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Research Article

Prevalence of Renal Dysfunction Among Patients with Chronic Heart Failure

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Abstract

Chronic heart failure is a major global health problem associated with substantial morbidity and mortality, and its close interaction with renal function through the cardiorenal syndrome significantly influences disease progression and outcomes. Renal dysfunction is commonly encountered in patients with chronic heart failure and is known to be associated with adverse prognosis; however, its burden in routine clinical settings, particularly in local populations, remains insufficiently characterized. The purpose of this study was to determine the prevalence of renal dysfunction among patients with chronic heart failure and to examine its association with key clinical variables. To achieve this, a hospital-based cross-sectional study was conducted in the Department of Cardiology at Satkhira Medical College and Hospital, Bangladesh, including 150 patients diagnosed with chronic heart failure. Relevant demographic and clinical data were collected, and renal function was assessed using estimated glomerular filtration rate calculated by the CKD-EPI equation. Statistical analysis was performed to evaluate the relationship between renal dysfunction and selected variables. The findings demonstrated that renal dysfunction was present in 58.0% of patients, with moderate impairment being the most common pattern, and was significantly associated with older age, hypertension, diabetes mellitus, and advanced NYHA functional class. In conclusion, this study highlights the substantial burden of renal dysfunction among patients with chronic heart failure and emphasizes the importance of routine renal function assessment for early identification and improved clinical management in this high-risk population.

Keywords

Chronic Heart Failure, Renal Dysfunction, Prevalence, Cardiorenal Syndrome, Glomerular Filtration Rate

1. Introduction

Heart failure is currently recognized as a major global health concern affecting populations worldwide. It is estimated that approximately 38 million individuals are living with heart failure, and evidence suggests that its prognosis may be poorer than that of certain malignancies [1]. Chronic heart failure (CHF) is a highly prevalent condition and represents a significant cause of hospital admissions, being strongly associated with considerable morbidity and mortality [2].

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The relationship between the heart and kidneys in patients with heart failure is complex, and the bidirectional interactions between these two organs are not yet fully understood. The concept of cardiorenal syndrome (CRS) describes a multifaceted disorder in which acute or chronic dysfunction of one organ can induce acute or chronic dysfunction in the other [3]. Heart failure and kidney disease share overlapping pathophysiological mechanisms, resulting in interconnected dysfunction referred to as cardiorenal syndrome [4]. As heart failure advances, compensatory mechanisms such as renal vasoconstriction occur, leading to reduced renal blood flow as circulation is preferentially maintained to vital organs including the heart, brain, and skeletal muscles during activity [5].

Renal dysfunction is frequently observed among patients with heart failure, with reported prevalence rates ranging from 20% to 57% in those with stable chronic heart failure [6-10]. Renal impairment acts as an independent contributor to disease progression and is associated with an increased incidence of cardiovascular events and mortality in both asymptomatic and symptomatic CHF populations [11]. Despite incomplete understanding of the underlying mechanisms, patients with heart failure who develop chronic kidney disease (CKD) or worsening renal function (WRF) generally experience poorer clinical outcomes compared to those without renal involvement [12-16]. Renal dysfunction may indicate more advanced vascular disease, older age, impaired cardiac performance, or a reduced likelihood of receiving optimal therapeutic interventions. Glomerular filtration rate (GFR) is considered one of the earliest and most important indicators for assessing renal function [17].

Renal dysfunction is commonly observed in patients with heart failure across different clinical settings. In patients with chronic stable heart failure, higher rates have been documented in patients hospitalized with acutely decompensated heart failure [18, 19]. Similarly, other studies have reported that impaired renal function occurs in a substantial proportion of CHF patients. Chronic kidney disease is also commonly present in nearly half of heart failure patients, largely due to shared risk factors contributing to both conditions [20].

However, many of the existing studies have primarily included younger populations with fewer comorbidities compared to those encountered in routine clinical practice. In addition, patients with significant renal dysfunction have often been excluded from clinical trials [21-23]. Although some data are available regarding the prevalence and progression of renal dysfunction in hospitalized heart failure patients, there remains a lack of information from representative cohorts of ambulatory patients with chronic heart failure. While several studies have explored the global prevalence of renal dysfunction in heart failure, further research is needed to better understand its burden in real-world clinical settings [16, 24]. Therefore, the present study aims to determine the prevalence of renal dysfunction among patients with chronic heart failure.

2. Methodology & Materials

2.1. Study Design and Setting

This was a hospital-based descriptive cross-sectional study conducted in the Department of Cardiology, Satkhira Medical College and Hospital, Dhaka, Bangladesh, over a one-year period from January 2025 to December 2025.

2.2. Study Population and Sample Size

A total of 150 patients diagnosed with chronic heart failure were included in the study. Patients were recruited from both inpatient and outpatient departments during the study period. The sample size was determined purposively, and participants were enrolled consecutively according to predefined eligibility criteria.

2.3. Inclusion and Exclusion Criteria

Patients of either sex with a confirmed diagnosis of chronic heart failure based on clinical and echocardiographic findings were included in the study. Patients with acute heart failure, known chronic kidney disease on dialysis, congenital heart disease, or incomplete clinical records were excluded.

2.4. Data Collection

Data were collected using a structured data collection form. Relevant information, including age, sex, comorbidities (hypertension and diabetes mellitus), etiology of heart failure, and New York Heart Association (NYHA) functional class, was obtained through patient interviews and review of medical records. NYHA functional class was assessed according to standard clinical criteria. Clinical findings and relevant investigations were also documented.

2.5. Assessment of Renal Function

Renal function was assessed using estimated glomerular filtration rate (eGFR), calculated from serum creatinine using the CKD-EPI equation. Renal dysfunction was defined as eGFR <90 mL/min/1.73 m^2 and further categorized as mild (60–89 mL/min/1.73 m^2), moderate (30–59 mL/min/1.73 m^2), and severe (<30 mL/min/1.73 m^2).

2.6. Study Variables

The primary outcome variable was the prevalence of renal dysfunction among patients with chronic heart failure. Independent variables included age, sex, hypertension, diabetes mellitus, and NYHA functional class.

2.7. Statistical Analysis

Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 25.0 (IBM Corp., Armonk, NY, USA). Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as mean ± standard deviation. The association between renal dysfunction and selected clinical variables was assessed using the chi-square test. A p-value of <0.05 was considered statistically significant.

3. Results

3.1. Baseline Characteristics of the Study Population

A total of 150 patients with chronic heart failure were included in the study. The mean age was 55.4 ± 11.3 years, with most patients in the 51–70 years age group (46.7%), followed by 41–50 years (21.3%), ≤40 years (18.7%), and >70 years (13.3%). Males constituted 61.3% of the study population, while females accounted for 38.7%. Hypertension was the most common comorbidity (68.0%), followed by diabetes mellitus (50.7%), and ischemic heart disease was the leading etiology of heart failure (58.7%) (Table 1).

Table 1. *Baseline Demographic and Clinical Characteristics of the Study Participants (n = 150).*

Variable		Frequency (n)	Percentage (%)
Age Group (years)	≤40	28	18.7
	41–50	32	21.3
	51–70	70	46.7
	>70	20	13.3
	Mean Age (years)	55.4 ± 11.3	
Sex	Male	92	61.3
	Female	58	38.7
Comorbidities	Hypertension	102	68.0
	Diabetes Mellitus	76	50.7
Etiology of Heart Failure	Ischemic Heart Disease	88	58.7
	Non-ischemic Causes	62	41.3

3.2. Prevalence of Renal Dysfunction

Renal dysfunction (eGFR <90 mL/min/1.73 m^2) was present in 58.0% of patients, while 42.0% had normal renal function (Figure 1).

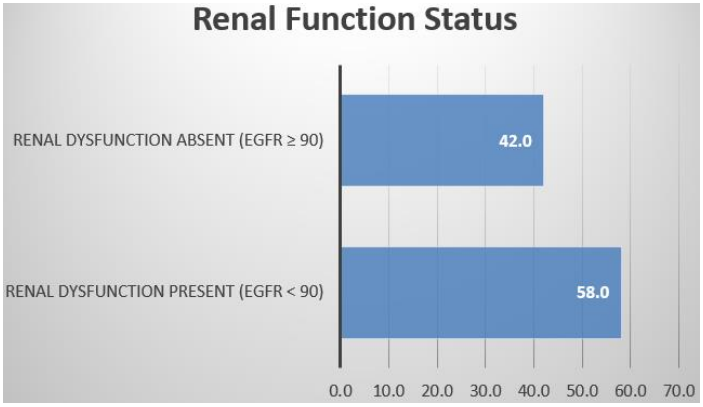

Figure 1. *Prevalence of Renal Dysfunction Among Patients with Chronic Heart Failure (n = 150).*

3.3. Distribution of Renal Function Based on eGFR

Among the study population, 42.0% had normal renal function (eGFR ≥90 mL/min/1.73 m^2). Among those with renal impairment, moderate dysfunction (30–59 mL/min/1.73 m^2) was the most frequent category (27.3%), followed by mild dysfunction (18.7%) and severe dysfunction (12.0%), with moderate dysfunction representing the largest proportion (Table 2).

Table 2. Distribution of Renal Function Based on eGFR Among Study Participants (n = 150).

eGFR Category (mL/min/1.73 m^2)	Severity	Frequency (n)	Percentage (%)
≥90	Normal	63	42.0
60–89	Mild Dysfunction	28	18.7
30–59	Moderate Dysfunction	41	27.3
<30	Severe Dysfunction	18	12.0

3.4. Association of Renal Dysfunction with Clinical Variables

Renal dysfunction was significantly more common among patients aged ≥60 years (67.5% vs 32.5%, p=0.020), those with hypertension (66.7% vs 33.3%, p=0.001), and those with diabetes mellitus (68.4% vs 31.6%, p=0.030). It was also significantly associated with advanced heart failure, with higher prevalence in NYHA class III–IV compared to class I–II (65.5% vs 42.3%, p=0.004) (Table 3).

Table 3. Association of Renal Dysfunction with Selected Clinical Variables (n = 150).

Variable	Renal Dysfunction Present n (%)	Renal Dysfunction Absent n (%)	p-value
Age ≥60 years	54 (67.5)	26 (32.5)	0.020
Hypertension	68 (66.7)	34 (33.3)	0.001
Diabetes Mellitus	52 (68.4)	24 (31.6)	0.030
NYHA Class III–IV	57 (65.5)	30 (34.5)	0.004
NYHA Class I–II	30 (42.3)	33 (57.7)	-

4. Discussion

In this hospital-based cross-sectional study conducted in the Department of Cardiology at Satkhira Medical College and Hospital, a substantial proportion of patients with chronic heart failure were found to have renal dysfunction as assessed by eGFR. Moderate renal impairment constituted the most common pattern, and renal dysfunction was significantly associated with older age, hypertension, diabetes mellitus, and advanced NYHA functional class. These findings underscore the high burden of renal involvement in chronic heart failure and highlight its close relationship with disease severity and comorbid conditions, emphasizing the need for routine renal function assessment in this patient population.

The baseline demographic and clinical characteristics observed in the present study are largely consistent with previously published literature on chronic heart failure populations. The majority of patients were in the 51–70 years age group, with a mean age of 55.4 ± 11.3 years, indicating a predominance of middle-aged to older adults, which aligns with findings reported by Ahmed et al., where large heart failure registries demonstrated a higher mean age of approximately 65–72 years [25], and by Shen et al., who reported a median age of 65 years among patients with chronic heart failure [26]. A male predominance was observed in this study (61.3%), which is comparable to Shen et al., where 59.6% of patients were male [26]. Regarding comorbidities, hypertension was the

most prevalent condition (68.0%), followed by diabetes mellitus (50.7%), findings that are consistent with data from the ADHERE registry reported by Ahmed et al., where hypertension and diabetes were present in 73% and 44% of patients, respectively [25]. Furthermore, ischemic heart disease was identified as the leading etiology of heart failure (58.7%), in agreement with global evidence indicating coronary artery disease as the most common underlying cause of chronic heart failure. Overall, these findings suggest that the study population is comparable to established heart failure cohorts, thereby supporting the external validity of the present study.

The present study demonstrated that renal dysfunction was present in 58.0% of patients with chronic heart failure, highlighting a substantial burden of impaired renal function in this population. This finding is consistent with previously published studies. Löfman et al. reported a prevalence of 51% for renal dysfunction defined as eGFR <60 mL/min/1.73 m^2 [27], while Lawson et al. observed a higher prevalence of 63% for chronic kidney disease among heart failure patients [28]. Similarly, Cobo et al. reported a prevalence of 59.1% for reduced renal function [29]. Although variations exist due to differences in study populations and definitions of renal dysfunction, the prevalence observed in the present study falls well within the range reported in the literature. These findings reinforce the strong and well-established association between chronic heart failure and renal impairment and highlight the importance of routine assessment of renal function in this patient population.

The present study further demonstrated that among patients with chronic heart failure, 42.0% had normal renal function (eGFR ≥90 mL/min/1.73 m^2), while renal dysfunction was distributed across mild (18.7%), moderate (27.3%), and severe (12.0%) categories, with moderate dysfunction being the most frequent abnormality. This pattern is consistent with previous studies reporting a graded decline in renal function among heart failure patients. Löfman et al. similarly observed mild dysfunction in approximately 36%, moderate dysfunction in 43%, and severe dysfunction in 11% of cases [27], indicating that moderate impairment is commonly the predominant category. Likewise, Stanojević et al. reported mild dysfunction in 57.8%, moderate dysfunction in 32.2%, and severe dysfunction in only about 1.1% [30], further supporting that early-to-moderate renal impairment is most frequently encountered in chronic heart failure populations. Additionally, Beck et al. demonstrated that worsening renal function, particularly eGFR <30 mL/min/1.73 m^2, is associated with a substantially higher burden of heart failure severity and adverse outcomes [31], emphasizing the clinical significance of advanced renal dysfunction despite its lower prevalence. Overall, the findings of the present study are consistent with existing literature, reinforcing that renal impairment in chronic heart failure most commonly manifests as mild to moderate dysfunction, with a smaller but clinically important proportion progressing to severe impairment.

The present study also demonstrated a significant association between renal dysfunction and several clinical variables in patients with chronic heart failure, with higher prevalence observed among patients aged ≥60 years, those with hypertension, diabetes mellitus, and those in advanced functional class (NYHA III–IV). These findings are consistent with previous literature. Li et al. reported that in patients with NYHA class IV heart failure, renal insufficiency was significantly associated with increasing age, with older patients showing a markedly higher prevalence of reduced eGFR [32], indicating that renal impairment worsens with advancing age and disease severity. Similarly, Zhang et al. demonstrated that patients with renal dysfunction had significantly higher rates of hypertension compared to those without renal impairment and a substantially greater proportion of NYHA class III–IV patients (40.7% vs 13%, $p < 0.001$) [33], highlighting the strong relationship between renal dysfunction and advanced heart failure status. Furthermore, Galil et al. reported a significantly higher prevalence of diabetes mellitus among patients with combined chronic kidney disease and heart failure [34], supporting the role of diabetes as a major contributing factor to renal impairment in this population. Overall, the findings of the present study align closely with existing evidence, reinforcing that renal dysfunction in chronic heart failure is significantly associated with older age, hypertension, diabetes mellitus, and more advanced NYHA functional class, reflecting the complex and interrelated nature of cardio-renal-metabolic interactions.

5. Conclusion

Renal dysfunction is a common and clinically important comorbidity in patients with chronic heart failure. In this study, more than half of the patients were found to have impaired renal function, with moderate dysfunction being the most frequent pattern. Renal impairment showed significant associations with older age, hypertension, diabetes mellitus, and advanced NYHA class, indicating that worsening renal function is closely linked with increasing disease severity and adverse clinical profiles in chronic heart failure.

Abbreviations

CHF	Chronic Heart Failure
CKD	Chronic Kidney Disease
CKD	Chronic Kidney Disease Epidemiology
EPI	Collaboration
CRS	Cardiorenal Syndrome
eGFR	Estimated Glomerular Filtration Rate
GFR	Glomerular Filtration Rate
IBM	International Business Machines Corporation
NYHA	New York Heart Association
RD	Renal Dysfunction
SPSS	Statistical Package for the Social Sciences
WRF	Worsening Renal Function

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Author Contributions

Suman Kumar Das: Conceptualization, Supervision, Project administration, Writing – review & editing

Reba Das: Methodology, Data curation, Investigation

Kajal Kumar Karmoker: Formal Analysis, Validation, Visualization

Nur Alam: Software, Resources, Writing – original draft

Conflicts of Interest

There are no conflicts of interest.

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