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A study of cardiorenal syndrome in heart failure

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Abstract

Heart failure is among key reasons of hospitalizations throughout the world. Prevalence is 1% among the ages of 50 and 59 years, gradually growing to >10% over age of 80 years.

In patients with heart failure, concomitant and notable renal impairment is prevalent. Heart failure is increasingly being classified as a type of cardiorenal failure, in which there are contemporaneous cardiac and renal dysfunctions, each of which accelerates the progress of the other. One-fourth of patients admitted to the hospital for treatment of ADHD[1] will have notable impairment of renal function, which is linked to worse outcomes.

It stays uncertain whether or not worsening renal function particularly contributes to poor consequences or whether it is simply a marker of advanced cardiac and renal dysfunction. Inspite of the fact that the definition of diuretic resistance, its prevalence, and prognostic consequences are less well understood, diuretic resistance, without or with decreasing renal function, is not uncommon in ADHF[1].

The etiology of cardiorenal syndrome is unknown, however it is thought to involve interconnected hemodynamic and neurohormonal pathways.

Mechanical fluid elimination using ultrafiltration, hemofiltration, or haemodialysis may be required for resistant hypervolemia when usual treatment for acute decompensated heart failure fails. While ultrafiltration helps deal with diuretic resistance, it's unclear whether treatment can help individuals with cardiorenal syndrome avoid worsening renal function or enhance their outcomes. In our observational study we are going to assess the risk factors, etiology and clinical outcome of Cardio-renal syndrome

Keywords: Heart failure, ultrafiltration, hemofiltration, or haemodialysis.

Background

The term cardio-renal syndrome has been variably defined but are often considered as a state of advanced cardio-renal dysregulation distinctly shown by either one or more of the three specific features, including
1)coronary failure with concomitant and significant renal disease (cardiorenal failure),
2) exacerbating renal function (initiated during the treatment of acute decompensated Heart failure),
The powerful link between renal and cardiovascular disease shows the complex Interlinkage between heart and kidneys. Arthur Guyton first extensively described normal physiological Interlinkage among systemic circulation by the heart and the control of extracellular fluid volume by the kidney[2]. However, the pathophysiological mechanisms

Showing this reciprocal relationship between the heart and the kidneys are still not clearly understandable.

History of Cardiorenal Syndrome

Robert Bright, who documented the major cardiac structural alterations found in patients with advanced kidney disease, described the subtle and highly interdependent link between the kidney and the heart as early as 1836.[1] Numerous breakthroughs in summarising the cardiorenal connection in terms of hemodynamic phenotypes, pathogenesis, treatment choices, and clinical outcomes have been accomplished since then.

This cardiocentric definition remains the cornerstone of CRS as commonly observed in the setting of acute decompensated HF, now called acute HF (AHF). Recognizing a wider clinical spectrum that may represent cardiorenal dysregulation, the Acute Dialysis Quality Initiative outlined a consensus approach in 2008 that phenotyped CRS into 2 major groups, cardiorenal and renocardiac syndromes, based on the primummovens of the disease process.[6,7]This was further grouped into 5 subtypes based on disease acuity and sequential organ involvement. The goals of this consensus definition of CRS were to facilitate reliable characterization of the clinical presentation of cardiorenal dysregulation for diagnostic and therapeutic purposes, to streamline inclusion criteria in epidemiological studies, to identify target treatment populations, and to develop novel diagnostic tools for the diagnosis and management of CRS.

Type 1 Cardiorenal Syndrome is Acute kidney dysfunction is caused by a fast deterioration of cardiac function (pulmonary edoema, rapidly decompensated chronic heart failure, cardiogenic shock, and predominant right ventricular failure), which leads to acute kidney failure.

Acute kidney injury is more severe in patients with compromised left ventricular ejection fraction than in those with maintained left ventricular function in this sort of situation, with an incidence of >70% in patients with cardiogenic shock. Acute kidney injury is difficult to diagnose early, and new biomarkers have helped to understand the condition.

Type 2 (Chronic) characters of CARDIORENAL SYNDROME are chronic abnormalities in cardiac function that causes progressive renal dysfunction, with a prevalence around 25%. Old age, hypertension, diabetes mellitus, and acute coronary syndromes are all independent predictors of worsening renal function [10]

Type 3 Acute Reno Cardiac Syndrome, less common than type 1, has following characters- An abrupt and primary detoriation of kidney function, leading to acute cardiac dysfunction (e.g., heart failure, arrhythmia, ischemia). Based on the RIFLE consensus definition (risk, injury, failure; loss; end-stage kidney disease), acute kidney injury has been diagnosed in 9% of hospital patients and in 35% of ICU patients.

Chronic Renocardiac Syndrome (Type 4) has following characters- primary chronic kidney disease that contributes to decreased cardiac function, ventricular hypertrophy, diastolic dysfunction, and/ or greater risk of adverse cardiovascular events. According to current diagnostic criteria for chronic kidney disease, at least 10% of the adult population has this serious public health issue [5].

Secondary (Type 5) Cardiorenal Syndrome is characterised through the presence of blended cardiac and renal dysfunction because of acute or persistent systemic disorders. In the intense setting, extreme sepsis represents the most common and serious situation that can have an effect on both organs.

1-Cardiorenal Failure

Renal impairment in sufferers with HF is more and more identified as an impartial risk factor for morbidity and mortality [17]. In an evaluation of sufferers enrolled withinside the CHARM study (2003)(Candesartan in Heart Failure Assessment of Reduction in Mortality and Morbidity) Hillege et al. confirmed that the extent of renal dysfunction was a potent unbiased predictor of death or HF admission[7]

Severe dietary parameters, particularly in CKD patients with other dietary limitations, may interact with sodium and fluid restriction. As a result, those limitations should be applied on an individual basis depending on serum sodium levels, diuretic resistance, and other clinical circumstances.hence Cardio-renal syndrome is a complex condition which needs multisystem analysis and and treatment. we are going to do an observational study on Cardio-renal syndrome to assess its risk factors, etiologies and clinical outcome.

Aims and Objectives

Aim:
Study of cardiorenal syndrome in heart failure
Objectives:
To study the Etiology of Heart failure and Cardiorenal syndrome.
To study the other Risk factors of Cardiorenal syndrome in Heart failure.
To study the clinical outcome.

Materials and Methods

Study Design

The present study is an Observational Study.
Methodology
1.Source of data

All patient aged

>18 years admitted with cardiac failure of any etiology with a duration of hospital stay more than 24 hours with or without renal dysfunction at Sri Aurobindo medical college and Post Graduate Institute, Hospital. Patients who gets admitted will be asked to participate in the study. Informed written consent shall be taken from all the patients or there relatives. A pre-structured proforma will be used to collect the baseline data. Detailed clinical examination and biochemical tests will be done on all the patients.

Inclusion Criteria

•All patients aged > 18 years admitted with cardiac failure(including heart failure of any etiology with a duration of hospital stay more than 24 hours with or without renal dysfunction.

•Those patients/guardian (in case of unconcious patient) who give consent .

Exclusion Criteria, Patients known case of chronic kidney disease. Patients with history of chronic NSAID abuse. Patients not satisfying above criteria .

Sample Size

There were 135 patients admitted with heart failure from 2016 to 2018 in SAMC & PGI Indore.. so approximately 50 patients will be feasible for my study according to the medical record data.

Investigation Planned

CBC, RFT1(within 24 hours of admission) (bloodurea,creatinine, serum electrolytes egfr) RFT2 (At discharge or at mortality whichever happens early)(BLOODUREA,CREATININE, SERUM electrolytes, egfr) tsh, uric acid , cardiac markers(cpkmp, tropt) rbs serum slbumin lipid profile urine –routine microscopy ecg chest x ray pa view echocardiography usg abdomen and pelvis

Data collection and methods

Especially designed pre-structured proforma will be used for collecting the relevant data. The data will be obtained from patient"s history,

Physical examination Blood investigations, radiological investigations & ECG.

Statistical analysis plan

All continuous variables were assumed to be normally distributed and are reported as arithematic mean with their Standard deviation. The Paired ttest , Unpaired t test and Chi square test will be used to compare and analyze the data.p value ≤ 0.05 will be considered statistically significant.

Results

Table: 1. Age group

		Count	Column N %
Age group	21-30	2	3.1%
	31-40	4	6.2%
	41-50	6	9.2%
	51-60	25	38.5%
	61-70	18	27.7%
	71-80	7	10.8%
	81-90	3	4.6%

In our study total patients were 65 of which Maximum number of patients were in the age group 51-60yrs (38.5%) followed by 61-70yrs (27.7%), 71-80yrs (10.8%), 41-50yrs (9.2%), 31-40yrs (6.2%), 81-90yrs (4.6%) and 21-30yrs(3.1%)

Table-2 age wise gender distribution

		Gender			
		Male		Female	
		Count	Column N %	Count	Column N %
Age group	21-30	1	2.5%	1	4.0%
	31-40	4	10.0%	0	0.0%
	41-50	4	10.0%	2	8.0%
	51-60	15	37.5%	10	40.0%
	61-70	10	25.0%	8	32.0%
	71-80	4	10.0%	3	12.0%
	81-90	2	5.0%	1	4.0%

In our study,62 % patients were male and 38% were female. Among 21 to 30 years 1 male was there whereas 1 female was there .Among 31 to 40 years 4 male was there whereas no female was there. Among 41-50 years 4 male and 2 female have been included. Among 51 to 60 yrs 15 male and 10 female were included. Among 61 to 70 years 10 male and 8 female have been included, whereas Among 71-80 years 4 male and 3 female have been included.

Among 81 to 90 years 2 male and 1 female have been included.

Table-3 Etiology

		Count	Column N %
Etology	Acute Coronary Syndrome	39	60.0%
	Sepsis	8	12.3%
	Dilated Cardiomyopathy	18	27.7%

In our study, Among the etiology, Acute coronary syndrome was the main contributor and it was the cause in 60% of the patients followed by Dilated cardiomyopathy in 27.7%cases and sepsis in 12.3% cases.

Table-4 Etiology on the basis of gender

		Gender			
		Male		Female	
		Count	Column N %	Count	Column N %
Etology	Acute Coronary Syndrome	25	62.5%	14	56.0%
	Sepsis	2	5.0%	6	24.0%
	Dilated Cardiomyopathy	13	32.5%	5	20.0%

In our study Among the patients of Acute Coronary Syndrome ,25 Patients were male and 14 patients were female .Among patients of sepsis 2 patients were male and 6 were females. Among patients of Dilated cardiomyopathy 13 were male and 5 patients were female

Table-5 Risk factors

		Count	Column N %
Thyroid Status	Normal	58	89.2%
	Hypothyroidism	7	10.8%
NYHA	Grade 3	14	21.5%
	Grade 4	51	78.5%
COPD	Yes	5	7.7%
	No	60	92.3%
CAD	Yes	47	72.3%
	No	18	27.7%
Sepsis	Yes	8	12.3%
	No	57	87.7%
Hypertension	Yes	25	38.5%
	No	40	61.5%
Type II DM	Yes	27	41.5%
	No	38	58.5%
Dyslipidemia	Yes	7	10.8%
	No	58	89.2%
Smoking Hisory	Yes	29	44.6%
	No	36	55.4%
ALcohol History	Yes	26	40.0%
	No	39	60.0%

In our observational study ,The major risk factor was Coronary artery disease seen in 72.3%.

Type 2 Diabetes mellitus was present in 58.5% patients while hypertension in 38.5%.

Smoking was the risk factor in 44.6% and alcohol in 40% patients.

Sepsis became the risk factor in 12.3% cases and dyslipidemia in 10.8%.

Hypothyroidism was present in 10.8% cases and COPD was present in 7.7% cases.

NYHA grade 4 was more common and was seen in 78.5% while NYHA grade 3 in 21.5% cases.

Table-6 Risk factor association with mortality

		Mortality			
		Yes	No	χ2 value	p value
Thyroid Status	Normal	18	40	.018[a]	1.000
	Hypothyroidism	2	5		
NYHA	Grade 3	6	8	1.224[a]	.332
	Grade 4	14	37		
COPD	Yes	2	3	.217[a]	1.000
	No	18	42		
CAD	Yes	15	32	.105[a]	.776
	No	5	13		
Sepsis	Yes	2	6	.143[a]	1.000
	No	18	39		
Hypertension	Yes	9	16	.522[a]	.583
	No	11	29		
Type II DM	Yes	10	17	.852[a]	.419
	No	10	28		
Dyslipidemia	Yes	1	6	1.001[a]	.423
	No	19	39		
Smoking Hisory	Yes	10	19	.339[a]	.598
	No	10	26		
ALcohol History	Yes	10	16	1.204[a]	.411
	No	10	29		

There was no significant p value between mortality and risk factors.

Discussion

Demographic parameters-

This was an observational study(done at Sri Aurobindo institute of medical science Indore) on heart failure with cardiorenal syndrome to asses its risk factors, etiology and clinical outcome.

(a)Age and gender distribution-

In our study, 62 % patients were male and 38% were female.

similar results were found [8]who has reported 67% males and 33% females

Mean age distribution-

in our study Maximum number of patients were in the age group 51-60yrs(38.5%) followed by 61-70yrs(27.7%), 71-80yrs(10.8%), 41-50yrs(9.2%), 31-40yrs(6.2%), 81-90yrs(4.6%) and 21-30yrs(3.1%).similar results were found in the study done by **Abdullah et a l(2019)**[9],which has reported maximum patients in the age group of 51-60 years of age(30%)

Etiology-

In our observational study ,out of 65 patients, 60%patients(maximum)(male-25 female-14) had acute coronary syndrome, 27.7% patients(male-13 female-5) had dilated cardiomyopathy and 12.3%patients (male-2 female-6)had sepsis.

Similar results were found in the study done by **prothasis et al (2020)**[10],which has reported 49%(maximum) patients with acute coronary syndrome,23% patients with dilated cardiomyopathy and 5 percent patient with sepsis. In the study done by **Salim et al(2017)**[11] 68.3 %patients had acute coronary syndrome and 24% patients had dilated cardiomyopathy.

Risk factors-

In our study The major risk factor was found to be

(a)Coronary artery disease , which was present in 72.3% of cases as compared to other studies like **Babu et a l(2017)** [12]in which the incidence of coronary artery disease was 63%

(b)Type 2 Diabetes mellitus-in our study group diabetes mellitus was present in 58.5% of the patients.

While compared to other studies done **by Babu et al (2017)**[12] it was 63% and in **Shah et al (2016**) [8] it was 64%,which was found to be similar.

©Hypertension- in our study group 38.5%. patients had hypertension .while compared study done by **Babu et al(2016)**[12]it was31.5%,which is found to be similar.

(d)Smoking was the associated risk factor in 44.6% of our study group patients. while compared to the study done by **Prothasis et al(2020)**[10] it was present in 42.04% of the patients**,** which was found to be similar

(e)Alcohol - was present in 40% patients of our study group patients.while compared to other studies it was 20.83 in the study done by Prothasis et al (2020) –and 14% in the study done by Salim et al(2017)[11]

(f) Smoking-was present 44.6% patients of our study population group .similarly it was present in 35% patient group of study done by **Abdullah et al(2019)**[9]

(g) Dyslipidemia-found to be risk factor in 10.8% patients of our study group.

Similarly in the study done by

Prothasis et al (2020)[10] it was present in14.58% patients of the study population.

(h)Sepsis became the risk factor in 12.3% cases of our study patient group while compared to other studies

Done by Prothasis et al(2020) in which it was 19.79%.

(i)Hypothyroidism was present in 10.8% cases of our study population group.

similarly it was 13.54 % in the study done by **Abdullah et al(2019)**[9]

(j)COPD was present in 7.7% cases of our study population.

While it was 38 % in the study done byBhatnagar et al(2018)[13]

Outcome

In our study mortality was 29 % which was significantly associated with decreased EGFR and raised UREA levels(done on admission and after 48 hours of admission).

Similarly In the study done by **Shah et al (2016)** [8]mortality was 28 % which was significantly associated with decreased EGFR and raised UREA levels.

in the study done by **Bhatnagar et al (2018**)[13]mortality was 22%,which was

significantly associated with decreased EGFR and raised UREA levels.

Conclusion

Heart failure often progresses to end-stage, preterminal (stage D) heart failure and Cardiorenal syndrome.

The following are the study's conclusions.

Cardiorenal syndrome is very common in people who have heart failure.

Patients with heart failure who have had two or more previous hospitalizations, sepsis, history of CAD and hypothyroidism are more likely to develop cardiorenal syndrome.

The development of cardiorenal syndrome is an independent predictor of frequent readmissions, In addition to longer hospitalisation and slower recovery.

Undertreatment of the cardiorenal syndrome has the potential to be fatal on an individual level and Have massive public health repercussions. The breadth of knowledge and complexity of care Required to provide the optimal treatment for these patients need a multidisciplinary approach Integrating cardiology, nephrology, and critical care expertise.

More research is needed to understand its pathophysiology and develop effective management Strategies. Individualization of each patient with prudent drug use is the best line of care until then. New medicines offer promise for better outcomes for these difficult patients.

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