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Epidemiological and Clinical Aspects of Heart Attacks in Haemodialysis at the Amirou Boubacar Diallo National Hospital in Niamey (Niger)

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Abstract

***Background:** Cardiovascular complications in hemodialysis patients are correlated with high mortality.*

***Objective**: to study the epidemiological and clinical aspects of heart disease in hemodialysis patients at the Amirou Boubacar Diallo National Hospital in Niamey (HNABDN) in Niger in 2021.*

***Methods:** This was a cross-sectional study conducted from November 2020 to March 2021 in the nephrology ward of the HNABDN. Were included, all chronic hemodialysis patients with a seniority of more than three months and consenting. Cardiac involvement was detected on a frontal chest X-ray and / or an EKG and / or a cardiac ultrasound. Sociodemographic, clinical, paraclinical, therapeutic and those related to hemodialysis variables as well as cardiovascular risk factors were studied.*

***Results**: A total of 51 hemodialysis patients were included. The average age was 47 ± 15 years. The sex ratio was 3.64. The mean length of time on hemodialysis was 46.22 ± 36.78 months. Hypertension was the most common risk factor in 88% of cases. As cardiac involvement, cardiomegaly was at 88.24%, repolarization disorders at 33.33%, cavitary dilation at 68.63%, concentric left ventricular hypertrophy at 31.37%, Mitral insufficiency and Valvular calcifications were found in 27.45% and 23.53% of cases, respectively.*

***Conclusion**: Frequent cardiovascular complications in hemodialysis patients. The involvement of cardiologists in the management of hemodialysis patients is necessary.*

Keywords: *Heart attacks, epidemiology, cardiovascular factors, Niger*

Introduction

Cardiovascular complications are the leading cause of death in patients undergoing chronic hemodialysis [1]. They are a major cause of morbidity in patients with chronic renal failure [2]. The death rate from cardiovascular disease in dialysis patients is 10 to 30 times higher than in the general population [3]. It should be remembered that all cardiac tunics can be involved [4-6].

Indeed, chronic renal failure (CRF) is associated with a true so-called uremic cardiomyopathy associating abnormalities in the size, geometry and function of the heart which are found in 70 to 80% of hemodialysis patients. The most common abnormality is left ventricular hypertrophy, the prevalence of which is correlated with the degree of renal failure. Heart failure is the most common clinical manifestation of this cardiomyopathy, and the rate of sudden death is particularly high in the latter, at 35% [7]. These cardiovascular complications are favored by the same risk factors as in the general population but also by

other mechanisms more specific to chronic renal failure such as arteriovenous fistula, anemia, volume factors and myocardial calcifications. [8].

Taking into account the frequency of cardiac complications in hemodialysis patients, the high mortality rate associated with them and the lack of study on the subject in our context, we deemed it useful to conduct this study in order to determine the epidemiological and chronic hemodialysis patients heart clinic at the Amirou Boubacar Diallo National Hospital in Niamey (Niger).

Methods

Study Framework: The nephrology department of the Amirou Boubacar Diallo National Hospital in Niamey (HNABD).

Study Method

Type and period of study: This was a cross-sectional study carried out over a period of five months (from November 1, 2020 to March 31, 202),

Study Population: Included were all patients on chronic hemodialysis for more than 3 months, able to answer questions, consenting and having performed during the study period a chest x-ray, an electrocardiogram and a cardiac ultrasound.

Sampling: The recruitment was exhaustive.

A cardiac abnormality was evident on the frontal chest X-ray and / or on the electrocardiogram and / or on the cardiac Doppler ultrasound.

The abnormalities looked for on the chest x-ray were:

- cardiomegaly

- anomalies of the pulmonary vascularization

- abnormalities of the pulmonary parenchyma and the pleura

The electrocardiogram made it possible to find

- Rhythm disturbances

- Repolarization disorders

- Conduction disorders Atrial and / or ventricular hypertrophy,

The cardiac doppler ultrasound looked for

- Pericardial effusion

- Cavitary dilation

- An enlargement of the walls and / or the left ventricular mass

A variation in the diameter of the aorta

Changes in the inferior vena cava

Valve modifications

- Wall kinetics disorders

- Abnormalities of systolic and / or diastolic functions

- Pulmonary arterial hypertension (PAH)

- Filling pressure anomalies.

Some parameters were retained according to their definition. So

- Cardiomegaly is defined by a cardio-thoracic report (RCT)

-> 0.5

- PAH by Systolic Pulmonary Arterial Pressure

- (PAPS)> 36mmHg

- Cavity dilation according to the following diagnostic criteria:

- For the left ventricle dilation is retained
- For man with a telediastolic diameter> 59mm and a telesystolic diameter> 40mm
- For women with a telediastolic diameter> 53mm and a telesystolic diameter> 35mm.
- For the right ventricle, dilation is defined by a basal diameter> 41mm, a

- median diameter> 35mm.

- For the OG and the OD: The expansion is defined by an area ≥20cm2 for

- The OG and a surface ≥18cm2 for the OD.

- Left ventricular mass (MVG): It was evaluated by the Devereux equation

• MVG = 0.8 [1.04 (IVS + LVIDd + LVPW) 3 - LVIDd3] + 0.6 with:

• IVS: end-diastolic thickness of the septum,

• LVIDd: diastolic dimension of the LV cavity,

• LVPW: end-diastolic thickness of the posterior wall [9].

- Left ventricular hypertrophy was defined by an indexed MVG> 88g / m2 in women and> 102g / m2 in men.

- Anterolateral and infero-lateral diastolic thickness: female ≤ 9 mm; man ≤10 mm.

- Left ventricular systolic dysfunction (LVEF) was retained if it was less than 55% on the Simpson Biplane.

- The systolic dysfunction of the right ventricle by a TAPSE <17mm.

Sociodemographic, clinical, hemodialysis and paraclinical variables were studied. The interpretation of the x-ray was done by a radiologist. The electrocardiogram and the cardiac doppler ultrasound were performed and interpreted by a cardiologist. The cardiac doppler ultrasound was performed with a Sono Scape model E2 device

Data were collected through an individual interview using a questionnaire. Data recording and analysis was done with SPSS software version 22.0. The quantitative variables were expressed as mean ± standard deviation and the qualitative variables as number and percentage. Pearson's chi-square test or Fisher's exact chi-square test was used for the comparison of qualitative variables. A p value <0.05 was considered statistically significant.

This is a study of scientific research initiated at the Faculty of Health Sciences of Abdou Moumouni University (UAM). Informed consent from each patient included in the study was obtained. The rules of anonymity and confidentiality were respected.

Results

Rate of Participation

During the period of our study, 168 patients were on chronic hemodialysis, of which 62 met our inclusion criteria. Of these 62 hemodialysis patients, seven had refused and four excluded, thus 51 patients were retained. The turnout was 82.26%

Sociodemographic and Hemodialysis Variables

Of the 51 hemodialysis patients, 40 were male, ie a sex ratio of 3.64. The mean age was 47 ± 15 years [range 22 and 78 years]. The age range [50 to 60 years [was 27.45%.

The mean length of time on hemodialysis was 46.22 ± 36.78 months [range of 3 months and 180 months]. Of the 51 hemodialysis patients, 90.20% performed two hemodialysis sessions per week and 84.32% worked eight hours per week. Arterio fistula. -proximal venous was used for 94.12%. Table 1 summarizes the socio-demographic and hemodialysis variables.

Table1. *Distribution of hemodialysis patients according to socio-demographic characteristics and those of extrarenal purification in 2020.*

	Numbers	Percentage
Gender		
Male	40	78.43
Female	11	21.57
Age (years)<30	09	17.65
[30-40]	09	17.65
[40-50]	07	13.72
[50-60]	14	27.45
≥60	12	23.63
Features of hemodialysis		
Number of sessions per week		
Two	46	90.20
Three	05	9.80
Duration of sessions per week (hours)		
08	43	84.32

10	03	5.88
12	05	9.80
Vascular approach		
Proximal arteriovenous fistula	48	94.12
Central catheter	03	5.88

Clinical Variables, Cardiovascular Risk Factors and Therapeutic Variables

Dyspnea was the most represented functional sign with 58% followed bypalpitations in 56.86% of cases.

As a physical sign, pelvic limb edema was present in 28 patients, or 54.90% of cases.

As cardiovascular risk factors, arterial hypertension, dyslipidemia and sedentary lifestyle were found respectively in 88.24%, 74.51% and 52.94% of cases.

The sodium-reduced diet (94.12%) iron intake (100%) and calcium-vitamin D intake (100.00%), calcium channel blockers (96.08%) and converting enzyme inhibitors (92 , 16%) were the most widely used treatments. Table 2 represents the cardiovascular risk factors, the clinical and therapeutic variables of hemodialysis patients.

Table2. *Distribution of hemodialysis patients according to cardiovascular risk factors, clinical and therapeutic variables of hemodialysis patients in 2020 (n = 51).*

		Numbers	Percentage
Clinical variables			
	Functional signs		
	Dyspnea	29	56.86
	Palpitations	27	52.94
	Chest pain	16	31.37
	Claudication of pelvic limbs	09	17.65
	Physical signs		
	Turgescence of jugular veins	10	19.61
	Edema of pelvic limbs	28	54.90
	Hepato-jugular reflux	02	03.92
	Hepatomegaly	13	25 .49
	Crackling Rails	08	15.69
Cardiovascular risk factors			
	High blood pressure	45	88.24
	Diabetes	05	09 .80
	Obesity	05	09 .80
	Active smoking	05	09.80
	Sedentary lifestyle	27	52.94
	Dyslipidemia	38	74,51
	Anemia	41	80.39
Therapeutic variables			
	Low sodium diet	48	94.12
	Diuretics	04	07.84
	Converting enzyme inhibitor	47	92.16
	Calcium channel blockers	49	96.08

	Beta blockers	13	02.55
	Iron	51	100.00
	Calcium-Vitamin D	51	100.00
	AT II Receptor Antagonists	03	05.88
	Other treatments	15	02.94

Heart Attacks in Hemodialysis Patients

Frontal Chest X-Ray and Electrocardiogram

Frontal chest x-ray: cardiomegaly was the most common radiological sign, ie 88.24% of cases.

On the electrocardiogram: hypertrophy was the most common electrical abnormality followed by repolarization disorders with respectively 39.22% and 33.33% of cases.

Conduction disturbances were present in 15.69% of cases, of which the most represented was 1st degree atrioventricular block (AVB) with 09.80% of cases.

Left ventricular hypertrophy (LVH) was the most prevalent, at 21.57% of cases.

Table 3 summarizes the cardiac abnormalities observed in hemodialysis patients on the frontal chest x-ray and on the electrocardiogram

Table3. *Distribution of hemodialysis patients according to cardiac abnormalities observed in hemodialysis patients on the frontal chest x-ray and on the electrocardiogram in 2020 (n = 51)*

		Number	Percentage
Frontal chest x-ray			
	Signs of pulmonary arterial hypertension	**03**	05.88
	Interstitial syndrome	**05**	09.80
	Pleural effusion	**10**	19.61
	Cardiomegaly	**45**	88.24
Electrocardiogram			
	Rhythm disturbances	**10**	19.61
	Sinus tachycardia	**03**	05.88
	Sinus bradycardia	**06**	**11.76**
	Supraventricular extrasystole	**01**	**1.96**
	Left axial deviation	**09**	17.65
	Electrical hypertrophy	**20**	**39.22**
	Biauricular hypertrophy	**02**	03.92
	Biventricular hypertrophy	**01**	**1.96**
	Hypertrophy of the left atrium	**06**	**11.76**
	Left ventricular hypertrophy	**11**	**21.57**
	Conduction disturbances	**08**	**1.69**
	1st degree atrioventricular block	05	09 .80
	Pre-excitation syndrome	**01**	**1.96**
	Incomplete right bundle branch block	**01**	**1.96**
	Anterior hemiblock	**01**	**1.96**
	Repolarization disorders	**17**	**33.33**

Cardiac Echo-Doppler

Morphological abnormalities were respectively dominated by cavity dilation in 68.63% of cases, concentric left ventricular hypertrophy in 31.37% of cases, ofvalvular kinetics and calcifications in 23.53% of cases each.

Mitral regurgitation and elevated filling pressures were the most common functional abnormalities at 27.45% of cases each, followed by PAH in 19.65% of cases.

The dilation of the left atrium was the most represented followed by the dilation of the cavitiesleft with respectively 21.57% and 13.72% of cases.

Assessment of diastolic function through the mitral filling profile in our series was respectively 37.25% for type 1, 43.14% for type 2and 17.65% for type 3. Table 4 summarizes the distribution of hemodialysis patients according to the cardiac abnormalities observed in hemodialysis patients using cardiac Doppler ultrasound in 2020

Table4. *Distribution of hemodialysis patients according to cardiac abnormalities observed in hemodialysis patients using cardiac Doppler ultrasound in 2020 (n = 51).*

	Number	Percentage
Morphological abnormalities		
Cavity expansion	**35**	**68.63**
Dilation of left cavities	**11**	**21.57**
Biauricular dilation	04	07.84
Left ventricular dilation	03	05.88
Dilation of the right ventricle	01	1.96
Dilation of the left cavities	07	13.72
Dilation of the four cavities	06	11.76
Dilation of the left cavities and the right atrium	03	05.88
Concentric left ventricular hypertrophy	16	31.37
Eccentric left ventricular hypertrophy	02	0.92
Septal hypertrophy	02	03.92
Kinetic disorders	12	23.53
Valvular calcifications	12	23.53
Valve thickenings	07	13.72
Pericardial effusion	07	13.72
Epanchementpéricardique	08	15.69
Left ventricular systolic dysfunction	09	17.65
Biventricular systolic dysfunction	01	1.96
Mitral regurgitation	**14**	**27.45**
Tricuspid insufficiency	04	07.84
Aortic insufficiency	06	11.76
Pulmonary artery hypertension	10	19,61
Increased filling pressures	**14**	**27.45**
Increased filling pressures	09	17.65
Left ventricular systolic dysfunction	01	1.96
Type 1	19	37.25
Type 2	22	43.14
Type 3	09	17.65

Discussion

Cardiovascular Risk Factors

In our study, hypertension was the most common cardiovascular risk factor represented with 88% of cases. Our results agree with the data in the literature, where hypertension is recognized as one of the most frequent and important risk factors linked to the development of cardiovascular diseases and which is very frequently observed during CRF (80% of CRI are hypertensive) [10,11].

Dyslipidemia was found in the majority of our patients with 76% of cases. Our results are similar to those of Moussa Z. et al [12] where dyslipidemia was found in 76.85% of patients.

It has been shown that the uremic environment constitutes a cholesterol deposit bed in the vascular endothelium and peripheral muscles, thus increasing the cardiovascular risk in chronic renal failure [13].

In our sample, the mean hemoglobin was 8.91 ± 2.16 g / dl. Mild anemia was mainly found in 32% of cases. Our results are similar to those of Cissé M. et al [14] where the mean hemoglobinemia was 8.89 ± 1.81 g / dl. Anemia during CRF is common due to lack of erythropoietin production and increased tissue resistance to erythropoietin.

Heart Attacks

Chest X-Ray

Cardiomegaly was the most common radiological abnormality, i.e. 90% of cases, far superior to that of Cissé M. et al in 2016 in Dakar [14] where cardiomegaly represented 63.16% of cases. This cardiomegaly could be linked to a volumetric and / or barometric overload in our patients. which could lead to remodeling of the heart chambers.

Electrocardiogram

In our series, isolated left ventricular hypertrophy was the predominant electrical abnormality, accounting for 22% of cases. Ouaha L. et al in 2009 in Morocco [15] found 32% left ventricular hypertrophy on the ECG. Activation of the renin angiotensin system is stronger in hemodialysis patients with plasma aldosterone which induces left ventricular hypertrophy.

Repolarization disorders were present in 34% of cases and disorderscondu ction in 16% of cases. Our results are similar to those reported by Cissé M et al [14] where repolarization disorders represented 34.21% of cases and conduction disorders 15.79% of cases. In the data in the literature based on the work of Green D. et al, ventricular repolarization disorders mainly occur during hemodialysis sessions [16].

Cardiac Echo-Doppler

Morphological Characteristics

Morphological abnormalities were respectively dominated by dilationcavity found in 70% of cases, at the expense of OG representing 22% of cases, as well as left ventricular hypertrophy in 40% of cases and mainly concentric. Data from the literature report that an increase in the size of the OG during echocardiographic follow-up is linked to an increased cardiovascular risk [7]. In many studies, left ventricular hypertrophy was the most represented anomaly as reported in the series by Cissé M. et al [14] and Ezziani M. et al [17] and where left ventricular hypertrophy respectively represented 71.05%, 56% and 61.1% of cases. This difference could be explained by the fact that on the one hand the majority of our patients presented an increase in the preload therefore of the volume secondary to the anemia, to the AVF and to the hydrosodium inflation which could cause a cavitary remodeling in a dilating form and on the other hand, the fact that hypertension had mainly been found in our patients with as a consequence a barometric overload which could be at the base of a left ventricular hypertrophy. although adaptive in response to wall stress can integrate together to give a mixed form associating dilation and hypertrophy.

Valvular calcifications were present in 24% of our patients. Our results are superimposable on those of Ouaha L. et al [15] where valvular calcifications represented 20% of cases.

Hemodynamic Characteristics

MI and elevated filling pressures were present 28% of the time each. PAH was present in 20% of patients. Our results are similar to those of Adam A. et al in 2019 in Chad [18] who found PAH in 22% of cases. The prevalence of PAH in hemodialysis patients is variable. It could reach 40% according to Yigla M. et al in 2006 [19].

Conclusion

Cardiovascular complications are the leading cause of morbidity and mortality in chronic hemodialysis patients. In our series the most frequent were cavitary dilations in particular that of the OG, the concentric left ventricular hypertrophy among the hypertrophies of the left ventricle, the disorders of the ventricular kinetics, valvular calcifications, mitral insufficiency, elevation of filling pressures and pulmonary arterial hypertension. These results demonstrate the need for special care for these patients, through continuous collaboration between Nephrologists and Cardiologists in order to ensure regular echocardiographic monitoring to prevent the occurrence of these complications and / or to slow their progress.

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