
Echocardiographic Abnormalities in Hemodialysis Patients in Togo

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Abstract: Cardiovascular diseases (CVD) are a common complication among patients with end-stage chronic kidney disease (CKD). They represent the leading cause of mortality in hemodialysis patients. In a resource-limited setting, our objective was to assess echocardiographic aspects in chronic hemodialysis patients through a case series study conducted over a 24-month period, from January 2019 to December 2020. We included all patients who had been undergoing iterative hemodialysis sessions for at least 6 months and had undergone at least one cardiac ultrasound in the nephrology department. In total, 79 patients were enrolled, with an average age of 47.5 years and a sex ratio of 0.93. Hypertension (HTN) was observed in 84.8% of patients, and obesity was present in 39.2%. The main structural abnormalities included left ventricular hypertrophy (LVH) in 64.6% of cases and dilatation in 36.7% of cases. Left atrial (LA) and right atrial (RA) dilatations were observed in 36.7% and 15.2% of cases, respectively. Cardiac valve lesions observed were primarily calcifications. Echocardiography, a readily accessible non-invasive medical imaging technique, revealed a high prevalence of LVH and signs of inadequate dialysis in our population.

Keywords: Echocardiography, Hemodialysis, Chronic Kidney Disease, Togo

1. Introduction

Cardiovascular disease (CVD) is one of the most common complications in patients with end-stage chronic kidney disease (ESRD) [1]. Approximately 80% of hemodialysis patients will develop cardiovascular complications during their follow-up [2]. Cardiovascular complications are the leading cause of mortality, accounting for 45% to 50% of all deaths [3]. These cardiovascular complications result from a complex combination of factors such as anemia, arteriovenous fistula (AVF), arterial hypertension (AH), bone mineral disorders, inflammation and infections [4].

To assess and prevent these cardiovascular complications,

transthoracic echocardiography is the tool of choice. It is a non-invasive method that offers a relatively accurate assessment of cardiac structure and function. In this context, a study was carried out to examine echocardiographic aspects in chronic hemodialysis patients, specifically within the nephrology and hemodialysis department of the Centre Hospitalier Universitaire Sylvanus Olympio (CHU SO).

2. Materials and Methods

a. Setting and type of study

The Nephrology and Hemodialysis Department of the Sylvanus Olympio University Hospital in Lomé served as the

setting for our study. The CHU SO was Togo's largest public hospital, with a nephrology department, a hemodialysis center and a cardiology department with a functional exploration unit.

This was a descriptive, cross-sectional case series study conducted over a 24-month period, from January 1, 2019 to December 31, 2020.

b. Inclusion and non-inclusion criteria

Our study included all patients, of all genders and ages, followed in the nephrology department for iterative hemodialysis sessions for at least 6 months and having at least one cardiac ultrasound. Patients who had been on hemodialysis for less than 6 months, those with incomplete records and those dialyzed for acute renal failure were excluded.

c. Variables studied and data analysis

Demographic information was collected for each participant, including gender, age, geographical location and profession. Clinical and paraclinical information, such as initial nephropathy, pre-dialytic blood pressure, interdialytic weight gain (IDWG), blood count (CBC), renal function tests (RCT) and renal function tests (RPT), was collected. Clinical and paraclinical information such as initial nephropathy, pre-dialytic blood pressure, interdialytic weight gain (IDWG), blood count, fasting blood glucose, creatininemia, frontal chest X-ray and echocardiographic aspects were collected.

These data were collected with Excel 2019 and analyzed using Epi info software. Quantitative variables were presented as mean and standard deviation, and descriptive results were expressed as percentage and proportion for qualitative variables. Frequency measurements were performed. A comparative analysis was performed to search for a difference between the variables collected at inclusion. Statistical tests used were Pearson's Chi-square test or

Fisher's exact test for qualitative variables and Student's t test for quantitative variables. The significance level was set at 0.05.

d. Operational definitions

Ultrasound left ventricular hypertrophy (LVH) was defined as a left ventricular mass index greater than or equal to 115g/m² in men and 95g/m² in women, bearing in mind that the ventricle is variable in normal subjects according to race and age.

Pulmonary hypertension was defined as a mean pulmonary arterial pressure greater than 25 mmhg at rest or 30 mm Hg on exertion, with a mean pulmonary arterial pressure greater than 30 mm Hg on exertion.

Socioeconomic level classified according to the Togolese SMIG (Salaire Minimum Interprofessionnel Garanti) of 52500 FCFA made it possible to make 3 socioeconomic groups: low socioeconomic level (income ≤ SMIG), medium socioeconomic niveau (SMIG ≤ income ≤ 3 xSMIG) and high socioeconomic level (income ≥ 3 xSMIG).

3. Results

The nephrology department's hemodialysis unit welcomed 171 new patients during the study period. Of these, 138 patients had CKD. Of these, 79 had at least one cardiac ultrasound. The mean age was 47.5±13.4 years, with extremes of 17 and 69 years. The sex ratio was 0.93. The remaining socio-demographic characteristics are shown in Table 1. High blood pressure (84.8%) and obesity (39.2%) were the dominant traditional cardiovascular risk factors. Initial nephropathies leading to hemodialysis were distributed as shown in Figure 1. The mean duration of dialysis was 24.7 ± 12.8 months, with extremes of 6 and 183 months.

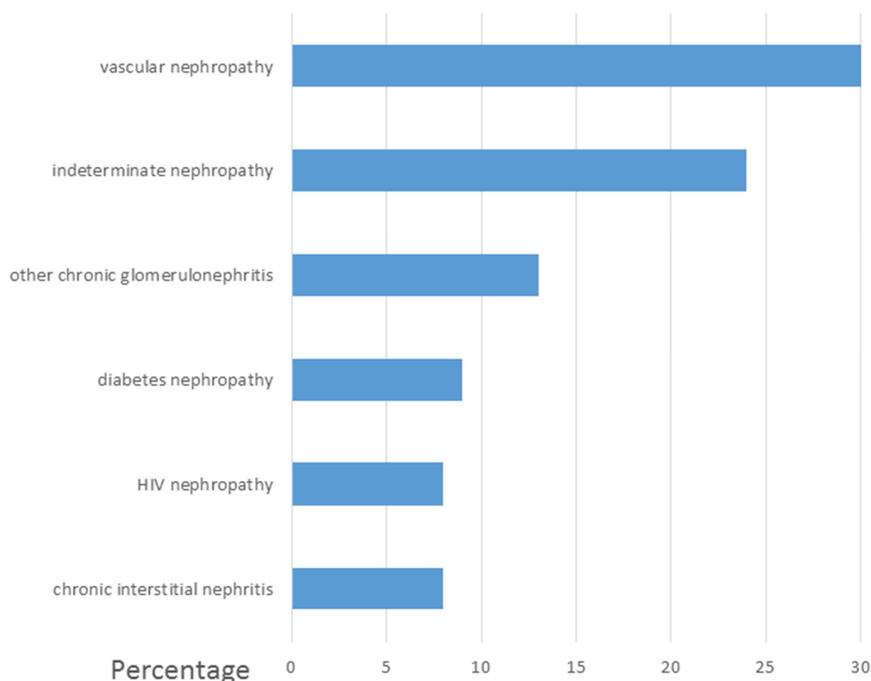


Figure 1. Distribution of hemodialysis patients according to initial nephropathy, CHU Sylvanus Olympio.

Table 1. Sociodemographic characteristics of hemodialysis patients, CHU Sylvanus Olympio.

| Age range | Number | Percentage |
|-----------------------|--------|------------|
| 15-20 | 1 | 1,3 |
| 21-30 | 9 | 11,4 |
| 31-40 | 23 | 29,1 |
| 41-50 | 35 | 44,3 |
| 51-60 | 8 | 10,1 |
| ≥60 years | 3 | 3,8 |
| Gender | | |
| Male | 38 | 48,1 |
| Female | 41 | 51,9 |
| Socio-economic status | | |
| High | 7 | 8,9 |
| Medium | 20 | 25,3 |
| Low | 52 | 65,8 |

Mean interdialytic weight gain was 3.8 + 2.1 kg, with extremes of 0.9 and 6.1 kg. All patients dialyzed 8 hours per week. Of the 58 patients with arteriovenous fistula (AVF), 51.7% had a proximal location. Anemia was noted in 97.5% of cases, hyperphosphatemia and hypocalcemia in 26.6% and 45.6% of cases respectively. Hyperkalemia and hyponatremia were observed in 2.5% and 17.7% of patients respectively. Mean values for biological parameters are summarized in Table 2, and radiological findings are summarized in Table 3.

Table 2. Biological characteristics of hemodialysis patients.

| | average | EcartType | Min | Max |
|-------------------|---------|-----------|-------|-------|
| Hemoglobin level | 9,6 | 3,2 | 4,4 | 12,0 |
| Phosphorus (mg/l) | 48,3 | 16,4 | 31,0 | 67,8 |
| Calcium (mg/l) | 81,4 | 18,7 | 65,0 | 102,0 |
| Potassium (meq/l) | 4,1 | 0,1 | 3,0 | 7,6 |
| Sodium (meq/l) | 129,5 | 12,3 | 112,0 | 151,0 |
| Protein level | 31,4 | 10,9 | 17,0 | 73,9 |

Table 3. Radiological Anomalies.

| | Number | percentage |
|------------------------|--------|------------|
| Cardiomégaly | 41 | 51,9 |
| Pneumopathy | 14 | 17,7 |
| Pleurisy | 3 | 3,8 |
| Acute pulmonary oedema | 1 | 1,3 |

Cardiac ultrasound abnormalities were classified into 2. Structural abnormalities, present in all patients, and functional abnormalities, found in 36.7% of patients. Structural abnormalities were dominated by LVH in 64.6% of cases; dilatation was observed in 36.7%. Study of the atria revealed dilatation of the left atrium (LA) in 36.7% of cases, and of the right atrium (RA) in 15.2%. Valvular lesions were calcifications. Pericardial effusion was noted in 7.6% of cases. Functional abnormalities are illustrated in Figure 2.

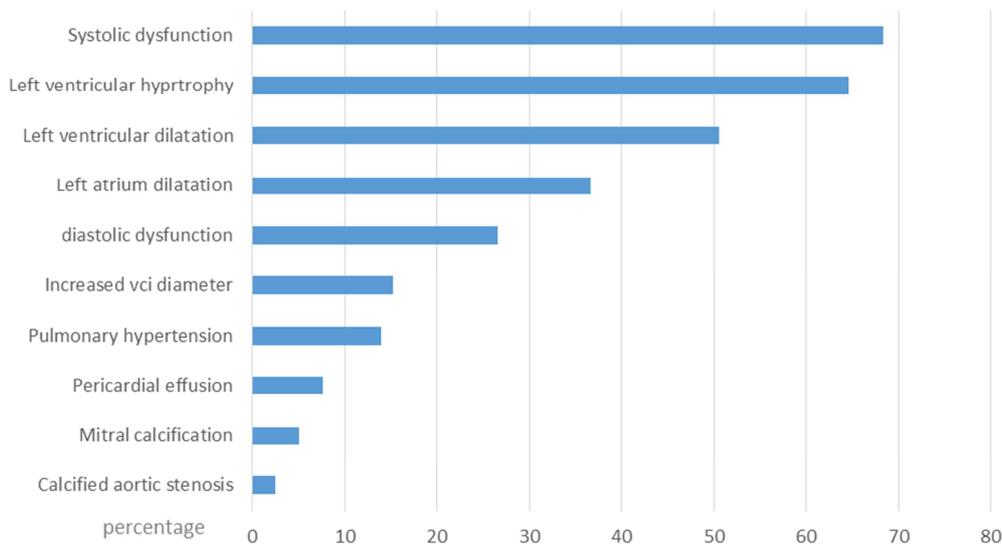


Figure 2. Echocardiographic abnormality in hemodialysis patients, CHU Sylvanus Olympio.

4. Discussion

The nephrology and haemodialysis department of CHU SO was the ideal setting for studies concerning chronic end-stage renal failure in Togo, as not only does it have sufficient technical resources but it receives patients from all over Togo and even from neighbouring countries and the sub-region. This study showed that all patients (100%) in the CHUSO hemodialysis unit had echocardiographically detectable cardiovascular disease. This high prevalence of

echocardiographic abnormalities contrasts with the 44.6% frequency found in a similar study in Bamako [5]. This may be explained by the fact that our patients have been on dialysis for an average of 24.6 months. Indeed, the frequency of cardiovascular complications would be directly related to the duration of dialysis [6]. Several cardiovascular risk factors contribute to this, the main one being hypertension (84.8% in our series, as in the study by Yattara et al in Bamako [5]). In addition to these known traditional risk factors (FDR), there are non-traditional risk factors such as anemia, hydrosodium overload, inflammation and

hyperhomocysteinemia [3].

Structural abnormalities were found in 100% of cases. Left ventricular hypertrophy (LVH) was the predominant lesion, accounting for 64.6% of cases. All studies in Africa concur and have found a frequency of between 50 and 75% of LVH in hemodialysis patients [7-9]. It is a major determinant of mortality [1]. Indeed, in a 2014 mortality study by Djibril *et al* in the same hemodialysis unit in Togo, LVH was found to be the 2nd factor associated with mortality [10]. At that time, overall survival was 50% at 6 months and 33.3% at one year [10]. LVH is present in around a third of all patients with chronic kidney disease (CKD), and increases to 70-80% in patients with end-stage renal disease [11]. This is the main feature of uremic heart disease [12]. The second feature of uraemic cardiomyopathy, apart from LVH, is the development of myocardial fibrosis followed by dilatation of the heart [1].

In our series, the frequency of dilatation of the left cavities, LV in 50.6% and OG in 36.7%, was similar to Yattara's data [5]. This dilatation of the left cavities is secondary to volume overload [5]. The latter itself depends on 3 essential factors: anemia, fluid retention and arteriovenous fistula [5]. Almost all patients had anemia due to the fact that they were receiving little or no erythropoietin supplementation. Epoetin-alpha, the supposedly least expensive of the available erythropoietins, was not widely available in Togo [13]. Its administration represents a budget of 222,000 FCFA, or 656 euros per month, which is not covered by social security, leaving no choice for the majority of patients with very low monthly incomes. Hydrosodic retention was reflected by excessive interdialytic weight gain in our patients, who were on subdialysis with only 08H per week of dialysis, and an average pre-dialysis systolic blood pressure of 164.3 mmHg. Pericarditis and pleurisy accounted for 7.6% and 15.2% respectively. These data fall far short of dialysis adequacy standards, and reflect the difficulty of access to hemodialysis treatment in Togo [13].

This inadequacy is also illustrated by the number of patients still wearing catheters (21 patients) after at least 6 months of dialysis. In addition, among patients with AVF, the predominantly proximal location in young subjects suggests dysfunction.

Valvular lesions reported in our series (7.7% of cases) were less frequent than in the series by Yattara in Bamako and Moustapha in Dakar, which found 30.1% and 44.7% respectively [5, 7]. Valvular anomalies were mainly represented by valvular calcifications caused by mineral-osseous disorders, but also by hydrosodic retention. In the advanced stage of CKD, extra-skeletal calcifications may be observed due to the constant increase in phosphocalcic product, such as vascular and cardiac calcifications [14].

5. Conclusion

All our patients had a cardiac abnormality on ultrasound. These abnormalities were dominated by left ventricular hypertrophy. This could be explained by the high frequency

of traditional risk factors such as hypertension and obesity, but also by the importance of non-traditional risk factors such as anaemia and fluid overload. The latter was accompanied by other stigmata indicative of sub-dialysis. Some patients had valvular anomalies dominated by calcifications. This study has once again highlighted the importance of cardiac ultrasound in haemodialysis patients. It is an easily accessible non-invasive medical imaging technique.

There is an urgent need to make the management of chronic kidney disease a national priority, not only to reduce mortality but also to improve patients' quality of life.

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