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Factors Associated with Echocardiographic Abnormalities in Patients with Chronic Kidney Disease in a Tertiary Hospital in Ivory Coast

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Abstract

Background: Cardiovascular risk factors (CVRF) are very frequent in patients with chronic kidney disease (CKD) and impose a new environment to which the heart must adapt. Cardiac ultrasound is a non-invasive and easy-to-perform examination that allows quantitative and qualitative assessment of the anatomy and function of the heart. The objectives of this study were to describe abnormalities observed on trans-thoracic Doppler-echocar-diography and to investigate the factors associated with them. **Materials and Method:** This was a monocentric retrospective cross-sectional study conducted in CKD patients hospitalized in a hospital center in Côte d'Ivoire from January 2017 to December 2018. **Results:** One hundred and four cases were collected with a mean age of 48.87 ± 14.47 years and a sex ratio of 1.7. Patients with end-stage-renal-disease (ESRD) represented 83.7% with 55.8% of cases of chronic glomerulonephritis. Cardiovascular risk factors were 100% anemia, 84.6% inflammatory profile, 77.9% hypertension, 76.9% hypocalcemia and in 67.3% oedema. Cardiac abnormalities were observed in 78.8% of patients. Left ventricular hypertrophy (LVH), accounting for 20.2% of cases, was associated with male gender (OR 0.127 CI 0.025 - 0.643; p = 0.013) and hypertensive nephropathy (OR 0.189 CI 0.056 - 0.637; p = 0.007). History of hypertension (OR 0.297 CI 0.084 - 1.050; p = 0.060) and diabetes (OR 5.315 CI 1.260 - 22.419; p = 0.023), hypertensive nephropathy (OR 0.174 CI 0.052 - 0.585; p = 0.005) and hypocalcemia (OR 6.094 CI 1.723 - 21.559; p = 0.005) are incriminated in the development of left ventricular dilatation (LVD) which accounted for 38.5% of cases. **Conclusion:** Left ventricular hypertrophy and dilatation are the main echocardiographic abnormalities observed in our population.

Keywords

Chronic Renal Failure Left Ventricular Hypertrophy, Ivory Coast

1. Introduction

Chronic kidney disease remains a public health challenge because of its increasing frequency, its fatal cardiovascular consequences and its very costly management for public authorities. A subject suffering from CKD has a mortality risk multiplied by 20 to 30 compared to the general population of identical age [1]. One out of two deaths is related to the occurrence of cardiovascular complications [2]. The spectrum of cardiovascular diseases observed in CKD includes ischemic heart disease, congestive heart failure and cardiac arrhythmias. The prevalence of these complications is 69.8% and the risk of cardiovascular events increases exponentially with decreasing glomerular filtration rate (GFR) [3]. There are several ways to assess cardiovascular complications, including transthoracic cardiac ultrasound. It is a non-invasive examination with a reliable degree of accuracy, routinely used to explore the heart chambers. Left ventricular hypertrophy (LVH), found in 60% - 80% of patients with CKD, is the most common morphological abnormality [4]. Dilated cardiomyopathy and calcifying valvulopathy may also be found [5]. Most of the patients in sub-Saharan Africa die because of lack of treatment for both CKD and the associated cardiovascular abnormalities [6]. There is paucity of local studies on cadiovascular abnormalities in patients with CKD in Cote d'Ivoire. Therefore, we initiated this work in order to evaluate the prevalence of echocardiographic abnormalities in patients with chronic renal failure not yet treated by hemodialysis and to identify the associated factors.

2. Patients and Methods

The study took place in the hospitalization unit of the Hemodialysis Nephrology Department of the University Teaching Hospital (CHU) of Yopougon in Abidjan in the Republic of Ivory Coast (RCI). It was a retrospective observational survey that was conducted over a period of two (2) years from January 1, 2017 to December 31, 2018. Were included patients aged more than 15 years, both sex, with established chronic kidney disease who have not received any form of renal replacement therapy, and who had a resting trans-thoracic echocardiography performed during their hospitalization. We excluded people less than 15 yars old or with acute kidney injury and patients with a history of cardiac disease followed by a cardiologist. From the hospitalization medical records, we collected on an individual survey form, socio-demographic parameters (age, sex, occupation, and educational level), clinical data (initial kidney disease, GFR, cardiovascular risk factors, and physical examination data), biological data (hemoglobin level, C-reactive protein (CRP), blood calcium, phosphorus, and creatinine

levels), and echocardiographic data (functional abnormalities (hypokinesia, hyperkinesia), morphological abnormalities (hypertrophy, dilatation, pericardial detachment or effusion), and left ventricular systolic ejection fraction).

We adopted the following operational definitions:

- Glomerular filtration rate (GFR) was estimated using the simplified MDRD formula.
- CKD was characterized by a GFR < 60 ml/mn/1.73m^2 persistent for more than three (3) months associated with normochromic normocytic anemia, hypocalcemia, hyperphosphatemia and small size kidneys (<100 mm).
- End-stage renal disease was defined as GFR < 15 ml/min/1.73m^2.
- Chronic glomerulonephritis (CGN) associated a massive proteinuria ≥ 3 g/24h and/or microscopic hematuria > 10,000/ml with blood cast, hypertension, edema and chronic renal failure.
- Hypertensive nephropathy was the combination of past history of hypertension, moderate proteinuria 1 - 2 g/24h, LVH on electrocardiogram and on echocardiography, hypertensive retinopathy and CKD.
- Chronic tubulointerstitial nephropathy (CTIN) was defined by the absence of hypertension, edema and hematuria, the presence of leukocyturia>10,000/ml without germs, and a history of urological disease.
- Fluid retention was characterized by the presence of limb edema, facial puffiness or ascites.
- HBP was defined as systolic blood pressure higher than or equal to 140 mmHg and/or diastolic blood pressure higher than and/or equal to 90 mmHg or regular use of antihypertensive drugs.
- Pericarditis was the presence of pericardial friction on physical examination, fluid effusion or pericardial detachment on cardiac ultrasound.
- Heart failure associated a hepato-jugular reflux, jugular turgor, painful hepatalgia or hepatomegaly, shortness of breath, gallop and tachycardia.
- Systolic dysfunction when the left ventricular ejection fraction was less than 50%; it was said to be severe if less than 30%.
- Left ventricular dilation was left ventricular telediastolic diameter indexed to body surface area > 31 mm/m^2 in men, > 32 mm/m^2 in women.
- Right atrial dilation characterized right atrial volume ≥ 35 ml/m^2.
- Systolic dysfunction was left ventricular ejection fraction ≤ 50%.
- Diastolic dysfunction was defined by a left ventricular ejection fraction ≤ 50% associated with mitral flow ≥ 2 and an A-wave deceleration time < 150 ms.
- Left ventricular hypertrophy (LVH) was reflected by left ventricular mass ≥ 110 g/m^2 in women and ≥135 g/m^2 in men.
- Hyperphosphoremia in case of phosphorus levels above 68 mg/l.
- Hypocalcemia if blood calcium level < 88 mg/l.
- Inflammatory profile when CRP was above 20 mg/l.
- Anemia if the hemoglobin (Hb) level was below 12 g/dl; anemia was said to

be severe if the Hb level was below 6 g/dl.

Data analysis was performed using Stata16 software. First, we performed a descriptive analysis. Quantitative variables were described as average when their distribution was normal or otherwise as median. In bivariate analysis, the dependent variables were left ventricular dilatation and left ventricular hypertrophy, and the proportions of the qualitative variables were compared among patients with or without one of the above-mentioned echocardiographic abnormalities by a chi-square test or Fisher's exact test when the numbers were less than 5. For quantitative variables, averages and medians were compared by a STUDENT test, and relative quantitative variables were transformed into categorical variables according to pathological standards. The threshold of $p < 0.05$ was considered significant.

3. Results

From January 1, 2017 to December 31, 2018, the inpatient unit of the nephrology department of the University Hospital (CHU) of Yopougon registered 1269 patients (624 in 2017 and 645 in 2018). One hundred and four (104) patients (61 and 43 respectively in 2017 and 2018) were kept according to our inclusion criteria, *i.e.* 8.2% of hospitalized patients. Socio-demographic and clinical characteristics of patients are resumed in Table 1. The mean age was 48 years (SD = 14.47) with extremes of 17 and 83 years. Etiologies of CKD were CGN in 55.8% of cases, hypertensive nephropathy in 39.4% and CTIN in 4.8%. The physical examination noted peripheral edema in 70 patients, associated with signs of cardiac (55 cases) and pulmonary (15 cases) congestion. Uncontrolled hypertension was present in 81 patients (77.9%). All patients had clinical anemia. Serum creatinine ranged from 25 to 180 mg/l with a mean value of 82 mg/l. According to estimated GFR, there were 7 cases of CKD grade 3 KDOQI, 10 cases of CKD grade 4 and 87 cases of CKD grade 5. 80 patients had an azotemia higher than 2 g/l. All patients had a biological anemia and the average hemoglobin level was 8 g/dl. Twenty four hour proteinuria more than 1 g was observed in 80 patients (76%). Disturbances of the phosphocalcic balance (hypocalcemia and hyperphosphoremia) were presents in 77% of the patients. C-reactive protein was high in 82 patients. Table 2 shows the echocardiographic abnormalities observed in 82 patients, *i.e.* a frequency of 78.8% abnormality. Hypokinesia was the most common functional abnormality, *i.e.* 26% of cases, followed by hyperkinesia in 3.8% of cases. Morphological abnormalities observed on echocardiographic were dominated by chamber dilatation (62.5%). Left ventricular dilatation (LVD) accounted for 38.5% of cases. Left ventricular hypertrophy (LVH) was found in 20.2% of cases. The average left ventricular ejection fraction was 57.24% ± 13.47%. We did not find any factors associated with the presence or absence of echocardiographic abnormalities in univariate analysis (Table 3). The proportion of male patients ($p = 0.019$) and subjects younger than 55 years ($p = 0.02$) was statistically higher in the group of those with LVH. Hypertensive nephropathy

Table 1. Socio-demographic and clinical data of population studied.

Data	n	%
Gender		
Female	39	37.5
Male	65	62.5
Age group		
17 - 35 years	18	17.3
36 - 55 years	49	47.1
56 - 75 years	34	32.7
≥76 years	3	2.9
Occupation		
Workers	21	20.2
Retired persons	10	9.6
Unemployed	63	60.6
Farmers	10	9;6
Past medical history		
HTA	81	77.9
Diabetes	21	20.6
Tobacco	27	26
Alcohol	41	39.4
Clinical signs		
Fluids retention	70	67.3
Hypertension	62	57.6
Heart failure	54	51.9
Acute pulmonary Edema	16	15.4

Table 2. Echocardiographic abnormalities in the 82 CKD patients.

Echocardiographic abnormalities		n	%
Functional abnormalities			
	Hypokinesia	27	26
	Normokinesis	73	70.2
	Hyperkinesia	4	3.8
Morphological abnormalities			
	Cavity dilatation	65	62.5
	Hypertrophy of walls	35	33.6
	Pericardial detachment	23	22.1
Dilated chambers			
	Left atrium	44	42.3
	Left ventricle	40	38.5
	Right atrium	10	9.6
	Right ventricle	10	9.6

Continued

Enlarged walls			
	Left atrium	14	13.5
	Left ventricle	21	20.2
	Right atrium	02	1.92
	Right ventricle	01	0.92
	Interventricular septum	11	10.6
Left ventricular ejection fraction			
	>70%	15	12.5
	51% - 70%	71	58.7
	31% - 50%	30	25
	≤30%	4	3.8

Table 3. Factors associated with the presence or not of abnormalities observed on echocardiography in univariate analysis.

	Normal echocardiography				
Parameters	**No (n = 82)**	**Yes (n = 22)**	**p-value**	**OR**	**CI (95%)**
	Gender				
Male	53 (64.6%)	12 (54.5%)	0.38	1.52	0.59 - 3.96
Female	29 (34.5%)	10 (45.5%)	0.38	0.66	0.25 - 1.70
	Age range				
>55 years old	49 (59.8%)	15 (68.2%)	0.47	0 .67	0.25 - 1.89
≤55 years old	33 (40.2%)	7 (31.2%)	0.47	1.44	0.53 - 3.92
	Medical history				
HBP	63 (76.8%)	18 (81.8%)	0 .61	0.78	0.29 - 2.08
Diabetes	17 (20.7%)	4 (18.2%)	0.79	0.85	0.25 - 2.84
	Initial nephropathy				
CGN	45 (54.9%)	12 (54.5%)	0.72	0.84	0.32 - 2.19
Hypertensive nephropathy	33 (40.2%)	8 (36.4%)	0.74	1.18	0.45 - 3.12
Interstitial nephropathy	4 (4.9%)	2 (9.1%)	0.95	1.08	0.11 - 10.15
	CKD stage				
GFR < 15 ml/min	68 (82.9%)	19 (86.4%)	0.69	0.76	0.19 - 2.95

(p = 0.01), HSR (p = 0.01), Hb < 8 g/dl (p = 0.05) and CRP ≥ 20 mg/dl were associated with the occurrence of LVH LVD was related to female gender and age (Table 4). In multivariate analysis, male gender (OR 0.127 CI 0.025 - 0.643; p = 0.013) and hypertensive nephropathy (OR 0.189 CI 0.056 - 0.637; p = 0.007) were associated with the occurrence of LVH (Table 5). There was a statistical relationship between LVD and HBP (p = 0.001), diabetes (p = 0.004), CNG (p = 0.003), hypertensive nephropathy (p = 0.059), GFR < 15 ml/min (p = 0.001),

Table 4. Factors associated with the existence or not of left ventricular hypertrophy in univariate analysis.

	Left ventricular hypertrophy				
Parameters	**Yes (n = 21)**	**No (n = 14)**	**p-value**	**OR**	CI (95%)
		Gender			
Male	19 (64.6%)	7 (50%)	**0.019**	3.51	1.20 - 10.27
Female	2 (9.5%)	7 (50%)	0.33	0.43	0.08 - 2.42
		Age range			
<55 years	15 (71.4%)	6 (42.9%)	**0.02**	3.47	1.13 - 10.68
≥55 years	6 (28.6%)	8 (57.1%)	0.97	1.02	0.27 - 3.80
		Medical history			
HBP	17 (80.9%)	13 (92.8%)	0.18	1.87	0.75 - 4.65
Diabetes	2 (9.5%)	5 (35.7%)	1.22	0.22	0.03 - 1.59
		Initial nephropathy			
CGN	8 (38.1%)	9 (64.3%)	0.96	1.03	0.33 - 3.20
Hypertensive nephropathy	13 (61.9%)	3 (21.4%)	**0.01**	1.18	0.45 - 3.12
CTIN	0	2 (14.3%)	-	-	-
		CKD stage			
GFR < 15 ml/min	18 (85.7%)	12 (85.7%)	0.15	1.92	0.78 - 4.71
GFR ≥ 15 ml/min	3 (14.3%)	2 (14.3%)	0.31	3.00	0.35 - 25.87
		Clinical signs			
RHS	4 (19.05%)	7 (50%)	**0.01**	3.45	1.20 - 9.94
TAS ≥ 160 mmHg	8 (38.1%)	11 (78.6%)	0.30	1.77	0.60 - 5.25
TAD ≥ 100 mmHg	9 (42.9%)	7 (50%)	0.24	2.14	0.59 - 7.77
		Biological signs			
Hb level < 8 g/dl	15 (71.4%)	7 (50%)	**0.05**	2.86	0.96 - 8.46
Hypocalcemia	14 (66.7%)	13 (92.8%)	0.92	0.99	0.39 - 2.53
Hyperphosphatemia	11 (52.4%)	7 (50%)	0.39	1.68	0.51 - 5.56
CRP ≥ 20 mg/l	19 (90.5%)	12 (85.7%)	**0.03**	2.71	1.1 - 6.68

Table 5. Factors associated with the occurrence of left ventricular hypertrophy in multivariate analysis.

			Confidence interval	
Variables	p-value	GOLD	Lower	Superior
	Socio-demographic data			
Age < 55 years	0.39	1.691	0.500	5.719
Male	**0.013**	0.127	0.025	0.643
	Initial nephropathy			
Hypertensive nephropathy	**0.007**	0.189	0.056	0.637
	Clinico-biological data			
Fluids retention	0.104	3.178	0.789	12.795
Hb < 8/dl	0.136	0.386	0.110	1.349
CRP > 20 mg/l	0.932	1.081	0.180	6.504

SHR (p = 0.029), SBP ≥ 160 mmHg (p = 0.010), Hb < 8 g/dl (p = 0.012), hypocalcemia (p < 0.001), and CRP ≥ 20 mg/l (p = 0.006) (Table 6). In multivariate analysis, history of hypertension (p = 0.060) and diabetes (p = 0.023), hypertensive nephropathy (p = 0.005) and hypocalcemia (p = 0.005) were associated with the occurrence of LVD (Table 7).

4. Discussion

Declining GFR is accompanied by an exponential increase in cardiovascular risk. We conducted this study to evaluate echocardiographic abnormalities in a population of chronic renal failure patients from black Africa. In our study, the age group 36 - 54 years represented 47.1% of the population and the average age was

Table 6. Relationship between clinico-biological data and the occurrence of left ventricular dilatation in univariate analysis.

	Left ventricular dilatation				
Parameters	**Yes (n = 40)**	**No (n = 25)**	**p-value**	**OR**	CI (95%)
Gender					
Male	27 (67.5%)	15 (60%)	0.051	2.80	0.98 - 7.99
Female	13 (32.5%)	10 (40%)	**0.001**	19.5	2.19 - 173.5
Age range					
<55 years	25 (62.5%)	13 (52%)	**0.006**	4.33	1.49 - 12.6
≥55 years	15 (37.5%)	12 (48%)	**0.016**	6.87	1.27 - 37.15
Medical history					
HBP	10 (25%)	7 (28%)	**0.001**	5.21	1.94 - 13.99
Diabetes	10 (25%)	3 (12%)	**0.004**	23.33	1.99 - 273.3
Initial nephropathy					
CGN	21 (52.5%)	12 (48%)	**0.003**	5.54	1.74 - 17.7
Hypertensive nephropathy	19 (47.5%)	10 (40%)	0.059	3.8	0.91 - 15.78
CTIN	0 (0%)	3 (12%)	-	-	-
CKD stage					
GFR < 15 ml/min	33 (82.5%)	19 (76%)	**0.001**	4.34	1.72 - 10.96
Clinical signs					
Fluid retention	28 (70%)	18 (72%)	**0.029**	3.11	1.10 - 8.75
TAS ≥ 160 mmHg	19 (47.5%)	12 (48%)	**0.010**	4.49	1.38 - 14.57
TAD ≥ 100 mmHg	12 (30%)	10 (40%)	0.180	2.14	0.59 - 7.77
Biological signs					
Hb level < 8 g/dl	25 (62.5%)	14 (56%)	**0.012**	3.79	1.31 - 11.01
Hypocalcemia	35 (87.5%)	16 (64%)	**0.000**	8.02	2.73 - 23.6
Hyperphosphatemia	18 (45%)	14 (56%)	0.539	1.47	0.43 - 5.03
CRP ≥ 20 mg/l	32 (80%)	25 (100%)	**0.006**	3.6	1.41 - 9.61

Table 7. Factors associated with the occurrence of left ventricular dilatation in multivariate analysis.

			Confidence interval	
Variables	p-value	OR	Inferior	Superior
Socio-demographic data				
Age < 55 years	0.196	2.152	0.673	6.877
Male	0.199	0.521	0.193	1.409
Medical history				
HBP	0.060	0.297	0.084	1.050
Diabetes	**0.023**	5.315	1.260	22.419
Initial nephropathy				
Hypertensive nephropathy	**0.005**	0.174	0.052	0.585
Clinico-biological data				
Fluids retention	0.930	1.047	0.378	2.898
GFR < 15 ml/min	0.631	1.392	0.361	5.369
SAR > 160 mmHg	0.289	0.599	0.233	1.543
Hb level < 8 g/dl	0.506	0.702	0.247	1.991
Hypocalcemia	**0.005**	6.094	1.723	21.559
CRP > 20 mg/l	0.131	0.397	0.120	1.318

48.87 ± 14.47 years. There were 62.5% male patients with a sex ratio of 1.7 in favor of men. These proportions are comparable to those found in the different studies conducted in Ghana and Nepal [7] [8]. The mean age was 43.9 ± 17.8 years and 59.36 ± 14.337 years respectively in Nepal and in Ghana [7] [8]. The predominance of male gender was also reported by Yaw *et al.* as 64.5% [8]. The predominance of chronic renal failure in relatively young males can be explained in part by the role of environmental factors, notably smoking, alcoholism and occupational exposure, in the occurrence and progression of renal pathologies [9]. The frequency of chronic end-stage renal disease (GFR < 15 ml/mn/1.73m^2) in our series was 83.7%. It was reported 51.2% in Uganda [10]. The causes of chronic renal failure were dominated by chronic glomerulonephritis (55.8%) and hypertensive nephropathy (39.1%) In Nepal, hypertensive (35%) and diabetic (31%) nephropathy were the main causes of chronic failure followed by chronic glomerulonephritis (14%) [7]. CKD due to the progression of hypertensive disease, is more frequent in black subjects than in Caucasians. There is a genetic predisposition of the black race to develop CKD more rapidly. The association of HBP and CKD is very frequent and most chronic kidney diseases are complicated by hypertension at the terminal stage [11]. In addition to the so-called classical risk factors (sedentary lifestyle, dyslipidemia, arterial hypertension, diabetes, chronic alcoholism, chronic smoking and obesity) that patients with CKD share with the general population, they have risk factors that are spe-

cific to them such as anemia, chronic inflammatory profile, fluids retention, arteriovenous fistula and phosphocalcic disorders [12]. In our series, we reported arterial hypertension (77.9%), smoking (26%), diabetes (20.2%) and drug abuse (1%). Indeed, all kidney diseases can be complicated by hypertension at the terminal stage, probably due to chronic stimulation of the renin-angiotensin-aldosterone system [10]. During CKD, the left ventricle undergoes structural and functional changes secondary to pressure and volume overload and cell apoptosis [13]. Out of 104 chronic renal failure patients who performed transthoracic echocardiography, 82 patients (78.8%) had an abnormality. Our data is comparable to those of some authors which reported 74% of abnormalities [7]. Regarding the functional data, in our series we reported 26% of hypokinesia and 3.8% of hyperkinesia. The preponderance of hypokinesia was found in the study by Fongoro in Mali with 44.74% of cases [14]. Structurally, the morphological abnormalities observed on cardiac ultrasound were dominated by chamber dilatation (62.5%), wall hypertrophy (33.6%) and pericardial detachment (22.1%). In Africa, several studies showed higher frequencies of pericarditis on echocardiography. Thus in Uganda and Mali the frequency was respectively 22% and 19.04% [10] [14]. In our study, the changes (dilatation and hypertrophy) of the cardiac structure concerned preferentially the left heart (left ventricle and left atrium). These changes appear to be adaptive responses to pressure and volume overload by stretching existing myocytes and thus increasing the internal dimensions of the left ventricle [15]. Out of the 35 cases of cardiac wall hypertrophy (33.6%), 21 cases of left ventricular hypertrophy (20.2%) were collected. Studies carried out in Uganda, Ghana and Nepal reported cases of left ventricular hypertrophy with proportions of 54.4%, 43%, and 49% respectively [7] [8] [9]. In literature, the prevalence of left ventricular hypertrophy (LVH) in the population of CKD would vary between 60% - 75% [16] [17]. Regarding the associated factors, only male gender and hypertensive nephropathy were associated with the occurrence of LVH in our study. In the study by Yaw in Ghana, in addition to male gender, the occurrence of cardiac abnormality such as left ventricular hypertrophy was caused by systolic blood pressure (SBP), diastolic blood pressure (DBP) and body mass index (BMI) [8]. Out of the 65 cases of heart chamber dilatation (62.5%), 40 concerned the left ventricle (38.5%). Our result was similar to that found in Mali by Fongoro who reported 40.47% of cases of dilatation of the left ventricle [14]. Dilatation permits to increase cardiac output at a comparable level of energy spending, whereas wall thickening redistributes the increased wall tension over a wider area [4]. A history of hypertension and diabetes, hypertensive nephropathy, and hypocalcemia are incriminated in the development of left ventricular dilatation. The analysis of left ventricular systolic function by cardiac ultrasound is done by measuring the percentage of shortening and the left ventricular ejection fraction [18]. The average left ventricular ejection fraction was 57.24% ± 13.47% with extremes of 20 and 87%. Thirty patients, which is 28.8% had an ejection fraction of less than 50%. In

Uganda, the left ventricular ejection fraction was lower than 50% in 18.9% of patients [10]. This dysfunction is multifactorial including coronary insufficiency, anemia, hyperparathyroidism, uremic toxins, malnutrition and prolonged hemodynamic overload [15].

5. Conclusion

Our study demonstrates the high frequency of LVH and LVD on trans-thoracic echocardiography of advanced chronic renal failure in an Ivorian hospital. Left ventricular hypertrophy (LVH) was associated with male gender and hypertensive nephropathy. History of hypertension and diabetes, hypertensive nephropathy and hypocalcemia were incriminated in the development of LVH. These left ventricular abnormalities were thus associated with traditional cardiovascular risk factors and severe renal impairment. Echocardiographic evaluation studies should be performed in the early stage of chronic kidney disease for early detection of cardiac abnormalities.

Conflicts of Interest

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

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