**HYPERTENSIVE HEART DISEASE IN A CARDIOLOGY SETTING IN LUBUMBASHI: CLINICAL, ELECTROCARDIOGRAPHIC, AND ECHOCARDIOGRAPHIC PROFILE**

**ABSTRACT**

**Aim**  
The aim of this study was to describe the clinical, electrocardiographic, and echocardiographic characteristics of hypertensive heart disease in Lubumbashi.

**Study design**

This study is of a cross-sectional descriptive design.  
**Place and Duration of Study**

The study was conducted on patients who attented at Cardiology Center of Lubumbashi(CCL) between 2020 and 2024.

**Methodology**  
Patients were retrospectively selected through exhaustive sampling. We included those with echocardiographically documented hypertensive heart disease and a complete medical record from which data concerning the study variables were collected. The information was entered into an Excel spreadsheet and analyzed to determine the relative frequencies of the different variables.

**Results**  
A total of 250 cases of hypertensive heart disease were documented, with a slight predominance of female patients (51.2%). The most frequently identified cardiovascular risk factors were advanced age (57.6%), obesity (38.8%), dyslipidemia (30.0%), and diabetes mellitus (20.4%). Heart failure was present in 110 patients (44.0%).

Electrocardiographic analysis revealed left ventricular hypertrophy in 53.6% of cases. Cardiac arrhythmias were also common, including ventricular extrasystoles (26.4%) and atrial fibrillation (12.8%).

Echocardiographic examination demonstrated left ventricular hypertrophy in 78.6% of patients, predominantly of the eccentric type (62.8%), as well as left atrial enlargement in 64.0% of cases. Among patients with heart failure, 81.0% had a reduced left ventricular ejection fraction (LVEF), reflecting systolic dysfunction.

**Conclusion**  
In Lubumbashi, hypertensive heart disease is frequently diagnosed at an advanced stage, often accompanied by marked left ventricular hypertrophy and major complications such as heart failure and arrhythmias. This alarming situation underscores the urgent need to strengthen hypertension prevention and management strategies within the general population to reduce the risk of onset or progression of hypertensive heart disease.

**KEYWORDS** : Hypertensive heart disease, Lubumbashi, Electrocardiography, Echocardiography

**INTRODUCTION**

Hypertension is the leading cause of cardiovascular diseases and premature mortality worldwide [1]. According to estimates from the World Health Organization (WHO), in 2023, approximately 1.28 billion adults aged 30 to 79 years were living with hypertension globally, with nearly two-thirds residing in low- and middle-income countries[2].

In Lubumbashi, a city located in the southeastern region of the Democratic Republic of the Congo (DRC), a recent study reported a hypertension prevalence of 33.6% among adults in the general population[3]. As a low- to middle-income region, Lubumbashi faces significant challenges related to low screening rates and inadequate blood pressure control[1,4]. This epidemiological context contributes to the development of complications, among which hypertensive heart disease is particularly prominent[5,6].

Hypertensive heart disease constitutes a major public health concern[7], especially in resource-limited settings[8]. In 2019, hypertensive heart disease was responsible for 18.6 million cases and 1.16 million deaths globally [5]. In sub-Saharan Africa, the burden of this condition increased substantially between 1990 and 2019[8,9], and it remains the leading cause of heart failure in the region [10,11].

Despite its increasing significance, no local study has yet characterized the profile of hypertensive heart disease in Lubumbashi, particularly in hospital settings. The present study aims to address this gap by describing the clinical, electrocardiographic, and echocardiographic features of patients with hypertensive heart disease in this region.

**MATERIAL AND METHODS**

**Study Setting and Type**

This was a descriptive, cross-sectional study conducted at the Cardiology Center of Lubumbashi (CCL), a referral hospital located in the southeastern region of the Democratic Republic of the Congo.The hospital specializes in the management of cardiovascular diseases. The study was based on a retrospective analysis of medical records of patients who attended the CCL between January 2020 and December 2024.

**Study Population, Inclusion and Exclusion Criteria**  
Participants were selected through exhaustive sampling, including all patients who met the inclusion criteria during the study period.

**Inclusion Criteria:**

-Age ≥ 18 years;

- Presence of hypertensive heart disease, defined by the presence of at least one of the following echocardiographic abnormalities not explained by another cardiac etiology: left ventricular systolic or diastolic dysfunction, left ventricular hypertrophy (LVH), or left atrial enlargement (LAE) in a hypertensive patient [6,9,12];

-Availability of a complete medical record, including data necessary for the analysis of the study parameters.

**Exclusion Criteria:**

-Presence of chronic diseases likely to alter cardiac structure or function independently of hypertension (e.g., chronic anemia, uncontrolled hyperthyroidism);

-Refusal to provide explicit consent for the use of medical data for research purposes.

**Study Parameters**  
The parameters analyzed were grouped into three categories: clinical, electrocardiographic, and echocardiographic.

**Clinical Parameters**  
The clinical parameters included the sex of the patients and cardiovascular risk factors or medical history, notably advanced age (defined as age ≥ 60 years)[13], obesity, diabetes mellitus, dyslipidemia, smoking, alcohol consumption, and the presence of heart failure diagnosed according to the criteria established by the European Society of Cardiology (ESC)[14].

**Electrocardiographic Parameters**  
Electrocardiographic tracings were obtained using a DMS Cardio Scan system, with a recording duration of 90 seconds. The analysis focused on chamber hypertrophy, cardiac arrhythmias and conduction abnormalities. The interpretation of the tracings was carried out in accordance with the guidelines of scientific societies, particularly those of the ESC[15].

**Echocardiographic Parameters**

Echocardiographic data were extracted from transthoracic echocardiography reports performed using a Philips ultrasound system equipped with a 2 to 4 MHz probe. The parameters analyzed included LVH, LAE, and left ventricular systolic function, particularly through the left ventricular ejection fraction (LVEF).

LVH was defined, in non-obese individuals, as a left ventricular mass indexed to body surface area greater than 95 g/m² in women and 115 g/m² in men. In obese patients, LVH was defined by a mass indexed to height raised to the power of 2.7, exceeding 47 g/m²,7 in women and 50 g/m²,7in men[15]. LVH was classified as eccentric when the relative wall thickness was less than 0.42, and as concentric when it was greater than or equal to 0.42[7,16].

LAE was defined by a left atrial volume indexed to body surface area greater than 34 ml/m²[16].

Among patients with heart failure, LVEF was considered reduced if it was less than or equal to 40%, mildly reduced if between 41% and 49%, and preserved if greater than or equal to 50%[14].

**Data Collection and Statistical Analysis**  
Data were extracted from the medical records of the included patients, entered into Microsoft Excel 2018, and subsequently analyzed using EPI INFO version 7.2. Statistical analysis consisted of calculating the relative frequencies of the studied variables.

**RESULTS**

**Clinical Characteristics(Table 1.)**

A total of 250 patients with hypertensive heart disease were included in this study. Among them, 128 were female (51.2%) and 122 were male (48.8%). The most frequently observed cardiovascular risk factors or comorbidities were advanced age, present in 57.6% of patients, followed by obesity (38.8%), dyslipidemia (30.0%), diabetes mellitus (20.4%) and alcohol consumption(10.4%).Heart failure was diagnosed in 110 patients, corresponding to a prevalence of 44.0%.

**Electrocardiographic Characteristics(Table 2.)**

The most common electrocardiographic abnormality was left ventricular hypertrophy, observed in 53.6% of patients. Other abnormalities included ventricular extrasystoles (26.4%), left anterior hemiblock (16.0%), left atrial hypertrophy (15.6%), atrial fibrillation (12.8%), and atrial extrasystoles (11.6%).

**Echocardiographic Characteristics(Table 3.)**

LVH was detected in 78.6% of patients. Among these, the hypertrophy was eccentric in 62.2% of cases and concentric in 31.8%. LAE was found in 160 patients, accounting for 64.0% of cases. Among those with heart failure, a reduced LVEF (≤ 40%) was noted in 89 individuals, representing 81.0% of heart failure cases.

**DISCUSSION**

The clinical profile of patients with hypertensive heart disease in our cohort was marked by a high prevalence of certain characteristics, including female sex (51.2%), advanced age (57.6%), obesity (38.8%), dyslipidemia (30.0%), and diabetes mellitus (20.4%). This profile aligns with that observed among hypertensive patients in the general population of Lubumbashi, as reported by Musung et al.[3].Furthermore, some of these characteristics, particularly advanced age, obesity, and diabetes mellitus,smoking and alcohol consumption are recognized as aggravating or contributory factors in the pathogenesis of hypertensive heart disease. Their concurrent presence may exacerbate the structural and functional cardiac alterations associated with chronic hypertension[6].

Our findings indicated a heart failure prevalence of 44.0 % (110 patients). A comparable study conducted in Niger by Moctar et al.[17]reported a higher prevalence (76.3%), likely explained by the exclusive inclusion of hospitalized patients at more advanced disease stages.

The burden of heart failure observed in our series is consistent with data from several meta-analyses[10,11], which underscore the predominant role of hypertensive heart disease as a leading cause of heart failure in sub-Saharan Africa.

Most heart failure cases exhibited reduced LVEF (81.0 %), reflecting an advanced stage of hypertensive heart disease. The condition typically initiates with diastolic dysfunction, forming the pathophysiological basis of heart failure with preserved ejection fraction. Nonetheless, a significant subset of patients progress to systolic dysfunction, particularly in the presence of precipitating factors such as ischemic events. This progression results in heart failure with reduced LVEF, corresponding to stage four hypertensive heart disease [12].

The elevated prevalence of heart failure with reduced LVEF in our cohort may be attributed to several factors, including delayed diagnosis due to the frequently silent nature of early disease stages and the high prevalence of cardiovascular risk factors associated with hypertension. These factors facilitate ischemic events, accelerating progression toward heart failure characterized by impaired LVEF.

Electrocardiographic analysis revealed a high frequency of LVH (53.7 %) alongside a significant prevalence of arrhythmias. The most common arrhythmias were ventricular extrasystoles (26.4%) and atrial fibrillation (12.8 %). This pattern, highlighting the predominance of LVH and arrhythmias, has also been reported by Sarr in Senegal[13] and Machihudé in Togo[18] in their respective cohorts. Indeed, hypertensive heart disease is widely recognized as a major etiological factor for both supraventricular and ventricular arrhythmias [19,20].

Transthoracic echocardiography identified LVH in 78.6% of patients (192 cases), a prevalence comparable to that reported by Machihude et al. (74.8%), underscoring the significance of this echocardiographic abnormality in Black populations[21].

Notably, the LVH observed was predominantly eccentric(62.2%), contrasting with several studies reporting a predominance of concentric left ventricular hypertrophy[13,18,22]. Given that concentric hypertrophy typically characterizes the early stage of hypertensive heart disease, the predominance of eccentric hypertrophy in our cohort suggests a more advanced stage of the disease [23].

LAE was present in 64.0% of cases, consistent with literature reports ranging from 16.0% to 83.0%[24]. In hypertensive heart disease, LAE is recognized as a key factor in the development of arrhythmias, particularly atrial fibrillation[20].

In summary, our findings indicate that hypertensive heart disease in Lubumbashi is frequently associated with additional cardiovascular risk factors, including advanced age, diabetes mellitus, obesity, and dyslipidemia. This association appears to accelerate disease progression to an advanced stage. In a substantial proportion of cases of our series, the condition is diagnosed at this late stage, often marked by a high prevalence of heart failure with reduced LVEF, LAE, LVH, and arrhythmias. These findings underscore the urgent need for earlier detection and more effective management of hypertension and the modifiable cardiovascular risk factors often associated with it, in order to prevent the onset or progression of hypertensive heart disease.

However, this study has limitations. Conducted in a single specialized center, its findings may not be generalizable to the wider population. Additionally, the absence of longitudinal follow-up precludes assessment of the natural progression of identified cardiac abnormalities. Future multicenter, prospective studies are warranted to validate these observations and further elucidate the evolving nature of hypertensive heart disease in sub-Saharan Africa.

**TABLES**

|  |  |  |
| --- | --- | --- |
| **Table 1. Clinical characteristics** | | |
|  | **Number(n)** | **Percentage(%)** |
| Female sex | 128 | 52.6 |
| Advanced age | 144 | 57.6 |
| Diabetes mellitus | 51 | 20.4 |
| History of dyslipidemia | 75 | 30.0 |
| Obesity | 97 | 38.8 |
| Alcohol consumption | 25 | 10.0 |
| Smoking | 12 | 4.8 |
| History of stroke | 25 | 10.0 |
| Presence of heart failure | 110 | 44.0 |

|  |  |  |
| --- | --- | --- |
| **Table 2. Electrocardiographic characteristics** | | |
|  | **Number(n)** | **Percentage(%)** |
| Left ventriculaire hypertrophy(LVH) | 134 | 53.6 |
| Left atrial hypertrophy | 39 | 15.6 |
| Premature ventricular complex | 66 | 26.4 |
| Premature atrial complex | 29 | 11.6 |
| Atrial fibrillation | 32 | 12.8 |
| Left anterior hemiblock | 40 | 16.0 |
| Left bundle branch block | 23 | 9.2 |
| Right bundle branch block | 9 | 3.6 |
| First-degree atrioventricular block | 3 | 1.2 |
| Complete atrioventricular block | 1 | 0.4 |

|  |  |  |
| --- | --- | --- |
| **Table 3. Echocardiographic characteristics** | | |
|  | **Number(n)** | **Percentage(%)** |
| Left atrial enlargement(LAE) | 160 | 64.0 |
| Left ventricular hypertrophy(LVH) | 192 | 76.8 |
| -Excentric LVH | 131 | 62.2 |
| -Concentric LVH | 61 | 31.8 |
| Left ventricular ejection fraction(LVEF) in heart failure | 110 |  |
| -Heart failure with reduced ejection fraction (HFrEF) | 89 | 81.0 |
| -Heart failure with mildly reduced ejection fraction (HFmrEF) | 9 | 8.1 |
| -Heart failure with preserved ejection fraction (HFpEF) | 12 | 10.9 |

**CONCLUSION**Hypertensive heart disease in the cardiological setting in Lubumbashi is characterized by a high prevalence of advanced disease forms, often complicated by marked LVH, heart failure, and arrhythmias. This alarming situation is primarily due to uncontrolled hypertension combined with multiple cardiovascular risk factors such as advanced age, obesity, dyslipidemia, and diabetes mellitus. These factors not only contribute to the development of hypertensive heart disease but also promote its progression to more severe stages. These findings emphasize the urgent need for early detection and stringent control of arterial hypertension to prevent the onset and worsening of hypertensive heart disease.

**COMPETING INTERESTS**

The authors have declared no conflicts of interest.

**ETHICAL CONSIDERATIONS**

This study adhered to prevailing ethical standards. Approval was obtained from the Ethics Committee of the Faculty of Medicine at the University of Lubumbashi, under reference number UNILU/CEM/026/2025.

**DISCLAIMER – USE OF GENERATIVE ARTIFICIAL INTELLIGENCE**

Declaration of AI Use:  
The authors declare that generative artificial intelligence (AI) tools were used during the writing and revision of this manuscript.

-Technology used: ChatGPT (GPT-4 version), developed by OpenAI (<https://chat.openai.com>).

-Purpose of use: To improve language clarity, correct grammatical errors, rephrase sentences, structure summaries, and suggest reformulations. The scientific content and original ideas were not altered.

-Input prompts provided: Instructions such as “improve the scientific writing of this paragraph,” “rephrase for clarity,” and “correct grammar while maintaining meaning.”

The authors take full responsibility for the integrity and accuracy of the final content.

**REFERENCES**

1. Mills KT, Stefanescu A, He J. The global epidemiology of hypertension. Nat Rev Nephrol. avr 2020;16(4):223‑37.

2. Hypertension artérielle [Internet]. [cité 15 juill 2025]. Disponible sur: https://www.who.int/fr/news-room/fact-sheets/detail/hypertension

3. Musung JM, Kakoma PK, Kaut Mukeng C, Tshimanga SL, Munkemena Banze JP, Kaj NK, et al. Prevalence of Hypertension and Associated Factors in Lubumbashi City, Democratic Republic of Congo: A Community-Based Cross-Sectional Study. Int J Hypertens. 2021;2021:6674336.

4. Cavagna P, Ikama MS, Kramoh KE, Takombe JL, Diop IB, Toure IA, et al. Antihypertensive strategies and hypertension control in Sub-Saharan Africa. European journal of preventive cardiology. 20 sept 2021;28(11):e21.

5. Huang X, Hu L, Long Z, Wang X, Wu J, Cai J. Hypertensive Heart Disease: Mechanisms, Diagnosis and Treatment. Reviews in Cardiovascular Medicine. 6 mars 2024;25(3):93.

6. Masenga SK, Kirabo A. Hypertensive heart disease: risk factors, complications and mechanisms. Front Cardiovasc Med. 2023;10:1205475.

7. Nemtsova V, Burkard T, Vischer AS. Hypertensive Heart Disease: A Narrative Review Series-Part 2: Macrostructural and Functional Abnormalities. J Clin Med. 1 sept 2023;12(17):5723.

8. Gao G, Chen Z, Yan G, Bao M. Impact of hypertensive heart disease, risk factors, and age-period-cohort models across 204 nations and regions from 1990 to 2019: a global perspective from the 2019 global burden of disease study. Front Cardiovasc Med. 2024;11:1417523.

9. Nkoke C, Makoge C, Dzudie A, Mfeukeu LK, Luchuo EB, Menanga A, et al. A predominance of hypertensive heart disease among patients with cardiac disease in Buea, a semi-urban setting, South West Region of Cameroon. BMC Research Notes. 4 déc 2017;10:684.

10. Dokainish H, Teo K, Zhu J, Roy A, AlHabib KF, ElSayed A, et al. Heart Failure in Africa, Asia, the Middle East and South America: The INTER-CHF study. Int J Cardiol. 1 févr 2016;204:133‑41.

11. Karaye KM, Dokainish H, ElSayed A, Mondo C, Damasceno A, Sliwa K, et al. Clinical Profiles and Outcomes of Heart Failure in Five African Countries: Results from INTER-CHF Study. Glob Heart. 2021;16(1):50.

12. Sorrentino MJ. The Evolution from Hypertension to Heart Failure. Heart Fail Clin. oct 2019;15(4):447‑53.

13. Sarr SA, Babaka K, Mboup MC, Fall PD, Dia K, Bodian M, et al. Aspects cliniques, électrocardiographiques et échocardiographiques de l’hypertendu âgé au Sénégal. The Pan African Medical Journal [Internet]. 17 oct 2016 [cité 3 nov 2024];25(77). Disponible sur: https://www.panafrican-med-journal.com//content/article/25/77/full

14. McDonagh TA, Metra M, Adamo M, Gardner RS, Baumbach A, Böhm M, et al. 2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure: Developed by the Task Force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC) With the special contribution of the Heart Failure Association (HFA) of the ESC. European Heart Journal. 21 sept 2021;42(36):3599‑726.

15. McEvoy JW, McCarthy CP, Bruno RM, Brouwers S, Canavan MD, Ceconi C, et al. 2024 ESC Guidelines for the management of elevated blood pressure and hypertension: Developed by the task force on the management of elevated blood pressure and hypertension of the European Society of Cardiology (ESC) and endorsed by the European Society of Endocrinology (ESE) and the European Stroke Organisation (ESO). European Heart Journal. 7 oct 2024;45(38):3912‑4018.

16. Lang RM, Badano LP, Mor-Avi V, Afilalo J, Armstrong A, Ernande L, et al. Recommendations for Cardiac Chamber Quantification by Echocardiography in Adults: An Update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging. Journal of the American Society of Echocardiography. 1 janv 2015;28(1):1-39.e14.

17. Moctar MA, Wahab KBA, Moctar MH, Idrissa H, Eric A, Toure IA. La Cardiopathie Hypertensive à l’Hôpital National de Niamey : Aspects Épidémiologiques, Diagnostiques et Thérapeutiques: Hypertensive Heart Disease at the Niamey National Hospital: Epidemiology, Clinical Presentation and Management. HEALTH SCIENCES AND DISEASE [Internet]. 24 mai 2024 [cité 17 janv 2025];25(6). Disponible sur: https://www.hsd-fmsb.org/index.php/hsd/article/view/5785

18. Machihude PIO, Pessinaba S, Sama HD, Afassinou YM, Almeida KD, Atta B, et al. 24-Hour Electrocardiographic (ECG) Holter Recording during Hypertensive Cardiopathy in Health Facilities in Lome. Journal of Integrative Cardiology Open Access. 25 févr 2022;2022(1):1‑5.

19. Afzal MR, Savona S, Mohamed O, Mohamed-Osman A, Kalbfleisch SJ. Hypertension and Arrhythmias. Heart Fail Clin. oct 2019;15(4):543‑50.

20. Varvarousis D, Kallistratos M, Poulimenos L, Triantafyllis A, Tsinivizov P, Giannakopoulos A, et al. Cardiac arrhythmias in arterial hypertension. The Journal of Clinical Hypertension. 9 août 2020;22(8):1371.

21. Kizer JR, Arnett DK, Bella JN, Paranicas M, Rao DC, Province MA, et al. Differences in Left Ventricular Structure Between Black and White Hypertensive Adults. Hypertension. juin 2004;43(6):1182‑8.

22. Ikama MS, Makani J, Nsitou BM, Mongo-Ngamami SF, Ellenga-Mbolla BF, Ondze-Kafata LI, et al. Profil échocardiographique des patients hypertendus Congolais. Annales de Cardiologie et d’Angéiologie. 1 févr 2019;68(1):32‑8.

23. Di Palo KE, Barone NJ. Hypertension and Heart Failure: Prevention, Targets, and Treatment. Heart Fail Clin. janv 2020;16(1):99‑106.

24. Cuspidi C, Rescaldani M, Sala C. Prevalence of Echocardiographic Left-Atrial Enlargement in Hypertension: A Systematic Review of Recent Clinical Studies. American Journal of Hypertension. 1 avr 2013;26(4):456‑64.