, dyslipidaemia, sedentariness;

3) data related to the HTN: seniority, concept of family HTN, antihypertensive protocol used (monotherapy, bitherapy, tritherapy, quadritherapy and more);

4) echocardiographic parameters:

- indication of the examination: initial evaluation of the HTN, symptom (dyspnea, thoracic pain) and complication (heart failure, stroke);
- measured parameters: interventricularseptal (IVS), LV posterior wall (LVPW) thickness, end-diastolic (EDLVD) and end-systolic (ESLVD) left ventricular diameters, left ventricular systolic and diastolic function, left ventricular mass (LVM).

- the left ventricular mass (LVM) was measured according to the recommendations of the American Society of Echography (ASE), and was then calculated using the formula by Devereux [14]. Left ventricular hypertrophy (LVH) was defined as a body surface area indexed LVM (LVMI) $> 135 \text{ g/m}^2$ in men, and $> 111 \text{ g/m}^2$ in women [14] [15].
- the relative wall thickness (RWT), defined by the 2 LVPW/EDLVD report, made it possible to distinguish the concentric LVH if $\text{RWT} \geq 0.44$, of the eccentric LVH if $\text{RWT} < 0.44$.

2.1. Definition of the Concepts and Classification

- the systolic dysfunction was defined by a left ventricular ejection fraction (LVEF) lowered to less than 50%.
- the disorders of relaxation were defined by $\text{E/A} < 0.5$, a $\text{DTE} > 280 \text{ ms}$, and an $\text{IVRT} > 105 \text{ ms}$;
- the disorders of the filling corresponding to a restrictive mitral profile, were defined by $\text{E/A} > 2$, and a $\text{IVRT} \leq 90 \text{ ms}$.

The various types of LVH were defined [16]:

- Normal left ventricle: normal LVMI, $\text{RWT} < 0.44$;
- Concentric LVH: increased LVMI, $\text{RWT} \geq 0.44$;
- Eccentric LVH: increased LVMI, $\text{RWT} < 0.44$;
- Concentric remodeling: normal LVMI, $\text{RWT} \geq 0.44$.

2.2. Statistical Analysis

The data were seized and analyzed with Epi-info 3.5.3 and SPSS 11.1 softwares. Chi-square and ANOVA tests allowed the comparison of the qualitative and quantitative variables. The research of the predictive factors of LVH was done using a logistic regression. The significance level was $p < 0.05$.

3. Results

3.1. Epidemiological Trends

They were 342 men (62.5%) and 214 women (38.5%), old on average of 53.7 ± 10.2 years (range: 25 and 96 years), without difference between males and females (52.4 ± 12.6 vs 53.5 ± 11.5 ; $p = 0.75$). The socioeconomic level of the patients was average in 296 cases (53.2%), weak in 196 cases (35.2%), and high in 64 cases (11.6%). The hypertension (HTN), old of 5.2 ± 4.5 years, was associated with overweight/obesity in 408 cases (73.4%), physical inactivity in 325 cases (58.5%), family history of HTN in 274 cases (49.3%), diabetes mellitus in 76 cases (13.7%), dyslipidaemia in 63 cases (11.3%), and tobacco use in 9 cases (1.6%), with a rate of office plurality of 2.7 risk factor by individual. **Table 1** summarizes the main characteristics of the study population.

3.2. Left Ventricular Hypertrophy (LVH) and Predictive Factors

Main indications of the examination were initial evaluation of HTN in 402 cases (72.3%), assessment etiologic of ischaemic stroke in 62 cases (11.2%), heart

Table 1. Characteristics of the study population.

	Men n = 342	Women n = 214	All n = 556	P
<i>Age, years</i>	53.7 ± 10.2	52.4 ± 12.6	53.5 ± 11.5	0.75
<i>Seniority of HTN, years</i>	5.1 ± 4.1	5.3 ± 5.2	5.2 ± 4.5	0.81
<i>Family history of HTN, n (%)</i>				
<i>Socioeconomic level, n (%)</i>	158 (28.4)	116 (20.8)	274 (49.2)	0.61
- -weak	108 (19.4)	88 (15.8)	196 (35.2)	
- -average	192 (34.5)	104 (18.7)	296 (53.2)	
- -high	42 (7.6)	22 (4.0)	64 (11.6)	0.0001
<i>Antihypertensive protocol, n (%)</i>				
- monotherapy	19 (3.4)	12 (2.1)	31 (5.5)	
- bitherapy	220 (39.6)	162 (29.1)	382 (68.7)	
- tritherapy	89 (16.0)	34 (6.1)	123 (22.1)	
- quadritherapy and more	14 (2.5)	6 (1.1)	20 (3.6)	0.05
<i>Associated cardiovascular risk factors, n (%)</i>				
- overweight/obesity	240 (43.2)	168 (30.2)	408 (73.4)	0.0009
- physical inactivity	142 (25.5)	183 (33.0)	325 (58.5)	0.008
- diabetes	52 (9.3)	24 (4.3)	76 (13.6)	0.001
- dyslipidaemia	43 (7.7)	20 (3.6)	63 (11.3)	0.025
- tobacco use	7 (1.2)	2 (0.4)	9 (1.6)	0.005

HTN: arterial hypertension.

failure in 58 cases (10.4%), dyspnea and chest pain in 22 cases (3.9%) and 12 cases (2.2%) respectively. The echocardiographic examination, performed in 1.125 hypertensive patients, was pathological in 590 cases (52.4%), and showed a hypertrophic cardiomyopathy (**Figure 1** and **Figure 2**) in 556 cases (49.4%). The left ventricular mass was an average of 289.5 ± 94.2 g (164.5 ± 52.6 g/m²) in the men, 247.6 ± 72.4 g (143.2 ± 42.7 g/m²) in the women; and the relative wall thickness was an average of 0.52 ± 0.13 . Thus, the left ventricular geometry was normal in 535 cases (47.5%). In the 556 cases of hypertrophic cardiomyopathy, the LVH was concentric in 470 cases (84.5%), eccentric in 70 cases (12.6%), and in 16 cases (2.9%) it was about a concentric remodeling of the left ventricle. The left ventricular ejection fraction (LVEF) was an average of $71.7\% \pm 8.5\%$ (range: 58% and 90%). The disorders of relaxation were present in 251 cases (45.1%). Concerning the research of the predictive factors of LVH, in bivariate analyses, this one was correlated with the gender ($p < 0.0001$), with the family history of HTN ($p < 0.0001$), with the antihypertensive protocol used ($p < 0.0001$), and with the dyslipidemia ($p = 0.0002$). In multivariate analysis, it arose that only the age ($p = 0.0001$), the male gender ($p < 0.0001$), the seniority of HTN ($p < 0.0001$), and the nature of the treatment, reflection of the severity of the HTN, were predictive factors of the LVH (**Table 2**).

4. Discussion

In our study, the HTN constitutes the first indication of the echocardiographic

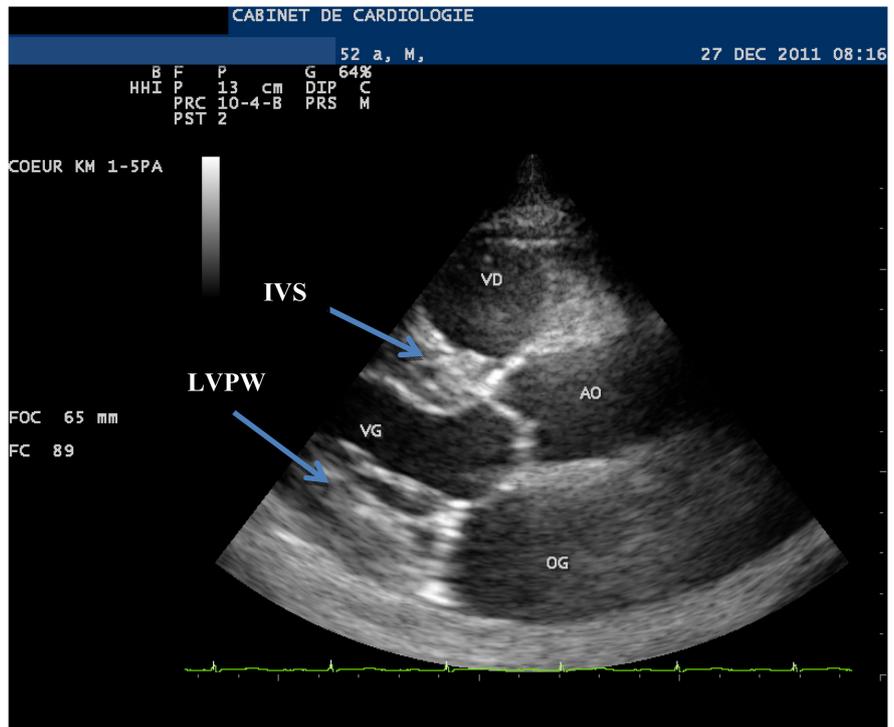


Figure 1. Transthoracic echocardiography, bidimensionnal mode, standard parasternal view, showing a concentric left ventricular hypertrophy (interventricularseptal [IVS] and LV posterior wall [LVPW]), in a 52 old-year hypertensive subject.

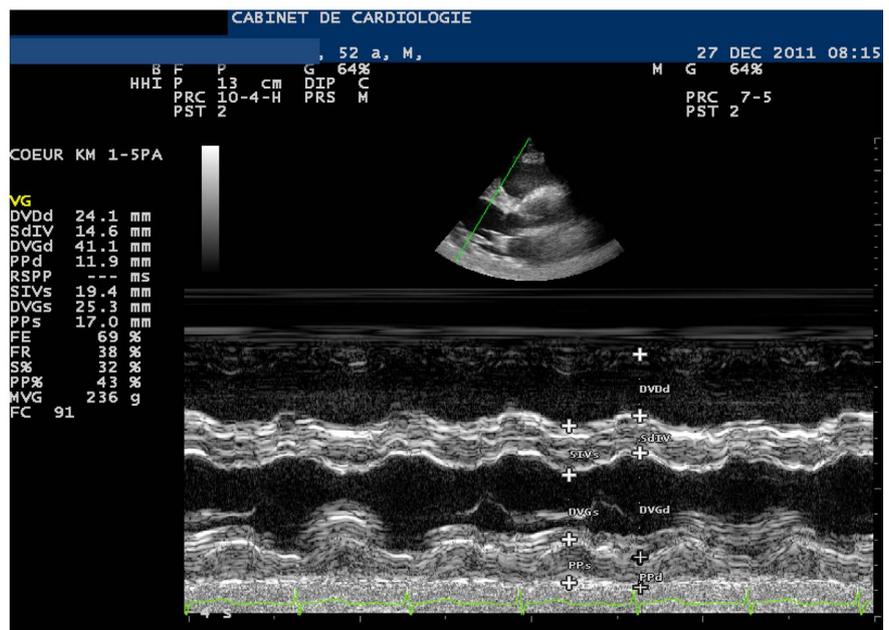


Figure 2. Transthoracic echocardiography, TM mode, standard parasternal view, showing an aspect of hypertrophic cardiomyopathy, in a 52 years hypertensive subject.

examinations with 61.4% of the cases. This report was raised at the Institute of Cardiology of Abidjan, where the HTN accounted for 49.2% of the echocardiographic indications [17], testifying to the importance of this pathology in

Table 2. Logistic regression of left ventricular hypertrophy.

Variables	OR (IC 95%)	P
Age	1.02 (1.01 - 1.04)	0.0001
Seniority of hypertension	1.08 (1.04 - 1.12)	<0.0001
Diabetes (yes/no)	1.06 (0.69 - 1.62)	0.7730
Male gender	1.85 (1.42 - 2.40)	<0.0001
Weak socioeconomic level	1.42 (0.93 - 2.18)	0.0993
Average socioeconomic level	1.75 (1.21 - 2.52)	0.0028
Quadritherapy and more	4.41 (1.59 - 12.1)	0.0042
Sedentariness (yes/no)	1.05 (0.80 - 1.37)	0.7018
Overweight/obesity (yes/no)	1.24 (0.92 - 1.67)	0.1515
Tritherapy	2.60 (1.48 - 4.55)	0.0008

sub-Saharan Africa. The African hypertensive patients are young, with a median age of 53.7 ± 10.2 years in our series, similar to those brought back to Cameroon and in Ivory Coast (54.9 ± 12.6 years and 55.7 ± 13.2 years respectively) [16] [17]. Association with other cardiovascular risk factors is frequently reported, making these patients of the cardiovascular high-risk subjects. At the African black, the severity of HTN predisposes with occurred of the complications, often early, with the row of which left ventricular hypertrophy (LVH). In our series, the LVH was found at about half of the hypertensive patients, with a male prevalence. It is the same in most African series [18]-[23], with frequencies varying between 40% and 63%, variability due to the methodological differences, making sometimes difficult any comparison. In the Framingham study [24] having related to 4.970 hypertensive patients, the frequencies of the LVH were 17.6% and 14.2% respectively among the men and women, by far lower than those noted among black hypertensive patients African, testifying to a particular predisposition in keeping with the genetic and racial factors [24]. As for the diastolic dysfunction, it is frequent, early appearing before even the installation of the LVH. The disorders of relaxation are dominating, such is the case in our series, found in a little less than half of the cases, of the 40% reported near in the North-African series [21]. The LVH has a multifactorial origin. Indeed, in addition to the HTN, certain factors considered as starting or modulating, can intervene in the genesis of the LVH. Among them, appear the sex, the age, the weight, the genetic and racial factors (the HTN is more frequent in the black race), the neurohormonal factors [25]. In our series, the age, the male gender, seniority of HTN, and its severity attested by the antihypertensive protocol (tritherapy or quadritherapy and more), were predictive LVH. Some of these factors, in particular the age, the gender, the seniority of the HTN, the arterial systolic pressure level, and others, such as obesity, hyperuricemia and alcohol, were identified like predictive factors of the LVH in African and Asian series [22] [26] [27].

5. Limits of the Study

The frequency of left ventricular hypertrophy brought back in our study is probably underestimated, if one takes account of the recent standards, defined by the learned societies, in particular the ESC/ESH with LVMI > 115 g/m² at the man, and > 95 g/m² at the woman. Also, certain data relating to the level of blood pressure, the rate of uric acid, like the consumption of alcohol, not collected at inclusion, did not allow a broader research of the predictive factors of left ventricular hypertrophy.

6. Conclusion

This study has shown that the left ventricular hypertrophy is a frequent presentation of hypertension disease among Congolese patients. The effective management of hypertension would make it possible to reduce the still heavy morbid-mortality which is ascribable for him, from where needs for the preventive measures, based on the medicamentous treatment and the therapeutic education of the patients.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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