Research Article

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ECG and Echocardiography Findings in Hypertension: A Comparative Study Male versus Female at the Gabriel Touré University Hospital (UH-GT)

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ABSTRACT

Background: *There is a lack of data on ECG and echocardiographic modifications in hypertensive patients in our setting that justify their inclusion.*

Methods: *This study aims to compare induced ECG and echocardiographic modifications in female and male hypertensive patients. It was a cross-sectional study among outpatients seen in the cardiology department of the UH-GT in Bamako-Mali and included hypertensive patients aged 18 years or older.*

Data were first collected on a survey form, inserted into a MS Access database, and finally analyzed with IBM SPSS software. Quantitative data are presented as mean with standard deviation and qualitative data as proportion. The level of significance for the statistical test was set at 5%.

Results: *Of 524 patients, 52.9% were new patients, and 96% had no known cardiac disease. The female sex represented 61.8%. The mean age was 55.33±15.013 years, and obesity based on body mass index was more prevalent in women's sex (81 vs. 19% in men's sex).*

The global prevalence of HTN was 38.8% in males and 61.1% in females. Among ECG modifications, rhythm disorders and hypertrophy were significantly higher in males, respectively (37.5 vs. 21.9 and 49.5 vs. 29). The most frequent echocardiographic signs included left ventricular end diastolic diameter (LVEDD) and interventricular septum (IVS), with 53 mm vs. 49,3 mm and 10 vs. 9,3 mm (<0.001). Other structural echocardiographic changes were an increase in left ventricular mass and index left ventricular mass with, respectively, 210.5 vs. 176.4 g and 115.4 vs. 96.8 g/m2.

Conclusion: *The prevalence of hypertension is high in both sexes, with consequences led by left ventricular hypertrophy in ECG and echocardiography. The higher prevalence of female HTN must be further studied, as must the associated factors.*

Keywords

Hypertension, Male, Female, Cardiology, Outpatient, ECG, Echocardiography.

List of Abbreviations

ASE: American Society of Echocardiography, BMI: body mass index, DBP: diastolic blood pressure, EACVI: European Association of Cardiovascular Imaging, IBM SPSS: International

business machine statistical package for social sciences, IVS: interventricular septum, HTN: hypertension, LMIC: low- and middle-income countries, LV: left ventricle, LVEDD: left ventricular end diastolic diameter, LVH: left ventricular hypertrophy, LVMI: LV mass, RWT: relative wall thickness, SBP: systolic blood pressure, TOD: target organ damage, UH-GT: University Hospital Gabriel Touré, WHO: world health organization.

Background

Hypertension (HTN) has been a worldwide leading risk factor for cardiovascular diseases for decades [1-3]. The World Health Organization (WHO) named it "Silent Killer" [4] and estimated that there are near 1,3 billion adults living with HTN, most of whom live in low- and middle-income countries (LMICs) [5]. It affects all age groups, male and female [6-9], and also out of health facilities [10].

Despite a high prevalence, HTN is underdiagnosed [11], poorly controlled [12-16], and treated [17-19]. All that, plus the presence of severe HTN, particularly in low-income countries [20], leads most of the time to the development of target organ damage (TOD) that is associated with cardiovascular events [21].

Methods

There is a lack of data on the ECG and echocardiographic modifications of hypertensive patients in our setting, justifying this study, which aims to compare induced modifications in female and male genders.

Data were retrieved from a cross-sectional study from November 2022 to April 2023 in the cardiology department of the UH-GT.

Included were all patients aged 18 years or older seen in the outpatient unit with the diagnosis of hypertension.

The following definitions have been adopted:
Hypertension: patient with systolic blood pressure (SBP) 140 mmHg and/or diastolic blood pressure (DBP) 90 mmHg or patient taking antihypertensive drug therapy.
ECG left ventricular hypertrophy (LVH): Sokolow-Lyon voltage (SV1 + RV5 or V6) ≥ 35 mV and Cornell voltage (SV3 + RaVL) > 20 mV for females and 28 for males.
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 × 1.04 [(LV end-diastolic diameter + septal wall thickness + posterior wall thickness)^3 – (LV end-diastolic diameter)^3] + 0.6 [22]
RWT = (septal wall thickness + posterior wall thickness)/LV end-diastolic diameter of the LV [23].

Echocardiographic LVH was defined as a LV mass index (LVMI: LV mass/body surface area) >150 g/m^2 in men and >120 g/m^2 in women. The degrees of LVM abnormality were assessed according to the recommendations of the European Association of Cardiovascular Imaging (EACVI) and the American Society of Echocardiography (ASE) [24].

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

Data were first collected on a survey form, inserted into a MS Access database, and finally analyzed with IBM SPSS software. Quantitative data are presented as mean with standard deviation and qualitative data as proportion. The level of significance for the statistical test was set at 5%.

Results

Our sample consisted of 524 patients from a population study of 990 patients (385 men and 605 women). A proportion of 52.9% were new patients, and 96% had no known cardiac disease. The female sex represented 61.8%.

The sample mean age was 55.33±15.013 years (60.80± 14.292 for male sex and 51.95±14.461 for female sex). Male height was significantly higher than the higher body mass index (BMI) for females, with p<0.001 (Table 1).

Table 1: Anthropometric variables in the sample of 324 hypertensive patients.

Sex	Age	Height (cm)	Weight (Kg)	BMI (Kg/m^2)
Male	60.8 ±14,292	169.175 ±6.271	70.70 ±12.942	24,65 ±4.056
Female	51.95 ±14.461	163.59 ±6.452	73.261 ±18.095	27,35 ±6.585
Total	55.33 ±15.013	165.73 ±6.930	72.28 ±16.36	26,32 ±5.896
p	<0.001	<0.001	0,082	<0.001

The proportion of women decreased with age (77.8% to 48.7%) in contrast to an increase for men (22.2% to 51.3%) (Figure 1).

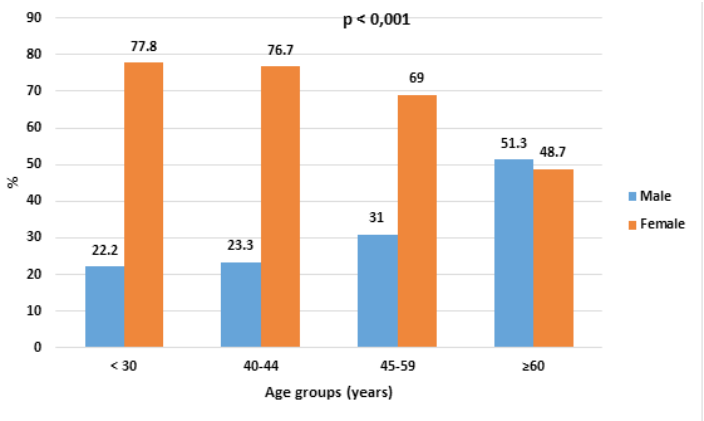

Figure 1: Age groups in the sample of 524 hypertensive patients.

Overweight and obesity based on BMI were by far prevalent among females (64,2 vs. 35,8 for overweight and 81 vs. 19 for obesity) (Figure 2).

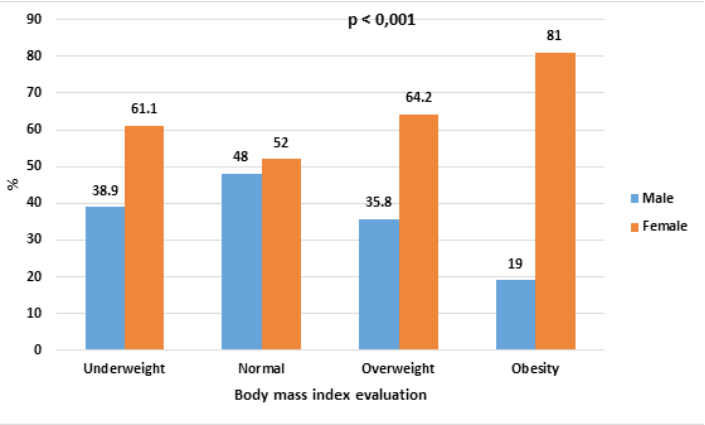

Figure 2: Evaluation of body mass index in the sample of 524 hypertensive patients.

For new patients, a proportion of 85.3% of males and 94.3% of females got no prescription, whereas 64.3 and 42.3% of old patients had, respectively, 1 or 2 molecules (Figure 3).

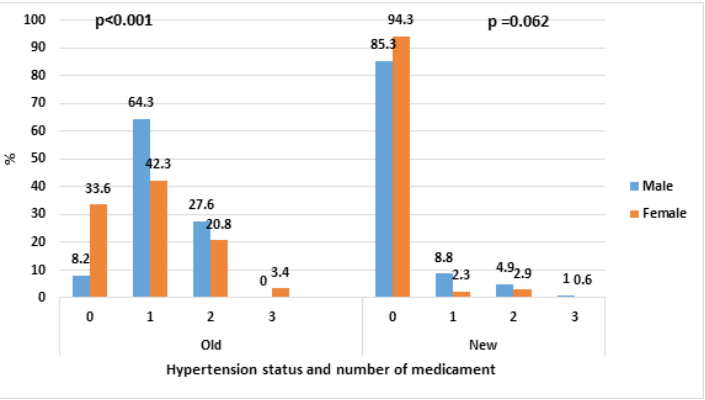

Figure 3: Classification of medicament number according to duration of hypertension in the sample of 524 hypertensive patients.

Among ECG modifications, rhythm disorders and hypertrophy were significantly higher in males, respectively (37.5 vs. 21.9 and 49.5 vs. 29) (Table 2).

Table 2: Distribution of electrocardiographic characteristics in the sample of 524 hypertensive patients.

Sex	Rhythm disorders	Conduction disorders	Hypertrophy	Repolarisation disorders
Male	37.5	06.5	49.5	04.5
Female	21.9	03.7	29.0	0.4
Total	27.9	04.8	36.8	04.2
p	<0.001	0.145	<0.001	0.787

The most frequent echocardiographic signs included left ventricular end diastolic diameter (LVEDD) and interventricular septum (IVS), with 53 mm vs. 49,3 mm and 10 vs. 9,3 mm (<0.001). Other structural echocardiographic changes were an increase in left ventricular mass and index left ventricular mass, respectively, 210.5 vs. 176.4 g and 115.4 vs. 96.8 g/m2 (Table 3).

Table 3: Distribution of echocardiographic characteristics in the sample of 524 hypertensive patients.

Sex	LVEDD (cm)	PW (cm)	IVS (cm)	LV mass g	Indexed LV mass (g/m2)	Relative wall thickness
Male	5.30 ±0.881	0.99 ±0.225	1.00 ±0.227	210.50 ± 79.236	115.44 ±43.885	0.38 ±0.107
Female	4.93 ±0.827	0.97 ±0.214	0.939 ±0.205	176.41 ±70.197	96.85 ±40.576	0.40 ±0.107
Total	5.070 ±0.866	0.98 ±0.218	0.96 ±0.216	189.422 ±75.545	103.948 ±42.794	0.39 ±0.108
p	<0.001	0.193	0,001	<0.001	<0.001	0.074

On the basis of ventricular mass, old patients were classified as having severe hypertrophy in 7.7% of males and 14.6% of females. For new patients, the proportions were respectively 7.2 and 12.3% (Figure 4).

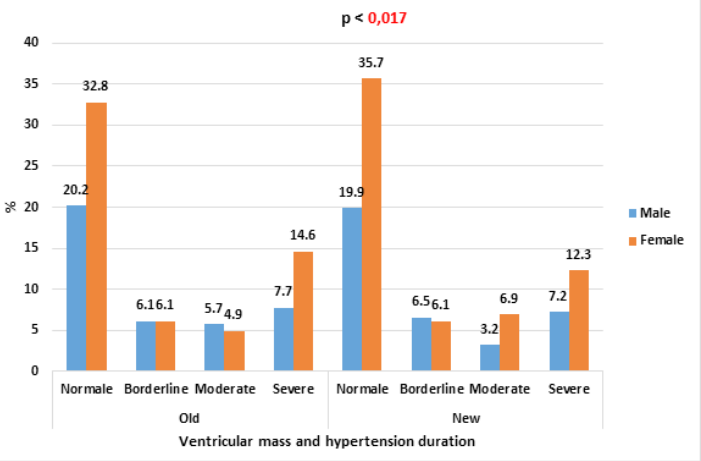

Figure 4: Classification of the ventricular mass according to the duration of hypertension in the sample of 524 hypertensive patients.

Discussion

Our sample of 524 hypertensive patients stemmed from a population of 990 ambulatory patients seen during the study period, giving a global prevalence of HTN of 52.9%. Therefore, the prevalence of male HTN is 38.8% and that of female HTN is 61.1% of all visits. Our higher prevalence of female sex is rarely found in the literature except in older patients [25]. But global HTN is more prevalent in males [26].

HTN, as the main modifiable cardiovascular risk factor, can lead to clinical complications associated with ECG modifications and echocardiography. But even in the absence of complications, modifications can be seen in echocardiography [27,28] and TOD independently of the type of hypertension [21] and the course of symptoms [29]. It should be noted that the mechanistic common ground between chronic blood pressure elevation and cardiac disease likely begins early in life [30].

The results of this study on ECG and echocardiography revealed the following findings:
Male sex: higher ECG-LVH in males (Table 2), higher LVEDD, IVS, LVM, and LVMI (Table 3).
Female sex: higher RWT (Table 3), more severe echo-LVH as well in old as in new patients (Figure 4).

From the ECG abnormalities, LVH is the most important, despite the low sensitivity of the ECG [30-32]. ECG-LVH has a prognostic value [33,34] and is a stronger risk factor for cardiovascular events in women than in men [35,36]. In our study, LVH was more present in male subjects compared to data from south Asia [37] and could be explained by many other factors, including comorbidities [38,39], using criteria [40].

To improve the detection of LVH, echocardiography has long been the gold standard. Echo-LVH is assessed differently, partly explaining its various prevalences [22,41,42]. In our study, all ventricular parameters were higher in men compared to women. ECG-LVH could be absent, especially in low-risk patients, and its probability in echocardiography can be assessed using scores [43].

Limitations

As a cross-sectional study, we cannot look for a trend over time, especially through following new patients. Furthermore, not all patients underwent echocardiography and ECG to assess the sensitivity of the latter and refine the prevalence.

Conclusion

The prevalence of hypertension is high in both sexes, with consequences led by left ventricular hypertrophy in ECG and echocardiography. The higher prevalence of female HTN must be further studied, as must the associated factors.

Declarations

Ethics Approval and Consent to Participate

The study has been approved as part of the University Hospital's research activities by the institutional board.

Informed consent has been obtained for all patients.

Author's Contributions

BA HO designed the study. Poudiougou M was responsible for data collection. BA HO, Camara Y, Sangaré I, and Menta I were responsible for statistical analysis. BA HO and Poudiougou M wrote the first draught. Camara Y, Sangare I and Menta revieswed and checked the manuscript. All authors approved the final version of the manuscript. All authors read and approved the final manuscript."

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