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DIFFERENTIAL OUTCOMES AND TREATMENT PATTERNS IN ACUTE HEART FAILURE STRATIFIED BY RENAL FUNCTION: A PROSPECTIVE OBSERVATIONAL STUDY

Abdul Rahman*(rahmanabdul4224@gmail.com)
Tahoora Tareq(tareqtahoora@gmail.com)
Department of Pharmacy Practice, MESCO College of Pharmacy, Hyderabad-500006, TG

Abstract

Background & Aim: *Heart failure (HF) remains one of the leading causes of morbidity and mortality worldwide, and renal dysfunction is a frequent comorbidity that complicates its management. This study sought to compare clinical features, treatment strategies, and outcomes in patients admitted with acute heart failure (AHF), stratified by renal function.*

Methods: *In this prospective observational study conducted at a tertiary care hospital in Hyderabad between September 2019 and February 2021, 132 patients with AHF were enrolled. Based on estimated glomerular filtration rate (eGFR), participants were categorized into Group A (eGFR >60 ml/min/1.73 m²; n=50) and Group B (eGFR ≤60 ml/min/1.73 m²; n=82). Clinical parameters, laboratory values, and therapeutic patterns were recorded during hospitalization and outcomes (NYHA class, readmission, mortality) were assessed at 1-year follow-up.*

Results: *Among the total cohort, 65 patients (49.2%) had HFrEF, 41 (31.0%) had HFmrEF, and 26 (19.6%) had HFpEF. Renal impairment was most prevalent in HFpEF cases (73.1%). Compared with Group A, patients in Group B were less frequently prescribed ACEIs/ARBs (30% vs. 58%; p<0.01) and digoxin (20% vs. 42%; p<0.01), but more often received hydralazine–isosorbide dinitrate (48% vs. 16%; p<0.001). One-year mortality was significantly higher in Group B (38.5% vs. 14.0%; p=0.002). Improvement in NYHA class was lower in Group B (34.1% vs. 48.0%).*

Conclusion: *Renal impairment in AHF patients was associated with poorer outcomes and underutilization of guideline-directed therapies. eGFR was a stronger predictor of mortality than the left ventricular ejection fraction. Optimizing therapy in patients with co-existing renal dysfunction warrants further clinical investigation.*

Corresponding author:
Abdul Rahman,
Department of Pharmacy Practice,
MESCO College of Pharmacy,
Hyderabad, Telangana, India,
Cell: +91 9100738098,
Email: rahmanabdul4224@gmail.com.

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INTRODUCTION:

Heart failure (HF) is a complex clinical condition resulting from structural or functional cardiac abnormalities that impair the heart's ability to maintain adequate tissue perfusion.[1] It represents the final common pathway of most cardiovascular diseases and remains a major cause of hospitalization and mortality worldwide. Patients with HF frequently experience impaired quality of life, recurrent admissions, and significant long-term mortality.

Renal dysfunction is a common comorbidity in patients admitted with acute heart failure (AHF). Approximately half of hospitalized HF patients present with some degree of renal impairment, and even mild reductions in glomerular filtration rate (GFR) are linked to worse cardiovascular outcomes.[2] The coexistence of renal impairment further complicates therapeutic decision-making because many guideline-directed medications can exacerbate kidney dysfunction. This frequently leads to underutilization of disease-modifying therapies, ultimately contributing to poor prognosis.

Despite the well-recognized bidirectional relationship between cardiac and renal dysfunction, there is limited data from Indian populations that directly compare outcomes of AHF patients with and without renal impairment. Understanding these differences may help guide clinical decisions and improve long-term outcomes.

The present study was designed to evaluate clinical characteristics, treatment patterns, and prognosis in AHF patients stratified by renal function. In addition, the prevalence of renal impairment across different subtypes of HF (HFrEF, HFmrEF, and HFpEF) was assessed.

METHADOLOGY:

This was a prospective observational study conducted in the Department of Cardiology at a tertiary care teaching hospital in Hyderabad, India. Patient recruitment occurred from September 2024 to February 2025

A total of 132 consecutive patients admitted with a primary diagnosis of acute heart failure (AHF) were included. Subjects were stratified into two groups based on estimated glomerular filtration rate (eGFR): Group A: eGFR >60 ml/min/1.73 m^2 (normal renal function, n=50), Group B: eGFR ≤60 ml/min/1.73 m^2 (renal impairment, n=82).

Inclusion criteria: Age ≥18 years, NYHA functional class II–IV, diagnosis of de novo or decompensated chronic HF.

Exclusion criteria: Acute STEMI as primary diagnosis, valvular or congenital heart disease, malignancy, rheumatic heart disease, pregnancy, incomplete clinical data, or loss to follow- up.

Data Collection: Demographic and clinical variables were recorded at admission, including comorbidities, vitals, physical findings, laboratory investigations, echocardiography, and prescribed medications. eGFR was calculated using the MDRD formula.

Outcomes: Patients were followed at 1 month, 3 months, and 12 months (outpatient visits or telephonic follow-up). The primary endpoint was all-cause mortality at 1 year. Secondary endpoints included change in NYHA class and rehospitalizations for AHF.

Statistical Analysis: Continuous data were expressed as mean ± SD and compared using independent t-tests. Categorical variables were expressed as proportions and compared using chi-square or Fisher's exact test. A p-value <0.05 was considered statistically significant. Analyses were performed with SPSS v22.

RESULTS:

Of 132 patients enrolled, 50 (37.8%) had normal renal function (Group A), while 82 (62.1%) had renal impairment (Group B).

Baseline Characteristics: Group A patients were younger (mean age 56.4 ± 12.9 years) compared to Group B (62.7 ± 11.8 years, p=0.001). Gender distribution was similar between groups. Most patients presented in NYHA class III.

Comorbidities: Hypertension (82% vs. 66%; p=0.03), ischemic heart disease (82% vs. 58%; p=0.001), and anemia (13% vs. 3%; p=0.02) were significantly more common in Group B.

Heart Failure Subtypes: HFrEF (49.2%), HFmrEF (31.0%), and HFpEF (19.6%). Renal impairment was most common in HFpEF (73.1%).

In-hospital Management: Group B patients were less frequently prescribed ACEIs/ARBs (30% vs. 58%; p<0.01) and digoxin (20% vs. 42%; p<0.01), but more often received hydralazine–isosorbide dinitrate (48% vs. 16%; p<0.001) and statins (95% vs. 82%; p=0.02).

Clinical Outcomes: At one year, mortality was significantly higher in Group B (38.5% vs. 14.0%; p=0.002). Improvement in NYHA class was less frequent in Group B (34.1% vs. 48.0%), while rehospitalization rates were comparable (19.5% vs.

15.2%).

Table 1 : Baseline characteristics

variable	Group A (n=50)	Group B (n=82)	p-value
Mean Age (years)	56.4	62.7	0.001
Male(%)	52.0	55.0	0.54
Female (%)	48.0	45.0	0.54
Hypertension (%)	66.0	82.0	0.03
Diabetes mellitus (%)	56.0	70.0	0.07
Ischemic Heart Disease (%)	58.0	82.0	0.001
Anemia(%)	3.0	13.0	0.02

Table 2: HF Subtypes and Renal Impairment

HF Subtype	Total (n=132)	Renal impairment (n,%)
HFrEF (<40%)	65	36 (55.3%)
HFmrEF (40-49%)	41	29 (70.7%)
HFpEF (≥50%)	26	19 (73.1%)

Table 3: In-hospital Management

Therapy	Group A (n=50)	Group B (n = 82)	p- value
ACEIs/ARBs	29 (58%)	25 (30%)	<0.01
Digoxin	21 (42%)	16 (20%)	<0.01
H+ISDN	8 (16%)	39 (48%)	<0.001
Statins	41 (82%)	78 (95%)	0.02

DISCUSSION:

This prospective observational study demonstrated that renal impairment is highly prevalent (62.1%) among acute heart failure (AHF) patients and is associated with a markedly poorer prognosis. Our findings align with global data, such as that from the ADHERE registry, which established renal dysfunction as a powerful independent predictor of in-hospital mortality in AHF [3]. The nearly threefold higher one-year mortality in Group B (38.5% vs. 14.0%) underscores the critical impact of the cardiorenal axis on survival, a consistent finding in major HF registries worldwide [4].

The baseline characteristics of our cohort reinforce known risk profiles. Patients with renal impairment were older and had a higher burden of comorbidities, particularly hypertension, ischemic heart disease, and anemia. This clustering of risk factors contributes to a more advanced disease state and a complex clinical picture. The high prevalence of anemia in Group B (13%) is noteworthy, as it is a key component of the cardiorenal anemia syndrome, creating a vicious cycle that worsens both cardiac and renal function [5].

A pivotal finding of our study was the differential prevalence of renal impairment across HF subtypes, being highest in HFpEF (73.1%). This observation suggests a distinct pathophysiological link. While HFrEF is primarily driven by impaired contractility, HFpEF is increasingly recognized as a systemic pro-inflammatory and pro-fibrotic state associated with endothelial dysfunction and microvascular disease [6]. This systemic involvement likely has a more direct and pronounced impact on the renal vasculature and interstitium, leading to a higher prevalence of concomitant renal disease. Our results corroborate those from the TOPCAT trial, which also reported a high burden of renal dysfunction in HFpEF populations [7].

The underutilization of guideline-directed medical therapy (GDMT) in patients with renal dysfunction is a major concern highlighted by our data. The significantly lower prescription rates of ACEIs/ARBs (30% vs. 58%) and digoxin (20% vs. 42%) in Group B reflect a well-documented "therapeutic inertia" driven by fears of worsening renal function or electrolyte disturbances. This conservative approach, while understandable, may paradoxically contribute to the poorer outcomes it seeks to avoid, as the neurohormonal blockade provided by these agents is crucial for long-term survival [8]. Conversely, the more frequent use of hydralazine-isosorbide dinitrate (H+ISDN) in Group B (48% vs. 16%) represents a rational adaptation, as this combination is a recommended alternative for patients with renal impairment who are intolerant to ACEIs/ARBs.

Our conclusion that eGFR was a stronger predictor of mortality than left ventricular ejection fraction (LVEF) is a significant take-home message. It shifts the focus from a purely cardiac metric to an integrated cardiorenal assessment for risk stratification. This aligns with the growing understanding that the prognosis in HF is often determined by the dysfunction of other organs, particularly the kidneys.

The results emphasize the urgent need for tailored therapeutic strategies. The underutilization of GDMT highlights a critical gap in care. Greater adoption of newer drug classes such as Angiotensin Receptor-Neprilysin Inhibitors (ARNIs) and SGLT2 inhibitors, which have demonstrated cardiorenal protective benefits even in patients with advanced renal disease, could be a game-changer for this vulnerable population. Future studies should focus on implementing and evaluating such strategies in real-world cohorts similar to ours.

CONCLUSION:

Renal impairment was common among patients admitted with acute heart failure and was strongly associated with higher one-year mortality, underutilization of guideline-directed therapies, and reduced functional improvement. eGFR proved to be a stronger predictor of prognosis than left ventricular function. Future multicenter studies are needed to validate these findings and to identify effective management strategies for patients with combined HF and renal dysfunction.

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