


# ECG and Echocardiographic Findings of Female Hypertension (fHTN) in the Cardiology Department of the University Hospital Gabriel Touré (UH-GT)

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## Abstract

**Introduction:** In our setting there is a lack of publications on female hypertension in general population motivating this study to look for electro- and echocardiographic findings of female hypertension. **Methods:** We performed a cross-sectional study during 6 months in the cardiology department of the UH-GT including 324 female patients aged 18 and more seen in the outpatient unit and by whom the diagnosis of hypertension was set. All patients consented to be study participants after receiving clearly information about the study and that care giving will not be affected by their eventual refusal. Data collection has been done with all needed confidentiality rules. A survey formular was used to collect data in order to record them in an Access database. Analysis was done using IBM SPSS software. Quantitative data are presented as mean with standard deviation and qualitative as proportion. Level of significance for statistic test was set at 5%. **Results:** During the study time 324 among 524 hypertensive patients visited our outpatient unit giving a prevalence of fHTN of 61.8%. The means for age, body mass index (BMI) in female hypertensive patients were respectively  $52 \pm 14.461$  years and  $27.35 \pm 06.585$  Kg/m<sup>2</sup>. Main ECG findings were left ventricular hypertrophy (LVH)



and sinus tachycardia with respectively 93.6% and 46.4% followed by isolated ventricular extrasystole with 33.7%. Echocardiography findings included LVH, relative wall thickness (RWT) and reduced ejection fraction (EF) in respectively 41.05%, 37.35% and 21.91%. The left ventricular mass (LV) mass and geometry were abnormal in 44.4% and 37.3%. Remodeling as geometry modification (18.2%) and mitral flow Type 2 (90.4%) have been the most abnormal findings. **Conclusion:** Hypertension induced modifications mainly LVH in ECG and Echocardiography in female patients less than encountered among male hypertensive patients.

## Keywords

Hypertension, Female, ECG, Echocardiography, Mali

## 1. Introduction

Cardiovascular diseases (CVDs) are the leading cause of death globally with an estimated 17.9 million people died from CVDs in 2019, representing 32% of all global deaths [1]. And also prevalent cases of total CVD nearly doubled from in 1990 to 523 million in 2019 [2]. Among all others risk factors, including lipid abnormalities, tobacco smoking, physical inactivity, high salt consumption, arterial hypertension (HTN) is the most important contributor to the global burden of these diseases [3] [4] [5]. It is an important public-health challenge worldwide [6] [7] [8] [9]. There is also a shift of HTN from high-income countries to low-income countries in south Asia and sub-Saharan Africa [10] [11] and variable declines in hypertension has been noted in Europe [12]. Both female and male are affected with female prevalence of up to 83% [13] [14] [15].

In African countries HTN is a public-health problem [16] [17] [18] [19] and also for female with variable prevalence of 46.8% in Nigeria and 13.7% in Kenya [20]. There are many studies on hypertension in pregnancy [21] [22] [23]. In our setting publication is lack on fHTN in general population motivating this study to look for electro- and echocardiographic findings of female hypertension.

## 2. Methods

We performed a cross-sectional study from November 2022 to April 2023 in the cardiology department of the UH-GT.

Included were female patients aged 18 and more seen in the outpatient unit and by whom the diagnosis of hypertension was set.

Definition of terms:

Hypertension has been defined as patient with systolic blood pressure (SBP)  $\geq$  140 mmHg and/or diastolic blood pressure (DBP)  $\geq$  90 mmHg or patient being under anti-hypertensive therapy.

For ECG left ventricular hypertrophy (LVH) was assessed through Sokolow-Lyon voltage (SV1 + RV5 or V6  $\geq$  35 mV) and Cornell voltage (SV3 +

RaVL > 20 mV).

Left ventricular (LV) mass and relative wall thickness (RWT) were calculated in accordance with the American Society of Echocardiography convention using the following corrected equations:

- LV mass (g) =  $0.80 \times 1.04 [(LV \text{ end-diastolic diameter} + \text{septal wall thickness} + \text{posterior wall thickness})^3 - (LV \text{ end-diastolic diameter})^3] + 0.6$  [24].
- RWT = (septal wall thickness + posterior wall thickness)/LV end-diastolic diameter [25].

Echocardiographic left ventricular hypertrophy (LVH) was defined as a LV mass index (LVMI: LV mass/body surface area) > 150 g/m<sup>2</sup> in men and >120 g/m<sup>2</sup> in women.

All patients consented to be study participants after receiving clear information about the study and that care giving will not be affected by their eventual refusal. Data collection has been done with all needed confidentiality rules.

A survey formular was used to collect data in order to record them in an Access database. Analysis was done using IBM SPSS software. Quantitative data are presented as mean with standard deviation and qualitative as proportion. Level of significance for statistic test was set at 5%.

### 3. Results

During the study time 324 among 524 hypertensive patients visited our outpatient unit giving a prevalence of female hypertension of 61.8%.

The proportion of patients increased with age from 06.5 for <30 years to 35.5% in the age group > 60 years, 54% of the sample were new patients. Among old patients less than a third was regularly followed or treated with respectively 31.8% and 20.7% (Table 1).

The means for age, body mass index (BMI) were respectively  $52 \pm 14.461$  years and  $27.35 \pm 06.585$  Kg/m<sup>2</sup>. According to the American Society of Echocardiography mean left ventricular mass and relative wall thickness were respectively 176 g and 0.4 (Table 2).

ECG has been found abnormal in 49.1% of all cases. It's main findings were hypertrophy followed by rhythm disorders with respectively 29.1 and 21.91%. Conduction and repolarization disorders were found with less cases (Figure 1). Hypertrophy signs were dominated by left ventricular hypertrophy (LVH) with 93.6%. Among rhythm disorders sinus tachycardia came with 46.4% followed by isolated ventricular extrasystole with 33.7%. Conduction disorders were dominated by left bundle branch block (LBBB) (45.4%) whereas hypertrophy was found in 19.1% with LVH represented in 93.6% (Table 3).

Echocardiography findings included LVH, relative wall thickness (RWT) and reduced ejection fraction (EF) has been found in respectively 41.05%, 37.35% and 21.91% (Figure 2). The LV mass and geometry were abnormal in 44.4% and 37.3%. Remodeling as geometry modification (18.2%) and mitral flow Type 2 (90.4%) have been the most abnormal findings (Table 4).

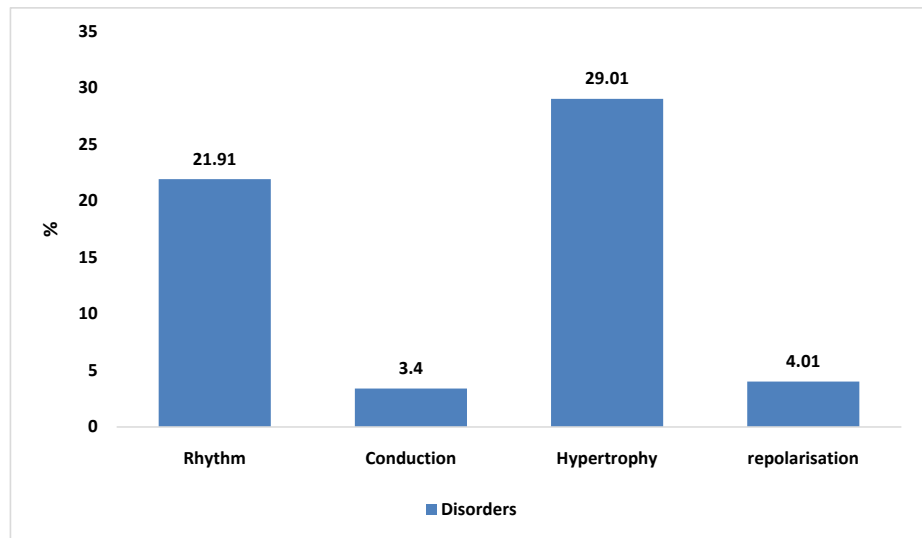
**Table 1.** Socio-demographic and clinical characteristics of the sample of 324 hypertensive female patients.

Variables	N	(%)	
Age group (years)	<30	021	06.5
	30 - 44	079	24.4
	45 - 59	109	33.6
	≥60	115	35.5
Type	New	175	54.0
	Old	149	46.0
Regularity	Visit	103	31.8
	Treatment	066	20.4
Number of molecules	0	215	66.4
	1	067	20.7
	2	036	11.1
	3	006	01.9
BMI* class (317 patients)	Underweight	011	03.5
	Normal	133	42.0
	Overweight	079	24.9
	Obesity	094	29.7

\* Body mass index for 317 patients.

**Table 2.** Distribution of variables in the sample of 324 hypertensive female patients.

Variables	Min	Mean	Max	SD
Age (years)	18	52	88	14.461
Height (cm)	142	164	188	06.452
Weight (Kg)	32	73	131	18.095
BMI (Kg/m <sup>2</sup> )	13.84	27.35	58.22	06.585
DIVGd (mm)	21	49.2	84.6	00.827
PWd (mm)	0.5	9.7	24	00.214
IVSd (mm)	0.5	9.4	19.4	00.205
LV Mass (g) /Ase	51	176	610	70.197
LV Mass index (g/m <sup>2</sup> )	28	97	398	40.576
EF (%)	15	61	88	15.377
RWT	0.17	0.40	0.95	0.108



**Figure 1.** Prevalence of ECG disorders in the sample of 324 hypertensive female patients.

**Table 3.** ECG findings in the sample of 324 hypertensive female patients.

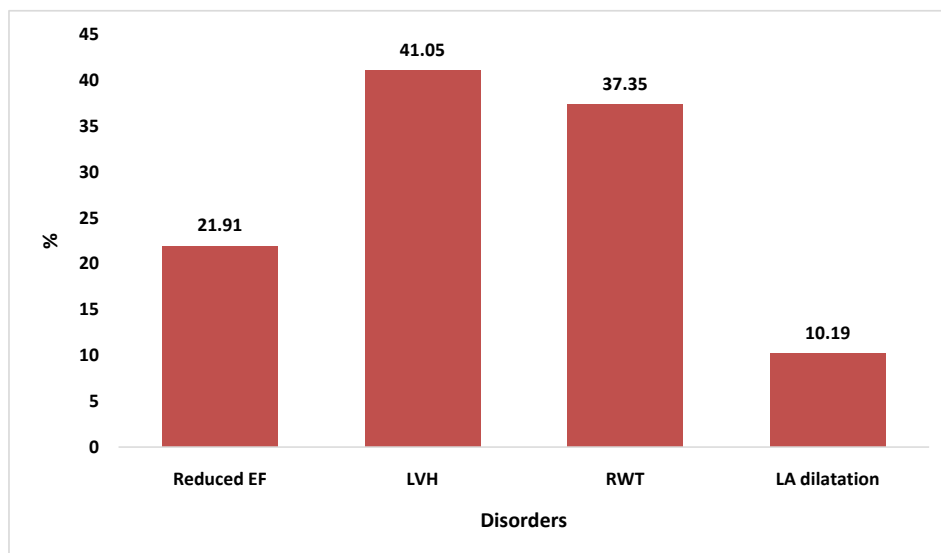
Variables	N	(%)	
<b>Rhythm disorders</b>	Sinus tachycardia	033	46.4
	VES	024	33.7
	Atrial fibrillation	009	12.6
	SVT	002	02.8
	VES + SVES	002	02.8
	VES bigeminated	01	01.4
<b>Conduction disorders (11)</b>	LBBB	005	45.4
	RBBB	003	27.2
	ALHB	002	18.1
	AVB1 + LBBB	001	09.0
<b>Hypertrophy</b>	LV	008	93.6
	RV	003	03.1
	LV + LA	002	02.1
	LA	001	001

VES: ventricular extrasystole; SVT: supra-ventricular tachycardia; SVES: supraventricular tachycardia; LBBB: left bundle branch block; RBBB: right bundle branch block; ALHB: anterior left hemi-block; AVB1: atrio-ventricular block first grade; LV: left ventricle; RV: right ventricle; LA: left atrium.

#### 4. Discussion

HTN as public-health problem need to be more addressed particularly in female patients as pointed out in this study with a prevalence of HTN 61.8%. The prevalence of fHTN varies greatly around the world with nearly 20% to 78% in some European regions [15] [20] [26] [27]. Ours is higher than that of other

African countries like Nigeria (46.8%) and Kenya (13.7%) and lower compared to Brazilian female (71.9%). This variation could be explained by the sample composition (general population, employers, hospitalized patients) and across different population.



**Figure 2.** Prevalence of echocardiographic disorders in the sample of 324 hypertensive female patients.

**Table 4.** Echocardiographic findings in the sample of 324 hypertensive female patients.

Variables	N	(%)	
LVEF	≥50	253	78.1
	40 - 49	029	009
	<40	042	013
LV mass	Normal	180	55.6
	Borderline	032	09.9
	Moderate	031	09.6
	Severe	070	21.6
	NA	011	03.4
LV geometry	Normal	203	62.7
	Concentric LVH	020	06.2
	Excentric LVH	042	13.0
	Remodeling	059	18.2
Mitral flow	Type 1	020	06.2
	Type 2	293	90.4
	Type 3	011	03.4

\*ASE.

According to sex in our department female HTN is more prevalent than male HTN (38.2% of our hypertensive patients). Most studies found a more prevalent male HTN [27] particularly before menopause that disappears after menopause [28].

In this HTN increases with age (**Table 1**) according to published data in the world and mostly due to vascular modifications with aging.

#### **ECG:**

HTN is strongly correlated to cardiovascular mortality [2] [29] [30]. A intermediate step is ECG and echocardiographic modifications and ECG as strong predictor of cardiovascular events [31] [32]. ECG remains the first line method for LVH detection in patients with hypertension [33] despite its low sensibility [34].

In this study ECG anomalies were found in near half of the sample. Data suggest that target organ damage is less common in female [35]. LVH is the most common ECG anomaly among hypertensive patients [36] [37].

#### **Echocardiography:**

Prevalence of echocardiographic LVH in our study was round 29%. In the literature LVH in echocardiography varies based on study population with most values higher than found in our study [38] [39]. Variations could be also due to used parameters [40], to sex with greater prevalence in men than in female [41] and finally to increase in blood pressure level [42] [43] or pulse pressure [44].

Regarding LVH geometry we found concentric remodeling in accordance with most studies [25].

## **5. Conclusion**

Hypertension induced modifications mainly LVH in ECG and Echocardiography in female patients less than encountered among male hypertensive patients.

## **Conflicts of Interest**

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

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