



Original Research

Incidence and Impact of Cardio-Renal Syndrome Type 1 in Patients with Heart Failure

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Abstract

Introduction :

Acute renal failure is detected in more than a third of patients with heart failure, thus defining the acute cardio-renal syndrome. Kidney failure is a risk factor that prolongs hospital stay for heart failure patients and likely leads to treatment failure and recurrent episodes of heart failure. The aim of this study is to assess the incidence and profile of heart failure patients with type 1 cardio-renal syndrome.

Methods :

This is a descriptive retrospective study, having included patients admitted for an attack of heart failure complicated by acute renal failure, during the period extending from January 2020 to December 2022 (2 years) at level of the cardiology department of the CHU-Tlemcen.

Results :

A total of 71 patients: 67.60% of men and 32.40% of women, with an average age of 67 ± 14 years were admitted for a heart failure episode complicated by acute renal failure in a period of 2 years. The most affected age group was that of patients over 70 years old (46.48%). The average length of hospitalization was 15 days with a death rate of 29.58%.

Conclusion :

The association of heart failure and renal failure has a poor prognosis because it often requires modification of the therapeutic strategy recommended in patients with heart failure. Kidney failure is a risk factor that prolongs the length of hospitalization for heart failure patients.

Key words : Acute cardio-renal syndrome, stroke of heart failure, renal failure, Tlemcen.

Introduction :

Thanks to the recognition of the bidirectional links between cardiac and renal functions, and the understanding that the dysfunction of one organ affects the other, a new syndrome of close interaction between the heart and the kidneys has recently been reported: the cardio-renal syndrome [1].

About one in four patients hospitalized for cardiac decompensation has kidney failure [2].

Kidney failure is a risk factor that prolongs hospital stay for heart failure patients, it is also a factor that likely leads to treatment failure and recurrent episodes of heart failure. And vice versa, heart failure can aggravate kidney damage and the latter leads to an increased risk of cardiovascular accidents [2].

Among patients hospitalized for cardiac decompensation in the context of chronic heart failure, 25% presented cardio-renal syndrome type 1. This incidence varies according to the etiology responsible for the cardiac attack [3].

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The aim of this study is to evaluate the incidence and profile of heart failure patients with type 1 cardio-renal syndrome.

Methods :

This is a descriptive retrospective study on admissions for an attack of heart failure complicated by acute renal failure at the University Hospital of Tlemcen, cardiology department. The data was collected retrospectively from January 2020 to December 2022 (2 years). All hospitalized patients with acute heart failure complicated by acute renal failure. We excluded all patients with chronic heart failure and patients with coronary syndrome in KILLIP III and IV.

Collection of data :

Data were retrieved from patient files archived at the Cardiology-Tlemcen department. We studied 71 files from which we collected demographic information (age and sex), history of cardiovascular diseases as well as comorbidities and associated risk factors (hypertension, diabetes, tobacco, chronic renal failure), reason and etiologies for hospitalization and length of hospital stay. We also collected the paraclinical data of the patients (biological examinations, ECG and echocardiography) as well as their therapeutic data during hospitalization and on discharge. And finally we compared the evolution of the different patients.

Statistical analysis :

Data entry and analysis were performed using SPSS 23 and Excel 2016 statistical software.

The description of the sample covers 71 patients. The qualitative variables are presented in the form of counts and percentages and the quantitative variables in the form of means, minimum and maximum.

Results :

We included 71 patients with a male predominance of 67.60% (sex ratio at 2.08). The average age was 67 ± 14 years with extremes of 17 and 95 years. The most affected age group was that of patients over 70 years old (46%). A history of heart disease was noted in the majority of patients (90.10%), then arterial hypertension in 51

patients (83.10%) followed by diabetes (54.9%) and chronic renal failure in 20 patients (28.2%). In our study, 28 patients were smokers (39.40%).

The signs were represented by an array of global (51%) and left heart failure in 39% of patients, while right heart failure was noted in only 10% of patients. 78.90% of the patients presented a clinical symptoms of pulmonary edema and lower limb edema was present in 62%. In this population, 42 patients admitted were oligo-anuric (59%) of which 60.60% of them did not recover their renal function during hospitalization.

In this population, 55 patients had a first attack of heart failure (77.46%), while 16 patients with acute cardio-renal syndrome were hospitalized for recurrence of an attack of heart failure, among them 76.19% died. 30 patients were admitted in shock (42.25%). The majority etiologies of acute heart failure were mainly rhythmic heart disease (46.50%), ischemic heart disease (39.40%), infectious etiologies of which pneumopathy is the most frequent cause of cardiac decompensation (38%), as well as hypertensive peaks at 28.20%. The general characteristics of the population are summarized in Table 1.

Table1 : General characteristics of the study population

Age	<50 years	11.26% (n=8)
	50-70 years	42.25% (n=30)
	>70 years	46.47% (n=33)
Genre	Men	67.60% (n=48)
	Women	32.40% (n=23)
CVRF	Heart diseases	90.10% (n=64)
	Hypertension	71.80% (n=51)
	Diabetes	54.90% (n=39)
	Tobacco	39.40% (n=28)
	Chronic Renal failure	28.20% (n=20)

Etiologies	rhythmic heart disease	46.50% (n=33)
	Ischemic heart disease	39.40%(n=28)
	Infectious etiologies	38% (n=27)
	Hypertensive peaks	28.20%(n=20)

The biological data showed a disturbance of the renal assessment in all the patients with an average creatinine level of 26.37mg/l. We noted that almost half of the patients were anemic (49.3%). In addition, hyponatremia was noted in 55% of patients as well as hypokalemia found in 49.87% of patients with this syndrome (table 2).

Table 2 : Biological characteristics of the study population

Biological parameters	Mean
blood sugar	1.76 g/l
Uremia	1.19 g/l
creatinine	26.37 mg/l
	Percentage
Creat 14-20mg/l	47.89%
Creat >20mg/l	52.11%
Hyperkaliemia	23.94%
Hypokaliemia	47.89%
Hypernatremia	8%
Hyponatremia	55%

Electrically, the electrocardiogram showed abnormalities dominated by atrial fibrillation(AF) (59.20%), left bundle branch block (33.80%) and right bundle branch block (15.50%).

On the echocardiographic level, almost half of the patients admitted had moderate cardiac dysfunction with LVEF between 40% and 50%, while 25.35% of the patients had major cardiac dysfunction. Pulmonary arterial hypertension was noted in 54 patients (76.06%). Almost half of the patients had right ventricular systolic dysfunction (n=36) (table 3).

Table 3 : Electrocardiographic and echocardiographic data

ECG	AF	59.20% (n=42)
	Regular sinus rhythm	38% (n=27)
	Left bundle branch block	33.80% (n=24)
	Right bundle branch block	15.50% (n=11)
LVEF	<40%	25.35% (n=18)
	40-50%	49.30% (n=35)
	>50%	25.35% (n=18)
Systolic Pulmonary BP	Hypertension	70.06% (n=49)
RV	RV dilatation	50.70% (n=35)

In our study only 35% required continuous diuretic treatment, 29% of patients admitted in a state of shock required the administration of a double hemodynamic support. Almost all patients received anticoagulants (90.1%), antiarrhythmics (80.1%) and diuretics in 73.2%. Beta blockers were prescribed to 31 patients (43.7%), ACE inhibitors in 40.8% (29 patients), calcium channel blockers in 9.9% (7 patients) and ARBs in 5 patients (7%) (table 4, 5).

Table 4 : In-hospital hemodynamic and diuretic treatment

medications		
Hemodynamic support	A single hemodynamic support	71.42 %
	Double hemodynamic support	28.57 %
Diuretic	Discontinuous diuretic	65%
	Continuous diuretic	35%

Table 5 : Output processing

Medications	Percentage
Anti coagulants	90.1%
Antihypertensives	83.1%
Antiarrhythmics	80.1%
Diurétiques	73.2%
Beta-blockers	43.7%
IEC	40.8%
Hypolipidemics	19.7%
CCI	9.9%
ARA II	7.0%

The evolution was favorable in 70.42% of patients, while 29.58% died during hospitalization of which 85.70% of them had a history of heart disease (18 patients died), 81% were hypertensives (17 patients died), 14 deceased patients were diabetics and 57.10% of deaths were anemic. The majority of deceased patients had not recovered their renal function during hospitalization (81%) (Table 6).

Table 6 : Rate of deaths according to FDR and history

Poor prognostic factors	Number of deaths	Percentage of deaths	P
Heart disease	18	85.70%	0.417
Hypertension	17	81.00%	0.268
Altered LVEF	16	72.00%	0.038
Age (W>55 M>65 years old)	14	66.70%	0.017
Diabetes	14	66.70%	0.198
Anemia	12	57.10%	0.391
Male gender	10	52.38%	0.032
Chronic renal failure	7	33.33%	0.531
Tobacco	5	23.80%	0.081

Discussion :

Our population is relatively old, as in the majority of African studies carried out on cardio renal syndrome, in particular the study carried out by Maïmouna SOW in 2014 at the Dakar University Hospital in Senegal where the average age found was 62 years with extremes of 17 to 87 years [4]. The risk of occurrence of type 1 cardio-renal syndrome is increased in patients over the age of 70 years, this can be explained by the fact that these patients present at this stage with several comorbidities, in particular diabetes, hypertension and dyslipidemia which can lead to cardiac and renal damage, while the results found by Malick Bodian and his collaborators in 2017 at the level of the Cardiology Service in Dakar, Senegal revealed that the most affected age group was that of 50-70 years with a percentage of 54.6% [5].

In our series, almost all patients admitted for type 1 cardio-renal syndrome had a history of heart disease, which means that the presence of a history of cardiovascular disease is a very important risk factor in the onset of acute cardio-renal syndrome [6]. 71.80% of affected patients are hypertensive, this rate is higher than that found in the study by Malick BODIAN described previously (52.78%) [7]. In the literature, hypertensive patients are 2 to 3 times more likely to have a cardiovascular event compared to normotensive patients. These complications are dominated by heart failure and ischemic heart disease [8,9]. This study found that cardio-renal

syndrome type 1 is associated with diabetes in half of the cases, several studies have shown that the occurrence of cardiovascular events is more frequent in diabetic patients compared to non-diabetics [10]. The etiologies are dominated by rhythmic heart disease and ischemic heart disease, while in other studies ischemic heart disease was the most prevalent [11,12].

In our study, 16 patients were hospitalized for recurrence of acute heart failure, survival in these patients was 21.30% while 78.70% died, this proves that the recurrence rate is a factor of poor prognosis. Global heart failure is the most frequent clinical presentation in our series followed by left heart failure, whereas the study carried out by GRC Millogo in Mali found a predominance of left heart failure (91.3%) [13].

In the Prime II study carried out on patients with severe heart failure, 50% of them had a serum creatinine greater than 15 mg/L [14]., whereas in the study carried out by JULIEN G, a liberal cardiologist in Paris, the rate of patients affected by moderate IR with a creatinine greater than 15 mg/L was 14% [15].

The presence of hyponatremia in half of our population could be explained by hemodilution and inappropriate ADH secretion caused by heart failure. The presence of hypokalemia would generally be secondary to the use of diuretics. Anemia is a factor of poor prognosis in patients with heart failure (HF) and must be systematically sought and corrected, it varies according to the

patient's age, the degree of heart failure and renal failure. In our population almost half of the patients were anemic; this percentage is close to that found by several other studies [16].

The main electrocardiographic anomaly found is complete arrhythmia due to atrial fibrillation with a percentage significantly higher than that found by Awa THIAW (11.1%) as well as Ikama MS and his collaborators (14.35%) [17,18]. LVEF, an important index of severity and poor prognosis of heart failure, was altered in more than two-thirds of patients, whereas McAlister et al. found in their study carried out in the cardiology department in CANADA in 2004 an altered LVEF in 57% [19].

To date, there are no international recommendations on the treatment of a patient with CRS type I. The first-line treatment is based on loop diuretics [20].

ACE inhibitors and AIIRAs are used after recovery of renal function. These drugs could not be administered immediately given the unstable hemodynamic state of our patients.

The average length of hospitalization was 15 days, while the length of hospitalization for patients with CRS type 1 observed in the Cardiology Department of Dakar, Senegal (2017) was 28 days. In our series, the death rate is estimated at 29.58% (21 patients), the same result observed in the study by Maïmouna Sow which found 14 cases of death with a percentage of 25.45% [4], therefore acute cardiorenal syndrome is associated with an increased risk of mortality. A similar percentage was found in the study carried out by Kirsten Bibbins-Domingo [21]. The majority of deceased patients were men over the age of 55. The deceased patients had a history of heart disease, hypertension or diabetes ; as well as an altered LVEF. So the history of heart disease, arterial hypertension or diabetes as well as anemia are pejorative factors of mortality. Also, impaired renal function is associated with an increased risk of mortality.

Limitations of the study:

1. Incomplete document especially during the COVID period

2. Subject not much studied in Algeria.

Conclusion :

The association of heart failure and renal failure has a poor prognosis because it often requires modification of the therapeutic strategy recommended in patients with heart failure.

Although the prevalence of cardio-renal syndrome type 1 is high, this syndrome is not widely studied in Algeria, whereas it is now the subject of various studies in developed countries.

Male sex and age, as well as a history of heart disease, high blood pressure and diabetes are the most dominant risk factors in the occurrence of this syndrome.

The acute cardio-renal syndrome is associated with an increased risk of mortality, so the non-recovery of renal function in the short term is a pejorative factor of morality.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study

Conflicts of Interest: The authors declare no conflict of interest.

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