

Impact of Cardiorenal syndrome Type 1 on Mortality and Health-related Quality of Life among Patients Admitted for Acute Heart Failure in a Nigeria Tertiary Hospital: A Prospective Cohort Analysis

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Abstract

Background

The presence of acute kidney injury in patients admitted with acute heart failure (AHF) known as cardiorenal syndrome type 1 (CRS1) is a serious clinical condition that is associated with prolonged hospitalization and poor prognosis. However, few studies have been done in this area in sub-Saharan Africa especially in Nigeria. The aim of this study was to determine the impact of cardiorenal syndrome type 1 (CRS 1) on duration of hospitalization, admission outcome, rehospitalization, mortality and health-related quality of life at day 30 among patients admitted for acute heart failure at Federal Teaching Hospital, Gombe.

Method

This was a prospective longitudinal cohort study where 149 patients admitted for acute heart failure at Federal Teaching hospital, Gombe were recruited after ethical approval for a duration of 10 months. Acute heart failure was diagnosed according to European Society of Cardiology guidelines. Serum urea and creatinine were measured at presentation and repeated at day 2 and day 7 or at discharge. Acute kidney injury was diagnosed according to KDIGO clinical practice guideline, 2012. Duration of hospital stay, admission outcome, rehospitalization, mortality and impact on health-related quality of life at day 30 were assessed and analysed for all the patients using computer-based Statistical Package for Social Sciences (SPSS) version 27.0.

Results

Out of 149 AHF patients recruited, 71 (47.7%) developed AKI either at presentation, day 2 or day 7. Patients with CRS1 have longer hospital stay (10.52 ± 5.23 vs 6.21 ± 2.67 days), increased in-hospital and day 30 hospital mortality ($\{15.5$ vs $1.3\}$ and $\{29.6$ vs $6.4\}$ respectively). Cardiorenal syndrome type 1 was also associated with poor health-related quality of life at day 30.

Conclusion

Cardiorenal syndrome type 1 accounts for 47.7% of AHF patients in this study. CRS1 contributes to longer hospital stay and it is a predictor of higher in-hospital and day 30 mortality, poor clinical outcome and overall health-related quality of life at day 30. This study provided an understanding of the magnitude of morbidity, mortality and poor health-related quality of life associated with CRS1.

1.0 Introduction

Heart and kidneys are interdependent in the clinical syndrome of heart failure (HF) and its complications.¹ It is now sufficiently clear that kidney dysfunction occurs frequently in all phenotypes of HF.¹ Kidney dysfunction is common in HF patients and is an independent poor prognostic factor in heart failure.¹

Acute heart failure (AHF) refers to rapid or gradual onset of symptoms and/or signs of heart failure (HF), severe enough for the patient to seek urgent medical attention, leading to an unplanned hospital admission or an emergency department visit.² AHF may be the first manifestation of HF (new onset) or, more frequently, be due to an acute decompensation of established chronic HF. AHF can present as acute pulmonary oedema, isolated right ventricular failure, cardiogenic shock, or acute decompensated heart failure.² AHF is associated with many complications, among them are arrhythmias, thromboembolism, cardiorenal syndrome type 1, and sudden cardiac death.³ These complications are markers of poor prognosis in patients with AHF.³

Acute kidney injury (AKI) refers to an abrupt decrease in kidney function that is possibly reversible or in which harm to the kidney can be modified.^{4–6} To make a diagnosis of AKI, patient must meet one of the following criteria: (a) increase in serum creatinine greater than or equal to 0.3mg/dL within 48 hours (b) increase in serum creatinine by greater than or equal to 1.5 times baseline that is known or presumed to have occurred within the past 7 days (c) urine volume less than 0.5mL/kg/h for at least 6 hours.^{4–6}

Cardiorenal syndrome type 1 (CRS1) is characterized by an acute heart disorder leading to acute kidney injury (AKI).⁷ It is one of the most common complications in the first 48 hours in patients with AHF.⁸ It is an important cause of hospitalization that affects the diagnosis as well as the prognosis and treatment of patients, increasing the risk of cardiovascular mortality and morbidity, duration of hospitalization and the frequent need for rehospitalization. It occurs in 25–33% of patients hospitalized for acute heart failure.^{9–11}

Common approaches to the CRS1 diagnosis include the use of the following reference values of baseline creatinine, from which the creatinine increase defines CRS1: a) serum creatinine on admission; b) the lowest creatinine during hospitalization; c) serum creatinine levels of other hospitalization; or d) outpatient measurements of serum creatinine.¹² However, KDIGO recommends the lowest serum creatinine during hospitalization as the most reference value.¹³

The burden of renal dysfunction in AHF has been reported to be high. Even slight decreases in estimated glomerular filtration rate (GFR) significantly increase mortality risk.¹⁴ This study provided an understanding of the magnitude of risks of morbidity and mortality associated with this group of patients and its impact on health-related quality of life especially in our environment with limited data on CRS1.

The objective of this study was to determine the impact of CRS Type 1 on duration of hospitalization, admission outcome, rehospitalization, health-related quality of life and mortality at day 30 among

patients admitted with AHF at FTHG.

Health-related quality of life (HRQoL) is defined as “an individual’s perception of their position in life in the context of culture and value systems in which they live and in relationship to their goals, expectations, standards and concerns” according to WHO.¹⁵ HRQoL is described as different from quality of life in that HRQoL is often used to exclude certain aspects of life that do not directly affect health status such as income and quality of environment.¹⁶ It encompasses five categories of concepts including duration of illness, impairment, functional status, health perception, and opportunities. HRQoL can help determine the burden of diseases, outcome measure, give an insight into risk factors, and monitor the progress of disease, measure performance of health systems. Heart failure patients face a wide variety of symptoms that adversely impact on their quality of life.¹⁷

Health related quality of life is measured using HRQoL instruments that are self-administered, interviewer-administered or posted questionnaires and basically classified into generic and disease-specific instruments.¹⁸ Kansas City Cardiomyopathy Questionnaire (KCCQ) is an example of disease-specific instrument which was used in this study because it has been validated to have greater sensitivity and responsiveness in Nigeria population.^{18–21}

A shorter version (KCCQ-12) was used which is highly correlated with the original 23-item scale score (KCCQ-23). The KCCQ-12 (see additional file 1) preserves the validity, reliability, responsiveness, prognostic importance, and interpretability of the original instrument while reducing the response burden by half. It thus has the potential to be more implementable in routine clinical care and can open important opportunities to improve the quality of heart failure care through quality assessment efforts, tailored population health interventions, more practical clinical trials, and better doctor-patient communication.^{22–24}

KCCQ-12 quantifies the following health status domains: symptom frequency, physical limitations, social limitations, and quality of life. The average scores of the four domains generate KCCQ-12 overall summary scores (KCCQ-12), and the mean of physical limitation and symptom frequency generates the clinical summary.^{22,23}

2.0 Methodology

2.1 Study Area

The study was carried out at the cardiology unit, Department of Medicine, Federal Teaching Hospital, Gombe, Gombe state. It is a 500-bed capacity tertiary health institution serving residents of Gombe state as well as other north-eastern states of Nigeria.

2.2 Study Design

This was a prospective longitudinal cohort study to determine the impact of CRS1 among patients admitted for acute heart failure (AHF) at Federal Teaching Hospital, Gombe (FTHG).

2.3 Study Population

The study population was consecutively adult patients with acute heart failure (both de novo presentations and acute decompensations with pre-established diagnosis of heart failure), who met the inclusion criteria, having presented to the emergency unit and/or cardiology clinic of FTHG within 24 hours. Acute heart failure was diagnosed based on guidelines of the European Society of Cardiology on the diagnosis and treatment of acute heart failure.² The duration of data collection was 10 months (May 2024 to February 2025).

2.3.1 Inclusion Criteria

1. Patients who fulfilled the diagnosis of acute heart failure using the guidelines of the European Society of Cardiology on the diagnosis and treatment of AHF.
2. Patients 18 years and above
3. Patients who gave consent to participate in the study.

2.3.2 Exclusion Criteria

1. Patients with pre-existing chronic kidney disease
2. Patients with evidence of other causes of acute kidney injury other than AHF like intravascular volume depletion, nephrotoxic medication, intrarenal and extrarenal obstruction.
3. Patients who have had kidney transplant.
4. Patients with solitary kidney.
5. Patients who died less than 48 hours of admission

2.4. Data Collection Methods

The patients were interviewed using standard proforma (see additional file 2) to obtain clinical details, including NYHA class within 24 hours of admission.

Clinical history involved previous HF-related admissions, possible aetiology of HF, medication use, history to exclude background kidney disease (history of kidney dysfunction ≥ 3 months) and other causes of AKI (including sepsis, intravascular volume loss, lower obstructive urinary symptoms, features of kidney dysfunction preceding AHF symptoms etc), previous serum urea and creatinine value within the last three months.

Serum creatinine and urea were measured on admission and repeated on days 2 and 7 or on hospital discharge (whichever came first). Serum urea and creatinine were measured using auto analyser Cobas integra 400 plus (Germany). All samples were analysed in the central laboratory of Federal Teaching Hospital, Gombe.

The presence of AKI was determined by comparing a patient's baseline creatinine levels with the highest creatinine level within 48 hours or 7 days during the index admission.^{5,25,26} For the baseline creatinine level, the first creatinine level^{12,25} or lowest creatinine^{12,26} level in the same index admission was used as baseline. AKI was defined as increase in baseline creatinine levels by at least 0.3 mg/dL ($\geq 26.5 \mu\text{mol/L}$) in the index admission within 48 hours^{12,25} or increase in baseline creatinine by at least 1.5 times within 7 days.^{5,27}

Renal ultrasound scan (including vascular doppler) was done with assistance of a radiologist for all the patients to assess the structural changes of the kidneys, intra-renal resistance, renal vessel obstruction and features of intrarenal and extrarenal obstruction to exclude background chronic kidney disease and other causes of AKI (see additional file 2).

Patients who met the inclusion criteria were consecutively recruited. Subsequently, each patient recruited was classified as patient with CRS type 1 and without CRS type 1 according to 2012 KDIGO criteria and each of the patients was followed up till 30 days independently as illustrated in Fig. 1 below.

All recruited patients were followed up from admission till day 30 to determine their duration of hospital stay, admission outcome, rehospitalization, mortality and health-related quality of life using KCCQ-12 at day 30. The follow up after discharge was via telephone contact and clinic visit. All the patients were on maximal tolerated dose of guideline directed medical therapy (GDMT) with or without other medications required in the treatment of AHF and co-morbidities. All the patients recruited in this study were compliance with their medications

Kansas City Cardiomyopathy Questionnaire-12 (KCCQ-12) was administered by the researcher at day 30. The study did not interfere with the patient's management according to hospital guidelines. Scales scores from KCCQ-12 are transformed to a 0 to 100 range by subtracting the lowest possible scale score, dividing by the range of the scale, and multiplying by 100. The scores were subsequently summarized in 25-point ranges, where scores represent health status as follows: 0 to 24: very poor to poor; 25 to 49: poor to fair; 50 to 74: fair to good; and 75 to 100: good to excellent.²² The average scores of the four domains generated KCCQ-12 overall summary scores, and the mean of physical limitation and symptoms frequency generated the clinical summary.

2.5 Statistical Analysis

All data generated were collated into Excel spreadsheet and subsequently transferred and analysed using computer-based Statistical Package for Social Sciences (SPSS) version 27.0. Continuous variables (such as duration of admission) were normally distributed after subjected to normality test (Kolmogorov-Smirnov test). Continuous variables were presented using mean and standard deviation. Categorical variables (such as admission and day 30 outcome, KCCQ domains) were presented in frequency and percentages. Independent sample t-test was used to compare the mean duration of hospitalization. Multinomial logistic regression analysis was used to determine impact of CRS1 on re-hospitalization, morbidity, mortality, and health-related quality of life. Kaplan Meier analysis was used to assess survival

distribution between the two groups and Cox regression analysis was used to estimate hazard ratio (HR). A p-value of less than 0.05 was considered significant.

3.0 Results

3.1 Data Distribution

Total AHF patients who presented to the hospital over the 10 months period was 162, out of which 13 patients were excluded, and 149 patients met the inclusion criteria. Two patients (1.3%) of the 149 patients lost to follow up before 30 days. Patients who developed CRS1 either at presentation, day 2 or day 7 of admission account for 47.7% of the total population.

3.2 Impact of CRS1 on Duration of Admission and Outcome on Acute Heart Failure

The mean duration of hospitalization of patients with CRS1 was significantly longer than those without CRS1 (10.52 ± 5.23 vs 6.21 ± 2.67 days, $p < 0.001$) using independent sample T-test. Patients with CRS1 showed increased mortality compared to those without CRS1 at admission (15.5% vs 1.3%, $p = 0.012$) and day 30 (29.6% vs 6.4%, $p < 0.001$) from multinomial logistic regression analysis as shown in Table 1.

Kaplan Meier analysis shows statistically significant survival distribution between the two groups. Log rank test with p-value < 0.001 in Table 2 indicates that there is statistically significant difference between the two survival curves in Fig. 2. This means that patients without CRS1 have significant higher cumulative survival probability over 30 days.

Cox regression analysis was used to estimate the hazard ratio (HR) as shown in Table 3. This implies that patients with CRS1 have 5.958 times increased risk of mortality at 30 days when compared to patients without CRS1.

Table 1
Duration of admission and Outcome of Study Subjects

Parameters	Total Subjects	CRS1	Non-CRS1	p-value
Duration of admission (days)	8.26 ± 4.62	10.52 ± 5.23	6.21 ± 2.67	< 0.001*
Admission outcome	12 (8.1)	11 (15.5)	1 (1.3)	0.012*
Died				
Day 30 outcome	26 (17.4)	21 (29.6)	5 (6.4)	< 0.001*
Died	6 (4.0)	3 (4.2)	3 (3.8)	0.629
Re-hospitalization	2 (1.3)	1 (1.4)	1 (1.3)	0.776
Missing				
*Statistically significant				

Table 2
Kaplan Meier Analysis Showing Survival distribution

	Chi-square	Df	p-value
Log rank (Mantel-Cox)	13.675	1	< 0.001
* Statistically significant			

Table 3
Cox regression table showing hazard ratio for mortality

	p-value	HR	95% CI
CRS1	0.001*	5.958	2.026–17.523
* Statistically significant			
HR- Hazard ratio, CI- Confidence interval			

3.2 Impact of CRS1 on Health-related Quality of Life in AHF

CRS1 shows statistically significant poor impact on clinical outcome and overall health-related quality of life as compared to patients without CRS1 at day 30 using Kansas City Cardiomyopathy Questionnaire-12 (KCCQ-12) score as analysed using independent sample T-test and multinomial logistic regression analysis as presented in Tables 3.4 and 3.5 respectively.

Table 4
KCCQ Scores

Domains	Mean Total Subject scores	Mean CRS1 scores	Mean non-CRS1 scores	p-value
Symptoms frequency	84.58 ± 15.33	77.87 ± 16.96	89.01 ± 12.38	< 0.001*
Physical limitation	67.46 ± 18.16	57.02 ± 20.66	74.37 ± 12.22	< 0.001*
Social limitation	67.49 ± 21.17	58.36 ± 24.64	73.52 ± 16.04	< 0.001*
Quality of life	64.17 ± 20.91	56.17 ± 23.17	69.46 ± 17.52	< 0.001*
Clinical Summary	75.57 ± 15.68	67.45 ± 17.36	80.95 ± 11.80	< 0.001*
Overall Summary	70.98 ± 16.60	62.40 ± 19.13	76.69 ± 11.70	< 0.001*

Table 5
KCCQ Domain Scores

Domains	Total Subjects (%)	CRS1 (%)	Non-CRS1 (%)	p-value
Symptoms frequency	0 (0)	0 (0)	0 (0)	0.074
Very poor to poor	5 (4.2)	4 (8.5)	1 (1.5)	0.062
Poor to fair	17 (14.4)	10 (21.3)	7 (9.9)	Reference
Fair to Good	96 (81.4)	33 (70.2)	63 (88.7)	
Good to Excellent				
Physical limitation	5 (4.2)	4 (8.5)	3 (1.4)	0.010*
Very poor to poor	14 (11.9)	12 (25.5)	2 (2.8)	< 0.001*
Poor to fair	43 (36.4)	22 (46.8)	21 (29.6)	< 0.001*
Fair to Good	56 (47.5)	9 (19.1)	47 (66.2)	Reference
Good to Excellent				
Social limitation	8 (6.8)	5 (10.6)	3 (4.2)	0.035*
Very poor to poor	16 (13.6)	13 (27.7)	3 (4.2)	< 0.001*
Poor to fair	28 (23.7)	13 (27.7)	15 (21.1)	0.036*
Fair to Good	66 (55.9)	16 (34.0)	50 (70.4)	Reference
Good to Excellent				
Quality of life	6 (5.1)	4 (8.5)	2 (2.8)	0.038*
Very poor to poor	22 (18.6)	13 (27.7)	9 (12.7)	0.003*
Poor to fair	33 (28.0)	17 (36.2)	16 (22.5)	0.005*
Fair to Good	57 (48.3)	13 (27.7)	44 (62.0)	Reference
Good to Excellent				
Clinical Summary	6 (5.1)	4 (8.5)	2 (2.8)	0.042*
Very poor to poor	9 (7.6)	6 (12.8)	3 (4.2)	0.015*
Poor to fair	32 (27.1)	20 (42.6)	12 (16.9)	< 0.001*
Fair to Good	71 (60.2)	17 (36.1)	54 (76.1)	Reference
Good to Excellent				
Overall Summary	6 (5.1)	4 (8.5)	2 (2.8)	0.023*
Very poor to poor	15 (12.7)	11 (23.4)	4 (5.6)	< 0.001*
*Statistically significant				

Domains	Total Subjects (%)	CRS1 (%)	Non-CRS1 (%)	p-value
Poor to fair	36 (30.5)	20 (42.6)	16 (22.5)	< 0.001*
Fair to Good	61 (51.7)	12 (25.5)	49 (69.0)	Reference
Good to Excellent				
*Statistically significant				

4.0 Discussion

This study revealed that AKI is a common finding in about 47.7% of patients with acute heart failure in sub-Saharan Africa, especially Nigeria. In agreement with previous studies^{28–30}, patients with CRS1 had significantly longer hospital stay (10.52 ± 5.23 vs 6.21 ± 2.67 days), higher mortality in-hospital (15.5% vs 1.3%) and at 30 days (29.6% vs 6.4%) with evidence of lower survival rate as early as less than 5 days of admission among patients with CRS1. It was also found that patients with CRS1 have about six times increased risk of mortality at 30 days. This is because CRS1 results in more severe complications, including worsening fluid overload, liver failure and respiratory failure that increase the risk of mortality. Late presentation to hospital among patients in this study could have also contributed to higher mortality rate. This has important implications to both quality of life and health costs. However, Mahmoud et al.³¹ did not find statistically significant relationship in duration of hospital stay between CRS1 and non-CRS1 patients. This may be due to small prevalence of CRS1 in the study and exclusion of half of the patients recruited on account of lack of follow up creatinine levels. There was no significant relationship between CRS1 and re-hospitalization within 30 days. This could be due to short duration of follow up. Mahmoud et al.³¹ also found no statistically significant relationship between worsening kidney function in AHF and rehospitalization to day 60. However, in a retrospective study by J-J Chen et al.²⁵, there is a higher risk of re-hospitalization among patients with CRS1 within 90 days from admission. This could be attributed to a longer period of follow up.

Evidence from this study has shown that CRS1 is an independent predictor of poor clinical outcome, social limitation, poor quality of life and poor overall health-related quality of life within 30 days among patients admitted for AHF. This finding adds to the growing evidence that CRS1 is associated with worse prognosis contributed by increased congestion and reduced renal perfusion.¹⁴ Overall, the impact of CRS1 on quality of life is profound, driven by severe symptoms, high morbidity risk, the substantial physical, social and emotional challenges associated with managing a complex condition. This has adverse impact on economic productivity of the society and increase burden on the limited resources. This finding aligns with previous finding.¹⁴

However, despite findings from this study showed that cardiorenal syndrome type 1 is associated with increased mortality both in-hospital and within 30 days, biopsy was not performed to establish the cause of death.

5.0 Conclusion

This study demonstrated that CRS1 is associated with longer hospital stay, increased in-hospital and day 30 mortality among AHF patients with about six times increased risk of mortality. It is also a predictor of poor clinical outcome and poor overall health-related quality of life within 30 days in AHF. However, it is not associated with re-hospitalization within 30 days among AHF patients. This study provided an understanding of the magnitude of morbidity, mortality and poor health-related quality of life associated with CRS1.

Declarations

6.1 Ethical Approval and Consent to participate

The study proposal was approved by the Research and Ethics Committee of Federal Teaching Hospital, Gombe with approval number of NHREC/25/10/2013.

6.2 Consent for Publication

Not applicable

6.5 Funding

No funding support

Author Contribution

RA, YA, AA, MN, and HI conceptualized and design the work, involved in analysis and interpretation of data, approved the submitted version and have agreed to be personally accountable for their own contributions. IO, RS, JO and AA have substantively revised the work, approved the submitted version and have agreed to be personally accountable for their own contributions. All authors reviewed the manuscript.

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Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

References

1. Kelvin D, Jeffrey M. The kidney in heart failure: an update. *Eur Heart J*. 2015;36:1437–44.
2. Theresa A, Roy S, Marco M, Andreas B, Marianna A, Michael B, et al. European Society of Cardiology Guidelines for the diagnosis and treatment of acute and chronic heart failure. *Eur Heart J*. 2021;00:1–128.
3. Watson RDS, Gibbs CR, Lip GYH. Clinical features and Complications of Heart failure. *BMJ*. 2000;320(7229):236–9.
4. Christopher Sjoberg. Acute Kidney Injury: Treatment Depends on the Cause. *Medge com/clinician reviews*. 2019;29(10):e6–7.
5. John AK, Peter A, Rashad S, Emmanuel AB, Stuart IG, Charles AH, et al. KDIGO clinical practice guideline for acute kidney injury. *Kidney Int Suppl*. 2012;2(1):1–138.
6. Palevsky PM, Liu KD, Brophy PD, Chawla LS, Parikh CR, Thakar CV, et al. KDOQI US commentary on the 2012 KDIGO clinical practice guideline for acute kidney injury. *Am J Kidney Dis*. 2013;61(5):649–72.
7. Ronco C, Cicoira M, McCullough PA. Cardiorenal syndrome type 1: pathophysiological crosstalk leading to combined heart and kidney dysfunction in the setting of acutely decompensated heart failure. *J Am Coll Cardiol*. 2012;60:1031–42.
8. Rampengan SH. Cardiorenal syndrome type 1: a literature review. *Bali Med J*. 2019;8(2):537–41.
9. Ronco C, McCullough PA, Anker SD, Inder A, Nadia A, Sean MB et al. Acute Dialysis Quality Initiative (ADQI) Consensus Group. Cardiorenal syndromes: an executive summary from the Consensus Conference of the Acute Dialysis Quality Initiative (ADQI). *Contrib Nephrol*. 2010; 165: 54–67.
10. Hata N, Yokoyama S, Shinada T, Kobayashi N, Kuriharan O, Takahashi Y, et al. Acute kidney injury and outcomes in acute decompensated heart failure: evaluation of the RIFLE criteria in an acutely ill heart failure population. *Eur J Heart Fail*. 2010;12:32–7.
11. Tomislav N, Milan R, Miodrag S, Marina M, Dejan P. Cardiorenal syndrome type 1: Definition, Etiopathogenesis, Diagnostics And Treatment. *UDK: 616.12:616.61/. Ser J Exp Clin Res*. 2018;19(1):73–80.
12. Andréa ML, Bruno FO, André CM, Denilson CA, Pedro PM, Antonio JL, et al. Acute Cardiorenal Syndrome: Which Diagnostic Criterion to Use And What is its importance for Prognosis? *Arq Bras Cardiol*. 2020;115(1):127–33.
13. Kellum JA, Lameire N, KDIGO AKI Guideline Work Group. Diagnosis, evaluation, and management of acute kidney injury: a KDIGO summary (Part 1). *Crit Care*. 2013;17(1):204. 10.1186/cc11454.

14. Zeyuan F, Yang L, Hanhua J. Nomogram Model to Predict Cardiorenal Syndrome Type 1 in Patients with Acute Heart Failure. *Kidney Blood Press Res*. 2018;43:1832–41.
15. Study protocol for the World Health. Organization project to develop a quality-of-life assessment instrument (WHOQOL). *Qual life Res*. 1993;2:153–9.
16. Guyatt GH. Measurement of health-related quality of life in heart failure. *J Am Coll Cardiol*. 1993;22:A185–91.
17. Zambroski CH, Moser DK, Bhat G, Ziegler C. impact of symptom prevalence and symptom burden on quality of life in patients with heart failure. *Eur J Cardiovasc Nurs*. 2005;4:198–206.
18. Eurich DT, Jeffrey AJ, Kimberly JR, John AS. Assessing responsiveness of generic and specific health related quality of life measures in heart failure. *Health Qual Life Outcomes*. 2006;4:89. 10.1186/1477-7525-4-89.
19. Ortega T, Diaz-Molina B, Montolina M, Ortega F, Valdes C, Rebollo P, et al. The utility of a specific measures for heart transplant patients; reliability and validity of the Kansas City Cardiomyopathy Questionnaire. *Transplantation*. 2008;86:804–10.
20. Mbakwe AC, Aina FO, Amadi CE, Akinbode AA, Mokwunyei J. Comparative analysis of the quality of life of heart failure patient in Southwestern Nigeria. *WJCD*. 2013;3:146–50.
21. Patrick C, Charles B, Dennis R, John S. Development, and evaluation of the Kansas City Cardiomyopathy Questionnaire: A New Health Status Measure for Heart Failure. *J Am Coll Cardiol*. 2000;35:1245–55.
22. Spertus JA, Jones PG. Development and Validation of a Short Version of the Kansas City Cardiomyopathy Questionnaire. *Circ Cardiovasc Qual Outcomes*. 2015;8:469–76.
23. John A, Spertus PG, Jones, Alexander T, Sandhu SV. Arnold. Interpreting the Kansas City Cardiomyopathy Questionnaire in Clinical Trials and Clinical Care. *J Am Coll Cardiol*. 2020;76:2379–90.
24. Danli H, Liu J, Zhang L, Bai X, Tian A, Huang X, et al. Health Status Predicts Short- and Long- term Risk of Composite Clinical Outcomes in Acute Heart Failure. *J Am Coll Cardiol HF*. 2021;9:861–73.
25. Jia-Jin C, Tao-Han L, George K, Chieh-Li Y, Shao-Wei C, Pao-Hsien C et al. Acute Kidney Disease After Acute Decompensated Heart Failure: *Kidney Int Rep* (2022): 7; 526–536.
26. Kellum JA, Lameire N, KDIGO AKI Guideline Work Group. Diagnosis, evaluation, and management of acute kidney injury: a KDIGO summary (Part 1). *Crit Care*. 2013;17(1):204. 10.1186/cc11454.
27. Li ZZ, Yang XB, Guan Y, Xu X, Tan MT, Hou FF, et al. Development and Validation of a Risk Score for Prediction of Acute Kidney Injury in Patients with Acute Decompensated Heart Failure: A Prospective Cohort Study in China. *J Am Heart Assoc*. 2016;5:e004035. 10.1161/JAHA.116.004035.
28. Familoni OB, Alebiosu CO, Olunuga. The Pattern of Aggravated Renal Dysfunction in Patients with Advanced Heart Failure. *Trop J Nephrol*. 2006;1:87–91.
29. Caetano F, Barra S, Faustino A, Botelho A, Mota P, Costa M, et al. Cardiorenal syndrome in acute heart failure: A vicious cycle? *Rev Port Cardiol*. 2014;33(3):139–46.

30. Saoussen Antit S, Bousnina M, Fathi R, Fekih EB. Lilia Zakhama. Echocardiographic Predictive Factors of Worsening Outcome in Type 1 Cardiorenal Syndrome. J Saudi Heart Association. 2024;36:42–52.

31. Mahmoud US, Beth AD, Gad C, Karen S, Christopher E, Licette L, et al. Renal dysfunction in African patients with acute heart failure. Eur J Heart Fail. 2014;16:718–28.

Figures

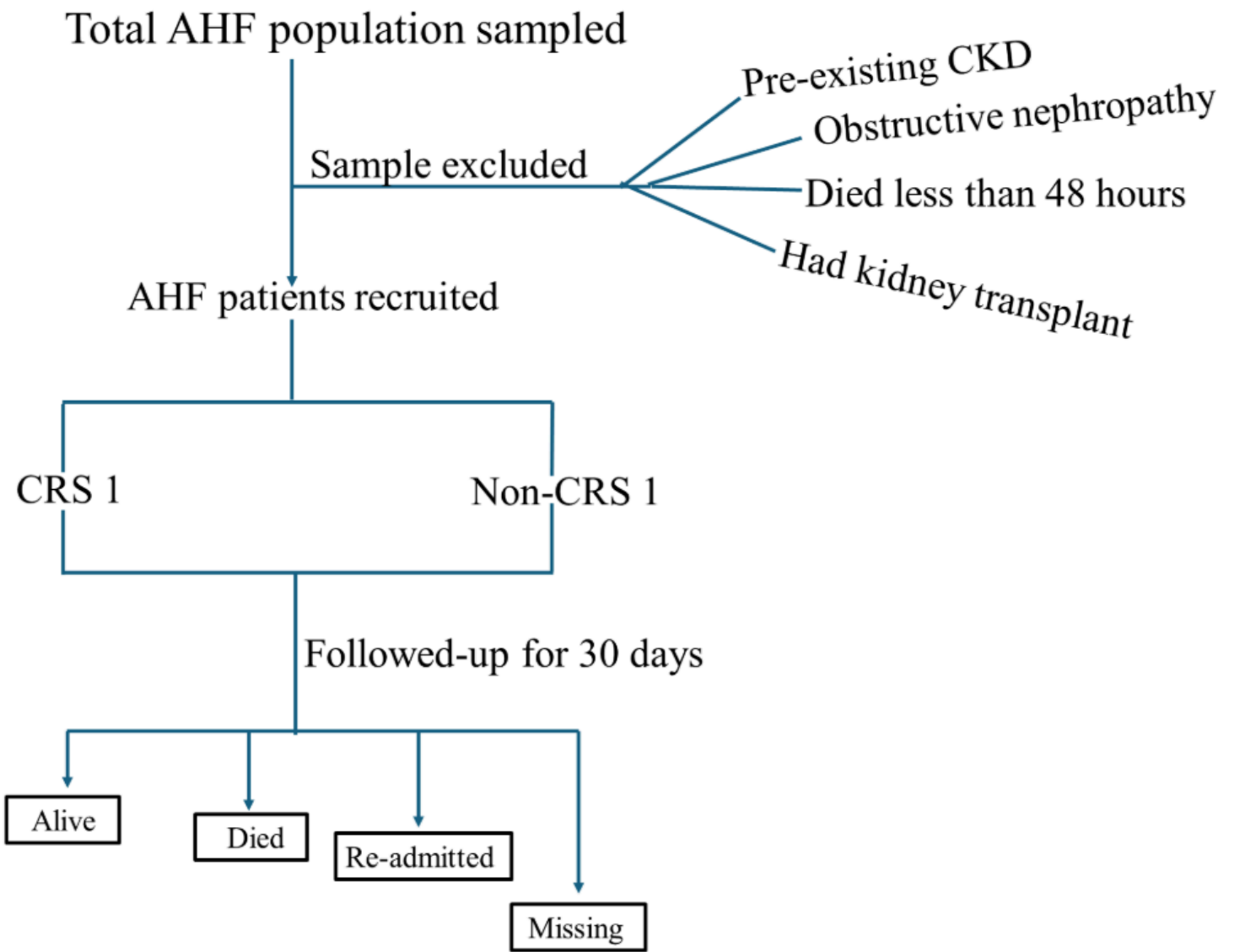


Figure 1

Flow chart of sample recruitment

AHF- Acute heart failure, CKD- Chronic kidney disease, CRS1- Patients with cardiorenal syndrome type 1, Non-CRS1- Patients without cardiorenal syndrome type 1.

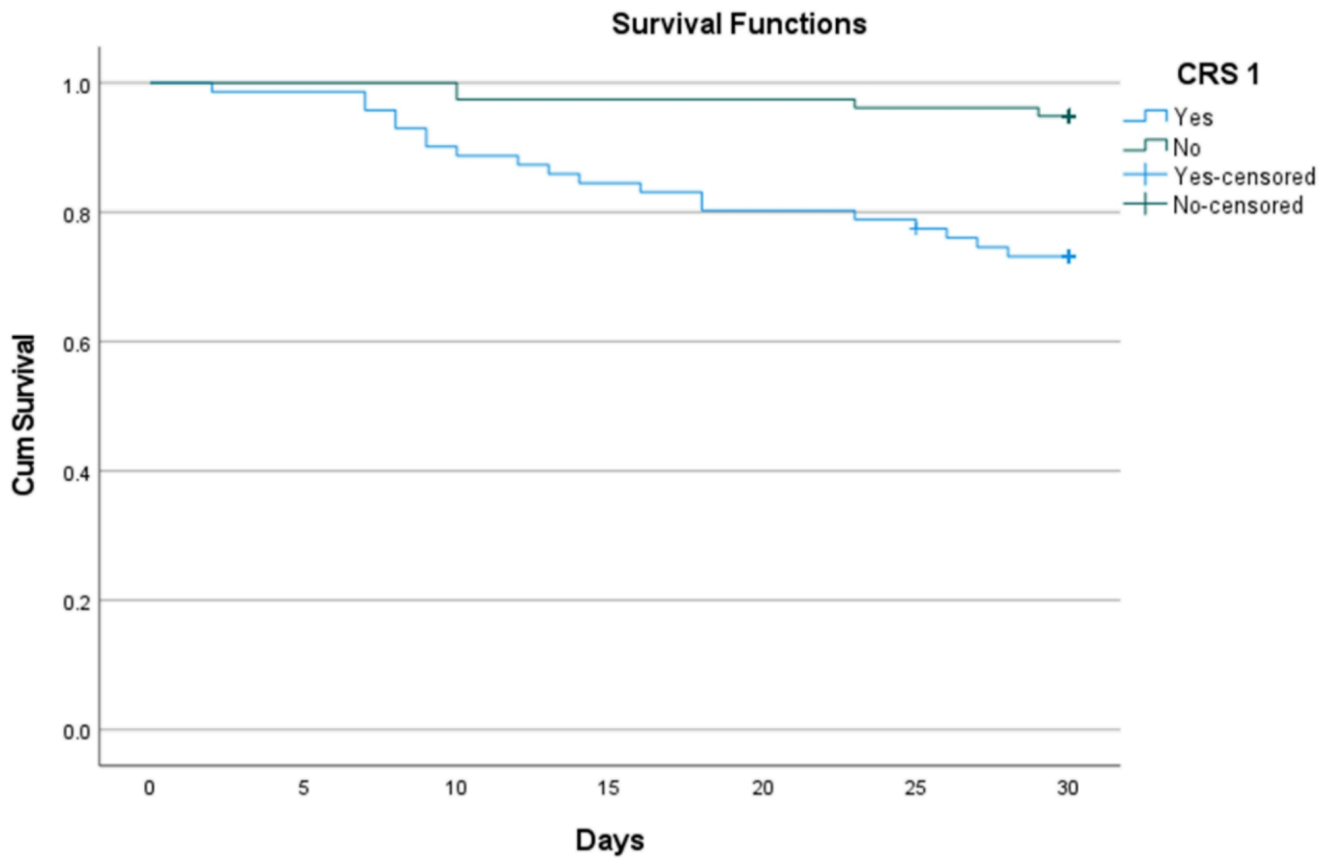


Figure 2

Kaplan Meier Survival Curve showing less cumulative survival rate in patients with CRS1

Yes- Patients with CRS1

No- Patients without CRS1

Yes-censored- Patients with CRS1 who are alive at day 30

No-censored – Patients without CRS1 who are alive at day 30