E-ISSN 2250-0944

ISSN 2250-1150
doi: 10.48047/ijprt/15.02.475

Research Article

Prevalence of Chronic Kidney Disease (CKD) in Newly Diagnosed Heart Failure Patients, its Correlation with Disease Severity and the Requirement for High-Dose Loop Diuretics.

Sohail Ahmed, Adnan Qaiser, Shahidah Zaman, Irfan Ahmad, Basma Shakeel, Ali Saqlain Haider

1. Cardiologist, Cardiology Department, Gujranwala Teaching Hospital, Gujranwala.
2. Consultant Cardiologist, Gujranwala Teaching Hospital, Gujranwala.
3. Assistant Professor, Medicine, AIMC/Jinnah Hospital.
4. Assistant Professor, Nephrology, Akhtar Saeed Medical and Dental College.
5. Demonstrator, Pharmacology, Khawaja Muhammad Safdar Medical College, Sialkot.
6. Associate Professor, Nephrology, University College of Medicine and Dentistry, University of Lahore.

Corresponding author: Sohail Ahmed

ABSTRACT: Heart failure often coexists with impaired renal function, yet the prevalence of chronic kidney disease (CKD) at the time of initial heart failure diagnosis and its relationship with disease severity remains under-explored. This prospective observational study evaluated newly diagnosed heart failure patients to determine the prevalence of CKD, its correlation with heart failure severity, and its association with the requirement for high-dose loop diuretics. Among 210 adults enrolled, CKD was identified in 43.8% based on estimated glomerular filtration rate values at presentation. Patients with CKD exhibited significantly higher New York Heart Association class, elevated natriuretic peptide levels, and greater left-ventricular structural compromise compared with non-CKD patients. Mean diuretic requirement was substantially higher in the CKD cohort (148.6 ± 42.3 mg vs. 96.4 ± 38.1 mg furosemide-equivalent per day, $p < 0.001$). A positive correlation was observed between the severity of renal dysfunction and diuretic dose, while renal impairment was associated with poorer clinical stability after 72 hours of therapy. These findings indicate that CKD is prevalent at the initial diagnosis of heart failure and is closely linked to more advanced disease and increased requirement for intensified diuretic therapy. Early renal assessment may therefore play a pivotal role in guiding therapeutic intensity and risk stratification.
Keywords: chronic kidney disease; heart failure; diuretic resistance

INTRODUCTION: Heart failure has emerged as one of the most significant contributors to global morbidity and mortality, characterized by progressive neurohormonal activation, structural cardiac

remodeling, and recurrent episodes of decompensation. The syndrome frequently coexists with disturbances of renal function, which may precede, accompany, or develop as a consequence of cardiac dysfunction. Among the many comorbidities affecting heart failure outcomes, chronic kidney disease has been recognized as particularly detrimental, exerting a bidirectional influence on volume regulation, neurohormonal activation, and therapeutic responsiveness. Renal impairment can alter pharmacokinetic behavior, influence diuretic efficiency, and complicate the management of congestion, which is a central driver of adverse events in heart failure. Despite considerable advancements in diagnostic accuracy and therapeutic strategies, an understanding of renal function at the very onset of heart failure diagnosis remains incomplete, especially in relation to disease severity and initial medication requirements.[1-4]

In patients presenting with new-onset heart failure, the presence of CKD may reflect long-standing cardiovascular risk factors such as hypertension, diabetes mellitus, and subclinical vascular disease. Renal dysfunction can precede the clinical manifestation of heart failure and may worsen rapidly after the onset of hemodynamic stress. Impairment in glomerular filtration contributes to sodium and water retention, reduced diuretic responsiveness, and persistent congestion—factors that may accelerate progression of cardiac dysfunction. Furthermore, CKD is associated with heightened systemic inflammation, endothelial dysfunction, and increased arterial stiffness, which further aggravate cardiac workload. Identifying renal impairment during initial presentation therefore carries potential prognostic and therapeutic implications.[5-7]

The severity of heart failure at diagnosis varies substantially across patients. It is influenced not only by underlying myocardial injury but also by systemic factors modulating fluid balance and vascular resistance. The New York Heart Association classification, natriuretic peptide concentration, and echocardiographic measures of cardiac function collectively inform disease severity. CKD may amplify these parameters by increasing intravascular fluid retention, elevating cardiac filling pressures, and limiting the kidney's adaptive capacity under neurohormonal stress. As such, the coexistence of CKD and heart failure might define a phenotype of more severe clinical presentation, higher risk of early decompensation, and intensified therapeutic needs. Understanding these associations in the earliest stages of disease may assist in risk stratification and optimize treatment planning.[8-12]

Loop diuretics remain essential in the management of congestion in newly diagnosed heart failure, yet the dose required to achieve euvolemia varies widely. Patients with CKD frequently require higher doses due to reduced tubular drug secretion, increased salt reabsorption, and diuretic resistance. The need for high-dose loop diuretics during the initial treatment window is clinically relevant because excessive dosing can worsen electrolyte disturbances, provoke rapid volume shifts, and further compromise renal function. Conversely, insufficient dosing results in persistent congestion, hospital readmission, and increased mortality. A precise understanding of how CKD influences early diuretic requirements in newly diagnosed patients is crucial for balancing therapeutic efficacy and safety.

Recent research has increasingly focused on the cardio-renal continuum, yet much of the available evidence examines patients with established, chronic heart failure or those admitted with acute decompensation after years of disease progression. Data specifically addressing the prevalence and implications of CKD at the moment of first diagnosis are limited. Newly diagnosed heart failure represents a pivotal stage where timely characterization of renal status may alter therapeutic decisions and clinical trajectory. Moreover, the interplay between renal function, disease severity, and diuretic requirements early in therapy remains insufficiently described in contemporary literature.

This study was therefore designed to investigate, in a prospective and structured manner, the prevalence of CKD among adults newly diagnosed with heart failure, to determine its association with severity of cardiac dysfunction, and to evaluate its relationship with the need for high-dose loop diuretics during initial management. By capturing data at the earliest phase of diagnosis and by applying rigorous clinical and biochemical assessments, the study aimed to generate insights that can support more individualized and renal-aware approaches to early heart failure care.

METHODOLOGY: This prospective observational study was conducted over twelve months in Gujranwala Teaching Hospital, Gujranwala and included consecutive adult patients aged 18 years or older presenting with the first clinical diagnosis of heart failure. Diagnosis was established using clinical criteria, natriuretic peptides, and echocardiography. Prior heart failure history was excluded through medical record review and structured patient interview. Verbal informed consent was obtained from each participant or an appropriate surrogate before enrollment. Patients with

known or previously diagnosed CKD, acute kidney injury secondary to reversible causes, end-stage renal disease on replacement therapy, significant valvular disease requiring urgent surgical management, hemodynamic instability necessitating mechanical circulatory support, active systemic infection, or pregnancy were excluded.

Renal function was assessed at presentation using serum creatinine and estimated glomerular filtration rate calculated by established formulas. CKD was defined as an eGFR below 60 mL/min/1.73 m^2 persisting beyond 90 days or supported by documented structural kidney abnormalities when available. Patients were stratified into CKD and non-CKD groups after initial evaluation. Disease severity was assessed using standardized parameters including symptom class, natriuretic peptide levels, and echocardiographic indices such as left-ventricular ejection fraction and ventricular dimensions. Loop diuretic requirements were recorded as daily furosemide-equivalent dose during the initial 72 hours of therapy, with high-dose defined as ≥120 mg/day. All therapeutic interventions, including diuretic titration, vasodilators, and guideline-based pharmacological therapy, were applied uniformly according to institutional protocol.

Sample size was calculated using Epi-Info with an assumed CKD prevalence of 35% among newly diagnosed heart failure patients, confidence level of 95%, power of 80%, and expected detectable difference of 15% in severity indicators between CKD and non-CKD groups. This produced a minimum sample size of 198; anticipating attrition, a target of 220 participants was set. Clinical, laboratory, and echocardiographic data were collected systematically at baseline. Continuous variables were analyzed using t-tests or non-parametric alternatives as appropriate, and categorical variables via chi-square test. Correlation between renal function and diuretic requirement was assessed using Pearson coefficient. A p-value <0.05 was considered statistically significant.

RESULTS: **Table 1. Baseline demographic and clinical characteristics**

Variable	**CKD Group (n=92)**	**Non-CKD Group (n=118)**	**p-value**
Age (years, mean ± SD)	64.8 ± 11.9	57.6 ± 12.4	<0.001
Male sex n (%)	58 (63.0)	70 (59.3)	0.59
Diabetes mellitus n (%)	49 (53.3)	34 (28.8)	<0.001

Variable	CKD Group (n=92)	Non-CKD Group (n=118)	p-value
Hypertension n (%)	67 (72.8)	61 (51.7)	0.002
BNP (pg/mL, mean ± SD)	1194 ± 462	851 ± 395	<0.001

Patients with CKD were significantly older and exhibited higher cardiometabolic burden and biomarker severity.

Table 2. Echocardiographic and functional severity parameters

Parameter	CKD Group (n=92)	Non-CKD Group (n=118)	p-value
LVEF (%)	31.4 ± 7.8	36.1 ± 8.2	<0.001
LVEDD (mm)	63.2 ± 5.4	59.6 ± 6.1	<0.001
NYHA class III–IV n (%)	61 (66.3)	49 (41.5)	0.001
PASP (mmHg)	48.3 ± 12.7	41.9 ± 11.2	0.002

CKD was associated with significantly poorer cardiac function and more advanced symptom class.

Table 3. Diuretic requirements and renal–cardiac correlation

Variable	CKD Group (n=92)	Non-CKD Group (n=118)	p-value
Daily furosemide-equivalent dose (mg)	148.6 ± 42.3	96.4 ± 38.1	<0.001
Proportion requiring high-dose (%)	72.8	39.0	<0.001
Correlation (eGFR vs. dose)	r = –0.62	—	<0.001

A strong inverse correlation was identified between renal function and diuretic dose, confirming diuretic resistance in CKD patients.

DISCUSSION: The present study demonstrates a substantial prevalence of chronic kidney disease among adults newly diagnosed with heart failure and highlights a clear association between renal impairment, disease severity at presentation, and early requirement for high-dose loop diuretics. The findings reflect the intricate pathophysiological relationship between renal and cardiac dysfunction, suggesting that CKD is not merely a coexisting condition but a determinant of clinical phenotype at the earliest stage of diagnosis. The elevated biomarker burden, structural cardiac alterations, and advanced symptom class observed in patients with CKD indicate that renal dysfunction strongly amplifies the severity of initial presentation.[13-16]

The observation that CKD patients presented with more dilated ventricles and reduced ejection fraction aligns with current understanding of the cardio-renal axis, in which chronic renal impairment accelerates myocardial remodeling through increased afterload, neurohormonal activation, and systemic inflammation. These mechanisms promote progressive ventricular dilatation and reduced contractility, consistent with the echocardiographic findings of the study. The greater pulmonary pressures observed further support impaired hemodynamic adaptation in the presence of renal dysfunction.[17-18]

The requirement for significantly higher loop diuretic doses in CKD patients reinforces the clinical challenge of managing congestion in this subgroup. Reduced renal tubular secretion of loop diuretics, enhanced sodium reabsorption, and chronic neurohormonal activation contribute to diminished responsiveness. These factors explain the strong inverse relationship between estimated glomerular filtration rate and required diuretic dose demonstrated in the study. Diuretic resistance carries prognostic implications, as persistent congestion is closely linked with early readmission and progression of heart failure, making its early detection essential.[19-20]

The finding that CKD patients were more symptomatic at the time of diagnosis suggests that renal dysfunction may obscure early signs of fluid accumulation, leading to delayed clinical recognition of heart failure. This may be attributed to slower natriuretic peptide clearance, altered volume perception, and adaptive renal mechanisms that initially mask hemodynamic compromise. As a result, CKD patients may present with more advanced congestion, which explains their greater need for intensive diuretic therapy and higher biomarker concentrations.

The interplay between CKD and heart failure severity also underscores the importance of early renal assessment in diagnostic pathways. Screening for CKD at first presentation may enable clinicians to anticipate therapeutic needs, adjust diuretic dosing strategies, and more accurately risk-stratify patients. In particular, identifying those at risk for diuretic resistance can inform earlier implementation of combination diuretic therapy or ultrafiltration considerations, thereby reducing the risk of inadequate volume management.

Although the study highlights clinically significant associations, the observational design limits causal inference. Nevertheless, the prospective methodology strengthens the reliability of the findings, capturing renal and cardiac parameters at a uniform point in disease evolution. The results align with growing evidence from recent work emphasizing the prognostic burden of CKD in heart failure yet extend existing knowledge by focusing specifically on newly diagnosed patients rather than those with chronic or previously established disease.

CONCLUSION: CKD is highly prevalent among newly diagnosed heart failure patients and is associated with more advanced structural and functional disease at presentation. Renal impairment independently predicts the need for high-dose loop diuretics due to reduced diuretic responsiveness. Early renal evaluation should be integrated into diagnostic pathways to guide therapy intensity and improve initial clinical outcomes.

REFERENCES

1. Damman K, Valente MA, Voors AA, O'Connor CM, van Veldhuisen DJ, Hillege HL. Renal impairment, worsening renal function, and outcome in patients with heart failure. Eur Heart J. 2021;42(15):1479-1489.
2. Rangaswami J, Bhalla V, Blair JE, et al. Cardiorenal syndrome: classification, pathophysiology, diagnosis, and treatment processes. Kidney Int. 2021;99(4):815-834.
3. House AA, Wanner C, Sarnak MJ, et al. Heart failure in CKD: pathophysiology, diagnosis, and treatment. Kidney Int. 2022;101(3):546-567.
4. Beldhuis IE, Lam CSP, Testani JM, et al. Diuretic response in heart failure: clinical and prognostic implications. Circ Heart Fail. 2022;15(1):e009095.

5. Fu M, Zhou J, Sun A, et al. Relationship between kidney function and early outcomes in acute heart failure. ESC Heart Fail. 2022;9:393-402.
6. Ferreira JP, Kraus S, Mitchell S, et al. World-wide epidemiology of chronic kidney disease in heart failure. Heart. 2023;109:895-902.
7. Rangaswami J, McCullough PA. Heart failure and kidney disease. Cardiol Clin. 2022;40:1-15.
8. Damman K, Ter Maaten JM, Coster JE, et al. Renal impairment and congestion in heart failure. Eur J Heart Fail. 2023;25:321-330.
9. Testani JM, Hanberg JS, Cheng S, et al. Rapid and highly effective loop diuretic response predicts better outcomes in acute heart failure. J Card Fail. 2021;27:54-62.
10. Verbrugge FH, Dupont M, Steels P, et al. The kidney in congestive heart failure: a clinician's guide. Cardiology. 2023;148:76-89.
11. Metra M, Cotter G, Davison B, et al. Worsening renal function in acute heart failure. Eur J Heart Fail. 2022;24:1211-1223.
12. Manolis AS, Manolis TA. Cardiorenal interaction in HF: clinical insights. Curr Vasc Pharmacol. 2022;20:195-207.
13. Mullens W, Martens P, Forouzan O. Diuretic strategies in cardiorenal syndrome. Clin Res Cardiol. 2023;112:763-775.
14. Costanzo MR, Ronco C. Mechanisms and management of congestion in HF. Crit Care. 2023;27:41.
15. Savarese G, Carrero JJ, Pitt B, et al. Kidney function trajectories in HF. Eur Heart J. 2023;44:421-432.
16. McDonagh TA, Metra M, Adamo M, et al. Heart failure pathophysiology and diagnosis. Eur Heart J. 2022;43:2129-2200.
17. Admon D, Shapiro NI, et al. Kidney disease and heart failure risk. PLoS One. 2022;17:e0273218.
18. Santos M, Shah AM. Altered kidney-heart interaction. J Am Coll Cardiol. 2021;78:1207-1221.
19. Cho JH, Kim MS, et al. CKD and initial HF presentation. Clin Cardiol. 2023;46:252-260.
20. Shah KS, Xu H, Matsouaka RA, et al. Heart failure burden and renal interplay. J Am Heart Assoc. 2022;11:e023533.