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Research Article

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Cardio-Renal Syndrome: Experience of A Nephrology and Cardiology Department in Senegal In West Africa

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Abstract

Introduction: *Cardio-renal syndrome (CRS) is a complex physio pathological entity affecting the heart and kidneys in which acute or chronic dysfunction of one organ can lead to acute or chronic dysfunction of the other organ. The objective of this work was to evaluate the profiles of patients with cardio-renal syndrome in the nephrology and cardiology departments of the Aristide Le Dantec Hospital (HALD) in Dakar.*

Patients and Methods: *This were a prospective descriptive and analytical study over a period of 6 months. This study included any patient seen in consultation or hospitalized in the nephrology and cardiology departments and presenting with cardio-renal syndrome.*

Results: *The hospital prevalence of CRS was 19.18%. The average age of the patients was 62.128 ± 16.27 years with a sex ratio of 1.54. Forty-three patients (37%) had type 1 CRS; 30 patients (26%) had type 5 CRS; 28 patients (23%) had type 2 CRS; 8 patients had type 3 and type 4 CRS (7% each). The etiologies were dominated by decompensated heart failure (42%) for type 1, ischemic heart disease for type 2, acute lung edema (50%) for type3, nephroangiosclerosis (62%) for type 4 and hypertension (66%) for type 5.*

Conclusion: *Cardio renal syndromes are common in cardiological and nephrological hospitalizations and remain underdiagnosed.*

Keywords: Cardio Renal Syndrome, Dakar, Senegal

1. Introduction

According to a recent definition proposed by the Acute Dialysis Quality Initiative (ADQI) Group Consensus Conference, the term cardio renal syndrome (CRS) has been used to define different clinical conditions in which cardiac and renal dysfunction are one after the other. It is defined as any cardiac and renal disorder by which an acute or chronic dysfunction of one organ can induce an acute or chronic dysfunction of the other organ [1]. Five subtypes have been described. We distinguish between acute and chronic cardio-renal syndromes (types 1 and CRS 2 respectively), acute and chronic reno-cardiac syndromes (types 3 and 4 CRS respectively) and type 5 CRS is characterized by the association of renal failure and heart failure secondary to an acute or chronic systemic pathology [1].

In sub-Saharan Africa, little data is available on the CRS. In Abidjan, a study carried out on 70 patients found a frequency 12.5% of CRS with predominance of type 4 in 65.7% of cases [2]. In Senegal, 3 studies on CRS were carried out only in cardiology departments. Thiam et al. had found a prevalence of 30.05% for type I CRS and Bodian et al. found a prevalence of 3.22% of CRS, and type 2 was found in 97.2% [3,4]. To our knowledge, no study

has been carried out jointly in the nephrology and cardiology departments of the Aristide Le Dantec hospital. The objectives of our study were to determine the prevalence of different types of CRS in our patients, to analyze their epidemiological, clinical, therapeutic and evolutionary profile and to identify the factors influencing the occurrence of CRS.

2. Patients and Methods

This work was carried out in the nephrology and cardiology departments of the Aristide Le DANTE hospital in Dakar. This was a prospective descriptive and analytical study over a period of 6 months from November 1, 2018 to April 30, 2019. Was included, any patient seen in consultation or hospitalized in the services during the study period and suffering from CRS. Data collection was carried out using a pre-established form providing information on socio-demographic data (age, sex, level of study, geographical area, etc.), on patients' comorbidities (high blood pressure, diabetes, heart disease, etc.), on the clinical signs of APE (diuresis disorders, acute uremic syndrome), CKD (chronic uremic syndrome), right ventricular failure (RVF) and/or left, on biological data (hemoglobin level, urea, serum creatinine, blood ionogram, serum calcium, serum phosphate, lipid profile, 24-hour proteinuria, etc.), on morphological data in particular the electrocardiogram, echocardiography (assessment of LVEF, cardiac mass, pulmonary arterial hypertension, valvular heart disease, etc.), renal ultrasound (assessment of the size and of renal differentiation), data relating to types of cardio-renal syndromes and treatments including the use of antihypertensive, diuretic, anticoagulants, statins, dialysis. Cardiovascular collapse was defined as blood pressure less than 80 mmHg. Left ventricular hypertrophy was defined as a left ventricular mass indexed to body surface area greater than 131 g/m2 in men and 100 g/m2 in women. Pulmonary arterial hypertension was defined as a systolic pulmonary arterial pressure greater than 35 mmHg. Data were analyzed using EPI-Info software and continuous variables were presented as average ± standard deviation. p values less than 0.05 were considered significant.

3. Results

During the study period, we collected 610 patients and 117 presented with CRS, representing a hospital prevalence of 19.18%. The average age of the patients was 62.128 ± 16.27 years with a sex ratio of 1.54.

Average systolic and diastolic blood pressures were 130.9 +/- 30.2 mm Hg and 80.9 +/- 10.4 mm Hg. The average diuresis was 536 ml ± 576 ml/24 hours. Forty-four patients or 66.6% had a glomerular filtration rate (GFR) less than 15 ml/min. The clinical data of the patients are given in Tables 1

Quantitatives data	Work Force	Proportion (%)
Past history and comorbities		
- HBP	83	70,9
- Diabetes	24	29,5
- Heart disease	38	32,4
Kidney disease	14	11,9
- Phytotherapy	86	73,5
- Dyslipidemia	20	17
Clinical anemia	40	34
Edemia	65	56
Arterial pressure		
- Cardiovascular collapse	11	9
- Grade I HBP	16	14
- Grade II HBP	24	21
- Grade III HBP	22	19
Diuresis		
- Anuria	10 (31)	9
- Oliguria	7 (31)	6
Kidney disease signs		
● Symptomatique ARF	30	26
- Acute uremic syndrome	20	17,33
- Anuria	10	8,66
● Chronic uremic Syndrome	20	22

Signes of heart failure		
● Isolated LVF	57	48,71
- Dyspnea	38	32,47
- Cough	30	25,01
● Isolated RVF	10	8,54
- STJV	5	4,27
● CHF	47	40,62

ARF: acute renal failure; IVG: left ventricular failure; RVF: right ventricular failure; CHF: congestive heart failure; STJV: spontaneous turgor of the jugular veins.

Table 1: Distribution of Patients According to Past History and Clinical Data

The Biological Data are Given in Table 2.

Biological data	Average (proportions %)
Hemoglobin	9,34 ± 4,13g/dl
Uremia	1,25 ± 0,7g/L
Creatininemia	78 ± 14,56mg/L
Calcemia	89,54 ± 10,35mg/L
Natremia	133 ± 9,55mmol/L
Kaliemia	4,5 ± 1,54mmol/L
Fasting blood sugar	0,98 ± 0,32g/L
Troponinemia	403,24 ± 123,54ng/L
24-hour proteinuria	2,89 ± 1,98g/24H

Table 2A: Distribution of Patients According to Biological Data

Eight patients had undergone coronary angiography, i.e. 6.83%. The main indication was acute coronary syndrome followed by unstable angina. Six coronary angiographies found a predominant involvement of the left sector with partial obstruction of the anterior descending artery in 75%. The Results of Cardiac Echocardiography are Shown in Table 2.

Echocardiographic data	Workforce	Proportions (%)
Heart disease		
- Ischemic	34	39
- Hypertensive	19	22
- Undetermined	17	20
Valvular deseases	1	3
Altered Left Ventricular Fraction (ALV)	54	71,24
- Moderat	18	26,02
- Severe	34	45,21
Dilation of the heart chambers	19	20,21
Pulmonary Arterial Hypertension (PAH)	30	31,9
High Left Ventricular Filling Pressures (HLVFP)	23	25,6

Table 2B: Distribution of Patients According to Echocardiographic Data

Renal ultrasound found small and poorly differentiated kidneys in 10.25%. Forty-three patients (37%) had type 1 CRS, 30 patients (26%) had type 5 CRS, 28 patients (23%) had type 2 CRS, 8 patients had type 3 and type 4 CRS (7% each). The etiologies of cardio-renal syndromes are recorded in Table 3.

Etiologies	Workforce	Proportion (%)
Type 1 CRS		
- Decompensated IC	18	42
- Cardiogenic shock	12	27,9
- Acute coronary syndrome	11	25,2
- Pulmonary embolism	1	2,22
Type 2 CRS		
- Ischemic heart disease	15	53
- Hypertensive heart disease	3	11
- undetermined heart disease	11	29
- Valvulopathy	2	7
Type 3		
- Qcute Pulmonar Edema (APE)	4	50
- Hyperkaliemia	3	37,5
- Anasarca	1	12,5
Type 4 CRS		
- NASB	5	62
- Diabetic nephropathy	2	20,5
Type 5 CRS		
- HBP	20	66
- Diabetes	8	27
- Infectious endocarditis	2	7

Table 3: Distribution of Patients According to CRS Etiologies

Concerning treatment, therapeutic education and lifestyle and dietary measures were prescribed for all patients. As antihypertensives, angiotensin converting enzyme inhibitors alone (ACEI) were used in 78 patients or 57.35% followed by the combination between ACE inhibitors and calcium channel blockers (CI) in 25 patients or 18. 38%. Diuretics were used in 101 patients or 86.2%. Forty-two patients (36%) were on the furosemide and spirinolactone combination. Fifty-eight patients (48%) were on furosemide alone and 16 patients (14%) were on spirinolactone alone (14%).

Thirty-five patients were on anti-platelet aggregations (47%), 24 patients on anti-vitamin K (AVK) (32%) and 15 patients on low molecular weight heparin (LMWH) (20%). Twenty-four patients or 20.51% had benefited from hemodialysis. The main indication for emergency dialysis was acute pulmonary edema (APE) in 50% followed by threatening acute hyperkalemia in 20.58% and metabolic acidosis in 12.5%. Sixteen patients, or 66.6%, had developed stage V chronic kidney disease (CKD) and had to continue dialysis chronically. The average length of hospitalization was 10,427±5 days. Six patients or 5.12% had died, including 5 patients hospitalized in the cardiology department and one patient on dialysis. The causes of death were represented by cardiogenic shock in 4 patients (66%) followed by pulmonary embolism and PAE in 1 patient each (17%).

Concerning the analytical results, age and hypertension were significantly associated with the occurrence of type 1 CRS with p values of 0.021 and 0.05 respectively. Anemia was significantly associated with the occurrence of type 4 CRS with a p of 0.05. age over 60 years, hypertension, hypocalcemia was significantly associated with the occurrence of type 5 CRS with respective p values of 0.045, 0.021 and 0.043. No parameter was associated with the occurrence of types 2 and 3 CRS.

4. Discussion

CRS was found in 117 patients, giving a hospital prevalence of 19.18%. In the literature, the prevalence of CRS is currently difficult to estimate. In 2006, Smith et al. had reported, in a cohort of more than 80,000 patients with heart failure, 30% of patients with a glomerular filtration rate lower than 53 ml/min [5]. A much lower prevalence of 3.2% was found in a Senegalese study at the cardiology department of HALD [4]. The prevalence of type 1 CRS in our study was 37%, which remains high compared to a Spanish study with an incidence of 27.87% [6]. Shah et al. found a prevalence of 46% as did Mathew et al. who found a prevalence of 60.7% [7,8].

In our study, type 1 CRS (37%) predominated, followed by type 5 (26%), type 2 (23%), and types 3 and 4 (7% each). Our results are a little different from those of Austin et al. which found out of 2512 patients, 1707 cases or 67.79% of acute form of the syndrome (type 1 or 3), 128 patients (5.09%) of type 2 and 677 patients (26.95%) of type 4 [9]. Decompensated HF with underlying chronic heart disease was the main cause (57.5%) of type 1 CRS, followed by cardiogenic shock (27.9%) and acute coronary syndrome (ACS: 25.7%).

Numerous studies have been carried out to estimate the incidence of ARF in patients with acute Heart Failure (HF). Ronco et al and Haase et al had shown that on average 27 to 40% of patients hospitalized for acute cardiac decompensation develop ARF [10,11].

This ARF most often occurs in the context of cardiac decompensation [12]. In the literature, the causes of type 1 cardio-renal syndrome are variable, but remain largely dominated by decompensated HF, cardiogenic shock and coronary syndrome as shown in our study [11,12].

In our series, for type 2 CRS the main cause of chronic HF was ischemic heart disease (53%). The prevalence of this syndrome in the literature is between 20 and 40% and is probably underestimated [13,14]. The causes of HF are essentially represented by ischemic and hypertensive heart disease [14]. So, F. sense in 2014, Ronco and Ashwin found similar results with ischemic heart disease as the main etiology in 42% and 8% for hypertensive heart disease [11,15,16]. The high prevalence of ischemic heart disease confirms the high-risk status of our patients. Therefore, screening and monitoring of these patients must be a constant concern.

In our study, APE (50%) and hyperkalemia (37.5%) were the main causes of type 3 CRS these complications most often occurred due to pre-existing organic renal failure in 6 patients and for the other 2 patients the cause of the renal failure was obstructive. The same complications have been reported in several studies and in the same proportions. Thus, Emmanuel et al. found APE in 67% and threatening acute hyperkalemia in 27% [17]. In this syndrome, the secondary acute cardiac attack results from complications of acute renal failure such as acute lung edema due to major hydro sodium overload or the sudden increase in left ventricular afterload on a high blood pressure [18]. Supraventricular rhythm disturbances are secondary to complications of hydro-electrolyte disorders such as hyperkalemia.

Benign nephroangioclerosis was the main cause of type 4 CRS in 62%, followed by diabetic nephropathy in 25%. The mechanism of cardiac damage in this syndrome is complex and multifactorial [19]. The frequency of this cardio-renal syndrome in our study can be explained by the fact that patients are diagnosed with chronic renal failure at a late stage with the already existence of cardiovascular complications. The latter evolving on its own account can lead to cardiovascular complications increasing morbidity and mortality in these patients. The main causes of type 5 CRS were high blood pressure (66%), followed by diabetes (27%) and infective endocarditis (7%) in the context of sepsis. Ronco and colleagues found in several studies between 2008 and 2014 that diabetes mellitus was the main cause of type 5 cardio-renal syndrome in more than 50% [1]. It is well established that diabetes and hypertension are most often responsible for type 5 cardio-renal syndrome because they constitute risk factors for cardiovascular disease and a significant proportion of diabetic and hypertensive patients develop nephropathy.

In our study the main indication for ultrafiltration was APE refractory to diuretics in 5 patients. Indeed, ultrafiltration offers a relatively rapid mechanism for controlling overload with depletion rates of up to 500ml/h. Its potential advantage over loop diuretics is linked to the fact that ultrafiltration is isotonic whereas the urine flow of loop diuretics is hypotonic, ultrafiltration therefore eliminates more sodium (and less potassium) than diuretics for volume loss equivalent [20,21]. Some studies have compared ultrafiltration versus the use of loop diuretics. Currently, guidelines recommend ultrafiltration treatment only for patients who have not responded to initial drug treatment [22].

In our study, diuretics were used preferentially and ultrafiltration was limited only to patients with APE. This can be explained by the unavailability of dialysis to carry out UF sessions which are sometimes very long (more than 4 hours).

5. Conclusion

Cardio-renal syndromes are frequent in cardiological and nephrological hospitalizations and remain underdiagnosed in Sub-Saharan Africa. The diagnosis must be early based on the clinical context and biological and morphological data. The treatment is complex, hence the interest in collaboration between cardiologists, nephrologists and internists.

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