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Epidemiological, Clinical and Echocardiographic Aspects of Non-Obstructive Hypertrophic Cardiomyopathy in the Nephrology and Haemodialysis Department of the Point G University Hospital

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Abstract

Introduction: LVH is the earliest cardiovascular abnormality in CKD. It is a significant risk factor for mortality and cardiovascular morbidity in patients with chronic kidney disease. The objective of this study was to investigate non-obstructive hypertrophic cardiomyopathy in CKD patients hospitalised in the nephrology and haemodialysis department of the Point G University Hospital. **Methods:** This is a prospective study carried out from January 1, 2021 to December 31, 2021 and concerned chronic renal failure patients with non-obstructive hypertrophic cardiomyopathy. **Results:** During our study, we recorded 89 cases of non-obstructive hypertrophic cardiomyopathy, a prevalence of 42.8%. The sex ratio was 1.2 in favour of men. The average age of the patients was 45 ± 14.4 years with extremes of 16 and 78 years. The risk factors frequently found were anaemia (100%) and hypertension (92.1%). The clinical picture was dominated by the left heart failure syndrome (66.3% of cases). The different types of echocardiographic hypertrophy found were concentric (72%), eccentric (18%) and septal hypertrophy (10%). **Conclusion:** Non-obstructive hypertrophic cardiomyopathy is the early cardiovascular abnormality encountered in CKD. It is associated

with cardiovascular risk factors such as hypertension, anaemia and phosphocalcic disorders.

Keywords

LVH, Risk Factor, Chronic Renal Failure, Echocardiography

1. Introduction

LVH is a phenomenon of myocardial adaptation to the demands of increased load. Volume overload leads to an adaptive increase in luminal diameter, and pressure overload leads to a thickening of the arterial wall [1].

It is the earliest cardiac morphological abnormality in uraemic patients. It is present in more than 75% of patients with end-stage renal disease and is a major risk factor for cardiovascular mortality and morbidity in these patients [2].

The aim of this study was to investigate non-obstructive hypertrophic cardiomyopathy during chronic renal failure in patients hospitalised in the nephrology and haemodialysis department of Point G University Hospital.

2. Method

This was a descriptive study with prospective data collection in patients hospitalized in the nephrology and hemodialysis department of the CHU du Point G (Bamako), extending from January 1, 2021 to December 31, 2021, *i.e.* a duration of 12 months.

The inclusion criteria were patients in chronic renal failure with hypertrophic cardiomyopathy on cardiac Doppler ultrasound.

Patients with chronic renal failure who did not have hypertrophic cardiomyopathy on cardiac Doppler ultrasound, patients hospitalised outside our study period, and patients with incomplete medical records were not included.

Informed consent was obtained from the patients. The survey forms were prepared anonymously. We did not approach the institutional ethics committee.

Definition of variables:

Ultrasound left ventricular hypertrophy (LVH) was defined as left ventricular mass index > 125 g/m^2 in men and >110 g/m^2 in women.

Concentric hypertrophy: wall thickness to cavity size ratio > 0.42.

Eccentric hypertrophy: wall thickness to cavity size ratio < 0.42.

Septal hypertrophy (Asymmetric): the SIV/PP ratio ≥ 1.3.

Classic cardiovascular risk factors [3]:

AH: It was defined by a systolic blood pressure (SBP) greater than or equal to 140 mmHg and/or a diastolic blood pressure (DBP) greater than and/or equal to 90 mmHg. This hypertension was classified into three (3) grades:

Grade I: 140-159/90-99

Grade II: 160-179/100-109

Grade III: ≥180/110

Smoking: defined as the chronic intoxication of the body by tobacco that leads to dependence, approximately 20 pack-years.

Diabetes: Polyuro-polydipsic syndrome, polyphagia and random blood glucose (on venous plasma) ≥ 2 g/l (11.1 mmol/l) or fasting blood glucose level ≥ 1.26 g/l on two occasions (7 mmol/l).

Alcoholism: This is a disease related to chronic drink abuse with alcohol dependence.

Cardiovascular risk factors associated with chronic renal failure:

Age: over 55.

Lipid disorders: HDL cholesterol (<0.9 mmol/l), LDL cholesterol (>4.4 mmol/l), total cholesterol (>6.5 mmol/l), triglycerides (>2.1 mmol/l).

Anemia: defined as a decrease in circulating haemoglobin mass with the following haemoglobin levels: <12g/dl in women and <13g/dl in men.

Fluid Inflation: characterised by oedema of the limbs, puffiness of the face facial puffiness or ascites.

Mineral-bone disorders: classically associated with Hypocalcaemia (<2.2 mmol/l) with hyperphosphaemia (>1.6 mmol/l).

Arteriovenous fistula (AVF): is a surgically constructed neo-circulation characterised by low arterial resistance and increased venous return.

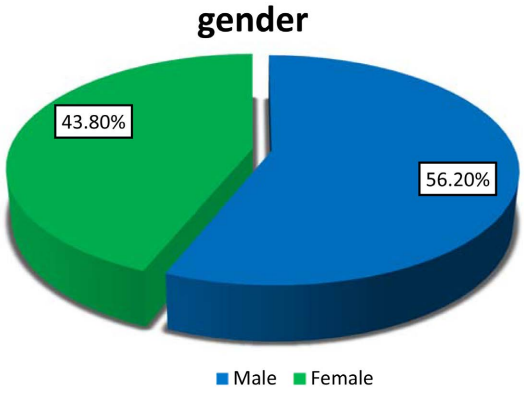
Data collection: Patients were recruited from the hospitalization record. The parameters studied in the file were sociodemographic data, clinical data, classical and specific cardiovascular risk factors of CKD, and cardiographic echo aspects of non-obstructive LV hypertrophy.

Data were analysed on an SPSS version 22.0 epidemiological analysis tool. Arithmetic means were calculated with a risk α-1.96 and $p < 0.05$. Data entry and word processing were done in Word and Excel. Prior verbal consent was obtained from the included subjects before recruitment, by means of an individual survey form.

3. Results

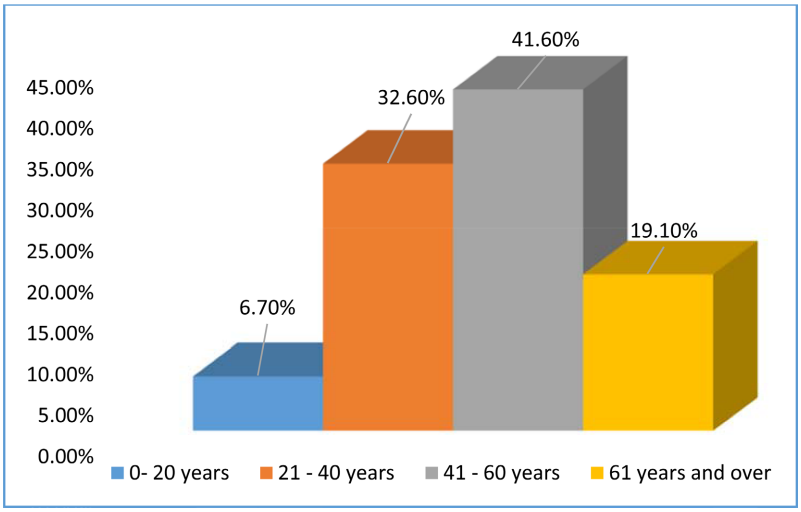
During the study period, in the nephrology department, out of 208 hospitalized CKD patients, 89 patients had a non-obstructive hypertrophic cardiomyopathy on cardiac ultrasound, *i.e.* a hospital prevalence of 42.8%. The male sex was in the majority with 56.8%, which gives a sex ratio of 1.2 (**Figure 1**). The average age was 45 ± 14.4 years with extremes of 16 and 78 years. The age group most affected was 41 - 60 years, *i.e.* 41.60% of cases (**Figure 2**). Hypertension was the dominant classical cardiovascular risk factor, accounting for 92.1% of cases (**Table 1**). Grade III hypertension was present in 43.8% of our patients (**Table 2**).

Anemia and phosphocalcic disorders were the specific risk factors for CKD, respectively in 100% and 97.8% of cases (**Table 3**). The dominant cardiovascular functional sign was dyspnoea in 73% of cases (**Table 4**). Tachycardia was the most common physical sign, accounting for 51.7% of cases, followed by IMO in



There was a predominance of males (56.8%). The sex ratio (m/f) was 1.2.

Figure 1. Distribution of patients by gender.



The most represented age group was 41 to 60 years, *i.e.* 41.60%. The average age was 45 ± 14.4 years with extremes of 16 and 78 years.

Figure 2. Distribution of patients by age group.

Table 1. Distribution of patients according to classical cardiovascular risk factors.

Classic risk factors	Number	Percentage (%)
HIGH BLOOD PRESSURE	82	92.1
Male	50	56.2
Age over 55	24	27.0
Diabetes	11	12.4
Dyslipidemia	9	10.1
Smoking	9	10.1
Alcoholism	6	6.7
BMI > 30	3	3.4
Drugs	2	2.2

High blood pressure was the most common risk factor, accounting for 92.1% of cases.

Table 2. Distribution of patients by grade of hypertension (n = 82).

Grade AH	Number	Percentage (%)
Grade I	12	13.5
Grade II	30	33.7
Grade III	39	43.8

Grade III hypertension was present in 43.8% of our patients.

Table 3. Distribution of patients according to specific risk factors for CKD.

CKD risk factors	Number	Percentage (%)
Anemia	89	100.0
Phosphocalcic disorders	87	97.8
Fluid sodium inflation	35	39.3
AVF	5	5.6

Anemia was observed in all our patients (100%).

Table 4. Distribution of patients according to cardiovascular functional signs.

Signs	Workforce	Percentage (%)
Dyspnoea on exertion	65	73.0
Chest pain	31	34.8
Cough	16	18.0
Orthopnea	17	19.1
Palpitation	9	10.1
Hepatica	4	4.5

Dyspnoea on exertion was dominant, accounting for 73% of cases. NB: a patient could present one or more functional cardiovascular signs.

34.8% of cases (Table 5). The dominant clinical syndrome of heart failure was IVG, which was present in 66.3% of cases (Table 6). 71.9% were in end-stage renal failure (Table 7).

4. Discussion

Socio-epidemiological aspects: During our study we recorded 533 hospitalizations in the department including 208 cases of CKD, *i.e.* a hospital prevalence of 39.02% of CKD.

Among the patients with chronic renal failure, 89 had hypertrophic cardiomyopathy on cardiac Doppler ultrasound, *i.e.* a hospital prevalence of 42.8%. It represented 41% of cases in KONCOULBA [3], compared to 57.4% in DIAWARA C [4], 59.6% in TOGO [5] and 71.05% in CISSE *et al.* [6]. This difference can be explained by the size of the sample but also by the criteria used to define LVH.

Table 5. Distribution of patients according to physical signs.

Physical signs	Workforce	Percentage (%)
Tachycardia	46	51.7
IMO	31	34.8
Extracellular dehydration	23	25.8
Crepitus rales	13	14.6
Jugular turgidity	12	13.5
Hepatojugular Reflux	10	11.2
Hepatomegaly	8	9.0
Pericardial friction	5	5.6
MI systolic murmur	5	5.6
Galloping noise	2	2.2

Tachycardia was found in 51.7% of the patients followed by IMO in 34.8% of cases.

Table 6. Distribution of patients according to clinical cardiovascular syndrome type.

Clinical cardiovascular syndrome	Workforce	Percentage (%)
GVI	59	66.3
ICG	18	20.2
OAP	7	7.9
Pericarditis	5	5.6
Total	89	100

Left ventricular failure was dominant at 66.3%.

Table 7. Relationship between hypertrophy and specific risk factors for chronic kidney disease.

Risk factors Specific to CKD	Hypertrophy of the LV			Total
	Concentric (p-value)	Eccentric	Septal	
Phosphocalcic disorder	63 (0,485)	(p-value)	(p-value)	
Fluid retention	23 (0.528)	16 (1.000)	9 (1.000)	88
AVF	2 (0.132)	11 (0.017)	3 (1.000)	37

There is a statistically significant relationship between hypertrophy and fluid retention as specific risk factors for chronic kidney disease ($P < 0.05$).

The sex ratio was 1.2 in favour of men. This male predominance has also been found in Senegal and Côte d'Ivoire [7] [8]. It could be explained in part by the more severe course of renal disease in men than in women [9].

The average age was 45.14 years compared to 38 and 47.19 years respectively in ABOUBACAR B [10] and TRAORE D [11].

Cardiovascular risk factors: The most important classical cardiovascular risk

factor was hypertension in 92.1% of cases, compared with 81.3% in TOGO A [5] and 72% in Kane A *et al.* [12]. AH was grade I in 13.5% of cases, grade II in 33.7% and grade 3 in 43.8% of cases. The predominance of hypertension could be explained by the high frequency of vascular nephropathy (60.7%) among the etiologies of CKD. It contributes to the development of LV hypertrophy [9].

In addition to hypertension, the other classic cardiovascular risk factors were, in order of frequency: male sex (56.2%), age over 55 years (27%), diabetes (12.4%), smoking (10.1%) and alcoholism (6.7%).

Regarding the risk factors specific to CKD, anaemia was the most dominant, accounting for 100% of patients. This predominance of anaemia has been reported by other authors including COULIBALY M [13] (100%), LAZOUMAR [14] (70%) and ABOUBACAR B [10] (97.6%). The high prevalence of anaemia during CKD is partly explained by the deficit in erythropoietin production during CKD and martial deficiency [9]. Apart from anaemia, phosphocalcic disorders (97.8%) and fluid retention (39.3%) were the main risk factors for CKD.

Phosphocalcic disorders combine hypocalcaemia (78.7%) and hyperphosphataemia (96.6%) with hyperparathyroidism (57.3%). This confirms the disturbance of phosphocalcic metabolism during CKD. These phosphocalcic disorders favour the occurrence of valvular calcifications [15].

Clinical aspects

Renal failure was the main reason for hospitalisation in 84.2% of cases. This result is lower than that of TRAORE D [11] who reported 100% of cases. On the other hand, SOW [16] found hypertension to be the main reason for hospitalisation with 43.59%. Renal failure, as the first reason for hospitalisation, can be explained by the fact that the observation of an increase in plasma creatinine prompted practitioners to refer patients to the nephrology department.

The functional cardiovascular signs were dominated by exertional dyspnoea (7%) and chest pain (34.8%). The same observation was made by Traore D [11] who also found a predominance of dyspnoea and chest pain respectively in 54.71% and 24.5% of cases. In the literature, all authors agree on the predominance of dyspnoea [10] [13]. In CKD, dyspnoea is not specific, as it may be related to anaemia. In our study 73% of patients had a Hb level below 8 g/dl. The physical signs were in order of frequency tachycardia 51.7%, IMO 34.8%.

The functional and physical signs made it possible to group together cardiovascular syndromes: left ventricular failure (66.3%), congestive heart failure (20.2%), uraemic pericarditis (5.6%);

Contrary to our result, TRAORE D [11] and Diawara [4] found the predominance of global cardiac insufficiency respectively in 48.9% and 37.7% of cases.

Echocardiographic aspects and cardiovascular risk factors: The different types of non-obstructive hypertrophic cardiomyopathy found on cardiac ultrasound were in order of frequency: concentric hypertrophy 72%, eccentric hypertrophy 18% and septal hypertrophy 10%. Our result is comparable to that of KARA H [17] who reported a prevalence of 39% concentric type, 43% eccentric type and

18% asymmetric septal type. The predominance of concentric left ventricular hypertrophy is the consequence of anaemia and fluid retention.

LV hypertrophy was correlated with the depth of anaemia and was more prevalent in patients with haemoglobin levels below 8 g/dl (68.53%) than in patients with haemoglobin levels above 8 g/dl (25.8%) [15].

In our study we found that the percentage of anaemic patients in the eccentric type was 75% compared to 73% in the concentric type. The same observation was made by KARA H [17] in Algeria, who found 67.3% for the eccentric type and 52.6% for the concentric type in anaemic patients.

Non-obstructive myocardial hypertrophy was associated with other cardiovascular complications. These complications were, in order of frequency: caecular dilatation (46.1%), systolic dysfunction (41.7%), pericarditis (14.1%), diastolic dysfunction (13.5%) and PAH (6.7%).

We found a significant relationship between hydro-sodium inflation and eccentric hypertrophy ($p < 0.05$) in agreement with the literature [11]. There was a relationship between eccentric hypertrophy and severe hypertension ($p = 0.04$). There was no correlation between the severity of hypertension and the occurrence of left ventricular hypertrophy (**Table 8**) in general, either moderate or severe.

Most of the patients were in end-stage chronic renal failure, 71.9%. This could be explained by the fact that patients were seen and hospitalised at late stages of chronic kidney disease (**Table 9**).

Table 8. Relationship between LV hypertrophy and grades of hypertension.

Cardiac hypertrophy	HTA grade			Total	p
	Slight	Moderate	Severe		
Concentric	9	20	30	59	0.623
Eccentric	2	9	3	14	0.040
Septal	1	1	7	9	0.158
Total	12	30	40	82	-

We found a statistically significant association between eccentric hypertrophy and severe hypertension.

Table 9. Distribution of patients by GFR (MRD).

GFR	Workforce	Percentage (%)
Mild to moderate IR	2	2.2
Moderate to severe IR	16	18.0
Severe IR	7	7.9
IRT	64	71.9
Total	89	100.0

Patients were in ESRD in 71.9% of cases.

5. Conclusion

Non-obstructive hypertrophic cardiomyopathy is the early cardiovascular abnormality encountered in CKD. It is associated with cardiovascular risk factors such as hypertension, anaemia and phosphocalcic disorders. It is often complicated by heart failure, hence the high frequency of signs of heart failure, most often dominated by exertional dyspnoea and oedema.

Conflicts of Interest

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

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