






Research Article

# Prevalence of Left Ventricular Hypertrophy in Chronic Renal Failure Patients Under Going Hemodialysis in Donka

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## Abstract

**Introduction:** Left ventricular hypertrophy is predictive of mortality in haemodialysis patients and occupies a very high proportion of cardiovascular complications. The aim of this study was to determine the prevalence of left ventricular hypertrophy in chronic renal failure patients under going hemodialysis at the CNHD. **Materials and methods:** This is a descriptive cross-sectional study in the Donka National Hemodialysis Center, running from February 01, 2024 to May 31, 2024. Chronic hemodialysis patients with electrical or echographic LVH were included in the study. **Results:** The number of chronic hemodialysis patients during the period was 405, among whom left ventricular hypertrophy was found in 140 patients or 34.57%. Chronic hemodialysis patients presenting with LVH during the study period had a mean age equal to  $42.1 \pm 14.3$  years, with a sex ratio= 2.3. Of 188 cardiac echograms performed, 112 cases (80%) had concentric hypertrophy and 28 cases (20%) had eccentric hypertrophy. **Conclusion:** The prevalence of left ventricular hypertrophy in chronic hemodialysis patients was found to be 34.57%. Large-scale studies in this chronic hemodialysis population are needed to investigate factors associated with left ventricular hypertrophy, in order to reduce cardiovascular morbidity and mortality.

## Keywords

Left Ventricular Hypertrophy, Chronic Hemodialysis Patients, Donka

## 1. Introduction

Left ventricular hypertrophy (LVH) corresponds to an increase in left ventricular mass due to an increase in myocyte size, often accompanied by myocardial fibrosis [1].

It is characterized by a phenomenon of myocardial adaptation and an increase in cardiac afterload, requiring greater contraction force to eject the same volume. It is a predictive factor for mortality in chronic hemodialysis patients, and accounts for a very high proportion of

cardiovascular complications [2].

Multiple factors associated with declining renal function increase the risk of developing LVH, including anemia, hypertension, hypervolemia and disorders of mineral metabolism [3]. However, several other "non-traditional" risk factors have been identified in recent years that also contribute to the increased prevalence of CVD in this population. The most studied and influential factors in terms

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of cardiovascular risk are inflammation and oxidative stress [4].

The links are close between renal and cardiac pathophysiology, and involve traditional cardiovascular risk factors, but also non-traditional risk factors linked to identified chronic renal failure [5]. Among these specific factors are those directly linked to uraemia, such as hydrosodium overload, anaemia and hyperparathyroidism. Fluid retention contributes to arterial hypertension, LVH and increased arterial wall thickness. All these factors contribute to an increased cardiovascular risk. Patients suffering from chronic kidney disease (CKD) have a high rate of cardiovascular disease (CVD). Indeed, the prevalence of CVD is 10 to 30 times higher in these patients than in the general population [6].

Among cardiovascular complications, left ventricular hypertrophy accounts for a very high proportion of end-stage renal disease patients [7].

Several data are available in Asia, the United States and Europe on this subject,

In the United States Mc Cullough et al (2016) found a 75% prevalence of LVH in dialysis patients [8].

In Italy (2020), Nardi et al. showed a prevalence of LVH among hemodialysis patients in 62.8% of cases [9].

In Japan, (2018) Kosaku et al. reported a 23.4% rate of LVH in hemodialysis patients [10].

In Algeria (2018), Kara et al. reported an LVH prevalence of 59.8% in their study [11].

In Morocco (2014), Eziani et al. had reported in a study carried out on 50 patients including 32 women and 18 men, 5 patients were hypertensive and anemia was found in 48% of cases [12].

In Benin (2017), Vigan et al. reported a 57.5% prevalence of LVH [2].

In Senegal (2016) Ciss éMouhamadou Moustapha et al. showed a 71.05% prevalence of LVH in hemodialysis patients [6].

In Guinea, a study by Balde Elhadj yaya et al. reported a prevalence of LVH of 85.7% in hypertensive patients [13].

Management of hemodialysis patients has improved markedly, but with an increase in cardiovascular complications, which are the main cause of morbidity and mortality. The aim of this study was to determine the prevalence of left ventricular hypertrophy in chronic renal failure patients undergoing hemodialysis at the CNHD.

## 2. Materials and Methods

This is a descriptive cross-sectional study in the Centre National d'hémodialyse Donka, located within the CHU de Donka. This public dialysis center currently has 30 dialysis machines, and is also the only national center for public dialysis, renal disease referral and treatment of chronic end-stage renal failure.

Chronic hemodialysis patients constituted the study material, the study media were the medical records of

hemodialysis patients, dialysis diaries, a Schiller brand Cardiovit FT-1 electrocardiograph, reports of cardiac echography performed free of charge at the CEMECO clinic by a cardiology specialist in search of ventricular hypertrophy and a survey form for data collection.

This is a descriptive cross-sectional study lasting four months, from February 01, 2024 to May 31, 2024.

Chronic hemodialysis patients were targeted during the study period; the study population consisted of hemodialysis patients with a clinical presentation of right, left or congestive heart failure and cardiovascular risk factors despite regularly monitored hemodialysis. Only chronic hemodialysis patients with LVH on cardiac ultrasound were included in the study. ECG was not performed in patients without informed consent to orient the diagnosis of LVH, prior to confirmatory cardiac ultrasound.

Recruitment involved all chronic hemodialysis patients during the study period who met the inclusion criteria. A minimum sample of 140 patients with LVH on cardiac ultrasound was obtained; data were collected on an individual survey form.

Variables were defined by epidemiological data (frequency, age, sex), clinical data (initial nephropathy, duration of dialysis), ECG and cardiac ultrasound data.

### 2.1. Epidemiological Data

- 1) Prevalence: Corresponds to the proportion of hemodialysis patients with left ventricular hypertrophy over a study period.
- 2) Age: Divided into 10-year age brackets, to determine average age.
- 3) Gender: to determine the M/F sex ratio.

### 2.2. Causal Nephropathy

Among the causes we have:

1. Chronic glomerular nephropathy

It was characterized by:

- (1) A history of recurrent edema of the lower limbs;
- (2) Proteinuria  $\geq 1.5$  g/24h;
- (3) High blood pressure.

2. Chronic interstitial nephropathy

It was characterized by:

- (1) A history of recurrent urinary tract infection or urinary lithiasis;
- (2) No proteinuria or moderate proteinuria  $< 1$  g/24h;
- (3) Germ-free leukocyturia.

3. Vascular nephropathy

Clinical and biological evidence in favour:

- (1) A history of arterial hypertension;
  - (2) Moderate proteinuria  $\leq 1$  g/l;
  - (3) Kir Kendall stage 2 or 3 hypertensive retinopathy;
  - (4) Concentric LVH.
4. Diabetic nephropathy

The patient had had diabetes for several years with:

- (1) Micro-albuminuria > 30 mg/24h or macro-albuminuria (proteinuria) >300 mg/24h;
- (2) Diabetic retinopathy on fundus;
5. Indeterminate nephropathies: all nephropathies that have not been classified in one of the nosological groups.
6. Hemodialysis life time: the time spent on hemodialysis since the date of initiation of hemodialysis, measured in months or years.

### 2.2.1. ECG Data

the Sokolow-Lyon index and the Cornell index (used for hypertension) for diagnosing LVH. Thus, we considered LVH in front of the index of:

- 1) Sokolow Lyon: If the sum of SV1+(RV5 or RV6) is >35 mm for patients aged 40 or over.
- 2) Cornell: If the sum of RVL+SV3 amplitudes > 20 mm in women and >28 mm in men. ECG results were interpreted under the assistance of a cardiologist.

### 2.2.2. Cardiac Ultrasound

To detect hypertrophy and/or dilation of the heart chambers, heart failure, pericarditis or valvulopathy. Cardiac ultrasound is performed free of charge at the CEMECO clinic by a doctor specializing in cardiology.

- 1) Ultrasound LVH: When the thicknesses of the

interventricular septum and the posterior wall of the left ventricle are greater than 11 mm at the end of diastole.

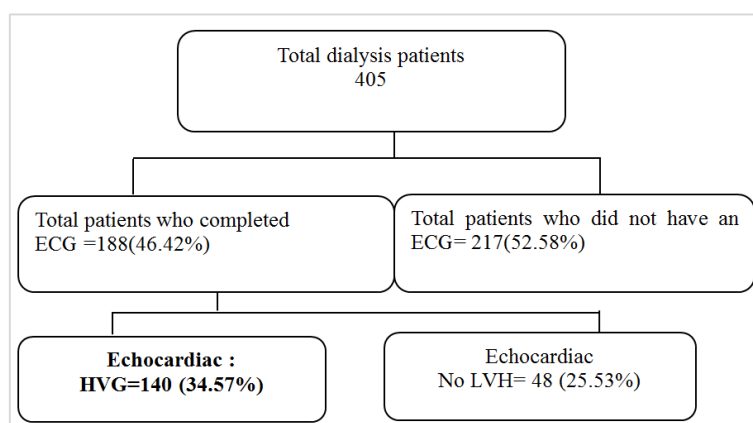
- 2) Concentric LVH was defined as a left ventricular mass index greater than 115 g/m<sup>2</sup> in men and greater than 95 g/m<sup>2</sup> in women, with an RWT greater than 0.42.
- 3) Eccentric LVH was defined as a left ventricular mass index greater than 115 g/m<sup>2</sup> in men and greater than 95 g/m<sup>2</sup> in women, with an RWT less than 0.42.

### 2.3. Data Were Collected on Survey Forms

A data base was created using the Kobocollect application for data entry, then exported to SPSS (*Statistical Package for Social Science*) version 2.1.0 for statistical analysis. Qualitative variables are interpreted in terms of frequencies and proportions, while quantitative variables are interpreted in terms of averages.

## 3. Results

The number of chronic hemodialysis patients during the period was 405, of whom 188 had completed electrocardiograms. Left ventricular hypertrophy was found on cardiac echography in 140 patients, or 34.57% ([Figure 1](#)).



**Figure 1.** Frequency of chronic haemodialysis patients with left ventricular hypertrophy during the study period at the Donka national haemodialysis center.

Chronic haemodialysis patients presenting with LVH during the study period had a mean age equal to  $42.1 \pm 14.3$

years, with extremes of 13 and 75 years; the 36-50 age group accounted for 77 or 55% ([Table 1](#)).

**Table 1.** Age distribution of chronic hemodialysis patients with left ventricular hypertrophy during the study period.

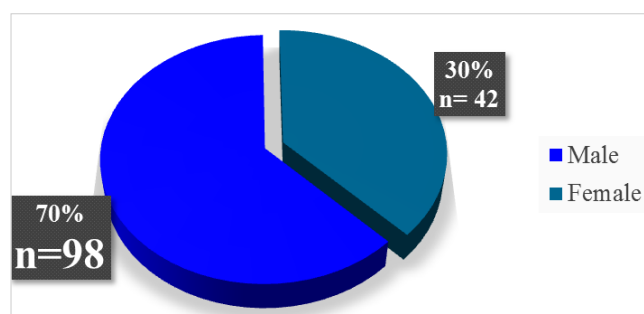
Age ranges	Number (N=140)	Percentage
≤ 20 years	4	2,9

Age ranges	Number (N=140)	Percentage
21 to 35 years old	32	22,8
36 to 50 years	77	55
51 to 65 years	22	15,7
> 65 years	5	3,6
Total	140	100

Mean age:  $42.1 \pm 14.3$  years

Extremes: 13 and 75 years

Of 140 chronic hemodialysis patients with LVH, 98 (70%) were predominantly male, with a sex ratio of 2.3 (Figure 2).



Sex ratio (M/F): 2.3

**Figure 2.** Distribution of chronic haemodialysis patients with left ventricular hypertrophy during the study period by gender.

Of 140 patients under going chronic hemodialysis during the study period, the nephropathy responsible for end-stage renal failure was dominated by vascular nephropathy in 53 patients (37.86%) (table 2).

**Table 2.** Distribution of chronic hemodialysis patients with left ventricular hypertrophy during the study period, according to causal nephropathies.

Initial kidney disease	Number (N=140)	%
Glomerular nephropathy	47	33,57
Nephropathy indeterminate	24	17,14

Initial kidney disease	Number (N=140)	%
Vascular nephropathy	53	37,86
Diabetic nephropathy	13	9,29
Chronic tubulointerstitial nephropathy	3	2,14

Out of 140 chronic hemodialysis patients, 56 (40%) were in the 3-9 month range (Table 3).

**Table 3.** Distribution of chronic haemodialysis patients with left ventricular hypertrophy during the study period, according to length of haemodialysis.

Length of time on hemodialysis (in months)	Numbers (N=140)	Percentages
3-9	56	40
10-16	13	9,29
17-23	24	17,14
>24	48	34,28

Out of a total of 188 ECG cases, 145 cases or 77.13% showed left ventricular hypertrophy according to the Sokolow index with a mean  $=44.9 \pm 16.7$  mm. According to the average Cornell index  $= 23.5 \pm 1.2$  mm, with a predominance in men with an index  $\geq 28$  mm in 38 cases or 20.2%, and in women with an index  $\geq 20$  mm in 38 cases or 20.2% (Table 4).

**Table 4.** Distribution of chronic hemodialysis patients with left ventricular hypertrophy during the study period, by ECG result.

ECG	Numbers (N = 188)	Percentages
Yes	188	100
Sokolow-Lyon index (mm)		
Normal (< 35)	43	22,87

ECG	Numbers (N = 188)	Percentages
$\geq 35$	145	77,13
Cornell index (mm)		
< 20 (Female)	34	18,1
< 28 (male)	78	41,5
$\geq 20$ (Female)	38	20,2
$\geq 28$ (Male)	38	20,2

Mean Sokolow index:  $44.9 \pm 16.7$  mm Extremes: 6 and 97.2 mm

Average Cornell index:  $23.5 \pm 11.2$  mm Extremes: 2.6 and 70.8 mm

Of 140 cardiac ultrasounds performed, 112 cases (80%) had concentric hypertrophy and 28 cases (20%) had eccentric hypertrophy (Table 5).

**Table 5.** Distribution of chronic hemodialysis patients with left ventricular hypertrophy during the study period, according to cardiac ultrasound findings.

Cardiac ultrasound results	Number (N=140)	Percentages
Concentric HVG	112	80
HVG eccentric	28	20

The association between gender and left ventricular hypertrophy on cardiac ultrasound yielded a statistically significant result with P-value =0.003; more specifically,

male gender had a positive influence on left ventricular hypertrophy (Table 6).

**Table 6.** Distribution of chronic hemodialysis patients with left ventricular hypertrophy on cardiac echocardiography and associated gender.

HVG		HVG Concentric	HVG Eccentric	Total	Chi-2 Square	P-Value
Gender	F	33 (23,57%)	7 (5%)	40	138,526	0,4
	M	78 (55,71%)	20 (14,29%)	98		0,003
Total		111 (79,29%)	27 (19,29%)	138	140	

## 4. Discussion

The present study was conducted at the Donka CNHD. We enrolled 140 patients over a 4-month period, all of whom met the inclusion criteria.

The prevalence of LVH reported in our series was 34.57% on cardiac ultrasound. The mean age was  $42.1 \pm 13.3$  years. Men were the most affected in our series, accounting for 70%, i.e. a sex ratio of 2.3. The nephropathy responsible for end-stage renal failure was dominated by vascular

nephropathy in 53 patients, i.e. 37.86%. Out of 140 chronic hemodialysis patients presenting with left ventricular hypertrophy on cardiac ultrasound, the age, expressed in months, of 56 patients (40%) was between 3 and 9 months. In our study, 140 patients showed left ventricular hypertrophy on cardiac ultrasound. LVH was concentric in 112 patients (80%), and 28 patients had eccentric LVH (20%). The association is particularly significant, with P-value =0.003, between male sex and positive influence on left ventricular hypertrophy.

Several studies have been carried out on the subject, and

each has found a greater or lesser frequency of LVH in dialysis patients.

Chargui et al. reported a higher prevalence than ours, with 65% LVH in a study of 60 patients carried out in 2021 [14]. Faye et al. reported a 50.57% prevalence of LVH in a study of 97 hemodialysis patients [15]. Foley et al. found 39.4% concentric LVH in their patients [16]. A study by Levin et al. reported that concentric LVH appears very early in the natural history of chronic renal failure [17]. Zhou et al., on the other hand, found 71.8% eccentric LVH [18].

Ashok Vankayala et al. obtained a mean age of  $43.27 \pm 10.1$ , higher than our results [19]. Vigan Jacques et al. reported a lower result, with a male predominance of 61% and a sex ratio of 1.6 [2]. The difference in study population, study duration, sample size, collection method, socio-economic factors, despite the same LVH assessment criteria, could be the reasons for this difference.

The study's limitations in comparison with the literature are mainly due to the type of study, which is cross-sectional in this series, but also to the difference in study duration. However, the study populations are the same. The results of these different studies are super imposable, giving the study internal and external validity. This comparison gives a generalizability to the results obtained in relation to certain data in the current literature.

- 1) Ethical considerations: in the field, informed consent was obtained from participants before submitting them to the questionnaire, and strict confidentiality was observed.
- 2) Study limitations: patients with central venous catheters and those with fistulas were reluctant to have electrodes placed, and the lack of informed consent corresponding to 217 hemodialysis patients (52.58%) despite information on non-invasive cardiac ultrasound.
- 3) Conclusion: patients suffering from chronic renal failure have a high rate of cardiovascular disease. The prevalence of cardiovascular disease is 10 to 30 times higher in these patients than in the general population. In this study, the prevalence of left ventricular hypertrophy in chronic hemodialysis patients was found to be 34.57%. The mean age of these patients was  $42.1 \pm 14$  years, with a male predominance. Cardiac ultrasonography found 112 cases of concentric ventricular hypertrophy in 80% of chronic hemodialysis patients. Large-scale studies in this chronic hemodialysis population are needed to investigate factors associated with this left ventricular hypertrophy, in order to reduce cardiovascular morbidity and mortality.

## Abbreviations

CHU	Centre Hospitalo-Universitaire
CNHD	Donka National Hemodialysis Center
ECG	Electrocardiogram
LVH	Left Ventricular Hypertrophy
BMI	Body Mass Index
CKD	Chronic Kidney Disease

CVD      Cardiovascular Disease

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## Conflicts of Interest

The authors declare no conflicts of interest.

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