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The Dual Burden of Chronic Kidney Disease and Cardiovascular Disease: Clinical Profiles and Outcomes among Admitted Patients in Community Based Medical College, Bangladesh (CBMC,B) Hospital

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Abstract

Chronic kidney disease (CKD) and cardiovascular disease (CVD) frequently coexist, contributing to a significant global health burden. In Bangladesh, data on the specific influence of CKD on the clinical presentation and prognosis of hospitalized CVD patients remain limited, highlighting a critical knowledge gap for targeted patient management. A prospective cohort study was conducted in collaboration between Department of Cardiology and Department of Nephrology of Community Based Medical College, Bangladesh (CBMC,B) Hospital, Mymensingh, Bangladesh, between June and July of 2025, to evaluate the impact of concomitant CKD on the clinical profile and outcomes of patients admitted with cardiovascular disease. A purposive sample of 193 adult patients admitted with primary CVD, such as acute coronary syndrome and heart failure, was enrolled. Participants were stratified into two cohorts: those with CKD (estimated glomerular filtration rate <60 ml/min/1.73m²) and those without. Clinical profiles, laboratory parameters, and in-hospital outcomes were systematically compared. Among 193 patients, 68(35.2%) had CKD. The CKD cohort was older and had higher rates of hypertension and diabetes ($p<0.05$). Heart failure was their predominant presentation (55.9% vs. 36.8%; $p=0.01$). In-hospital mortality (14.7% vs. 4.0%; $p=0.006$) and adverse events (29.4% vs. 11.2%; $p=0.001$) were significantly higher, and hospital stays were longer (8.5 days vs. 5.7 days; $p<0.001$). CKD is associated with a distinct, higher-risk clinical profile and significantly worse in-hospital outcomes in CVD patients. Integrated cardiorenal assessment and tailored management are imperative to improve the prognosis of this vulnerable patient population.

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Introduction

Cardiovascular disease (CVD) remains the leading cause of morbidity and mortality worldwide, posing a formidable challenge to global health systems.[1] Concurrently, chronic kidney disease (CKD) has emerged as a major public health concern, affecting approximately 10-15% of the global population, with its prevalence steadily rising.[2,3] These two conditions are not merely frequent companions but are pathophysiologically intertwined in what is often termed the 'cardiorenal syndrome', creating a vicious cycle of mutual deterioration.[4] The coexistence of CKD and CVD significantly amplifies the risk of adverse clinical events, including hospitalization, myocardial infarction, heart failure, and death, surpassing the risk associated with either condition alone.[5] The pathophysiological links between CKD and CVD are multifactorial and complex. CKD contributes to CVD progression through mechanisms

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such as chronic volume overload, hypertension, accelerated atherosclerosis from uremic toxins and dyslipidemia, vascular calcification, chronic inflammation, and fibrosis.[4,6] This unique milieu alters the clinical presentation of CVD; for instance, patients with CKD often experience atypical symptoms of acute coronary syndrome and have a higher propensity for heart failure.[7] Furthermore, CKD complicates the management of CVD, necessitating dose adjustments for many cardioprotective medications and increasing the risk of contrast-induced nephropathy and bleeding complications from antiplatelet or anticoagulant therapies.[8] Despite the established interconnection, the specific impact of CKD on the clinical profile and immediate outcomes of hospitalized CVD patients in specific regional contexts, particularly in South Asia, is not fully characterized. Bangladesh, a nation undergoing rapid epidemiological transition, faces a dual burden of non-communicable diseases, with rising rates of both CKD and CVD driven by factors like hypertension, diabetes mellitus, and changing lifestyles.[9,10] Data from high-income countries may not be directly generalizable to this setting due to differences in genetic predisposition, healthcare access, disease patterns, and management protocols. Several studies in other regions have demonstrated that CKD is a potent predictor of worse short- and long-term outcomes in patients with acute coronary syndromes and heart failure.[11-13] However, prospective data from Bangladeshi tertiary care hospitals, which capture the real-world clinical spectrum, complications, and in-hospital trajectories of this high-risk subgroup, are scarce. Understanding the local epidemiology is crucial for developing context-appropriate clinical guidelines, resource allocation, and preventive strategies. Therefore, this study aims to prospectively investigate the impact of comorbid CKD on the clinical profile and in-hospital outcomes of patients admitted with primary cardiovascular diagnoses at a tertiary care hospital in Mymensingh, Bangladesh.

Methods

Study design and sample population: This prospective cohort study was conducted in collaboration between Department of Cardiology and Department of Nephrology of Community Based Medical College, Bangladesh (CBMC,B) Hospital, Mymensingh, Bangladesh, between June and July of 2025. The study population consisted of 193 consecutively admitted adult patients with a primary diagnosis of cardiovascular disease (CVD), including acute coronary syndrome, heart failure, or arrhythmia.

Inclusion criteria*:* Patients were included if they were aged 18 years or above and were admitted with a primary, symptomatic CVD event confirmed by standard diagnostic criteria (e.g., ECG, cardiac biomarkers, echocardiography). Willingness to provide written informed consent was mandatory.

Exclusion criteria: Individuals were excluded if they had a history of end-stage renal disease on maintenance dialysis or prior kidney transplantation, acute kidney injury as the primary admitting diagnosis, or severe cognitive impairment preventing reliable data collection.

Study procedure: Using a purposive sampling technique, eligible patients were enrolled. Participants were stratified into two cohorts based on estimated glomerular filtration rate (eGFR <60 ml/min/1.73m² using the CKD-EPI formula): the CKD group and the non-CKD group. Data on demographic characteristics, clinical presentation, comorbidities,

laboratory parameters, and in-hospital outcomes (mortality, complications, length of stay) were collected via a structured questionnaire and patients' record review.

Data analysis: Statistical analysis was performed using IBM SPSS Statistics for Windows, version 23 (IBM Corp., Armonk, NY, USA). Continuous variables were compared using independent t-test, while categorical variables were compared using Chi-square test. Then, multivariate logistic regression analysis was done. A p-value of <0.05 was considered statistically significant.

Ethical approval: The study was approved by the ethical Review Committee of Community Based Medical College, Bangladesh (CBMC,B), Mymensingh, Bangladesh.

Results

We included a total of 193 patients admitted with a primary cardiovascular diagnosis. Based on eGFR, the cohort was stratified into 68 patients (35.2%) with chronic kidney disease (CKD) and 125 patients (64.8%) without CKD. The mean age of the overall cohort was 60.8±10.4 years, with a male predominance (64.2%). The CKD group was significantly older, with a mean age of 65.4±8.7 years compared to 58.1±9.9 years in the non-CKD group (p=0.001) (Table-I). Hypertension (89.7% vs. 72.8%; p=0.005) and diabetes mellitus was also significantly more prevalent (67.6% vs. 48.0%; p=0.008) in CKD. No significant differences were found in smoking, dyslipidemia and family history of CVD as risk factors between two groups (Table-II). Heart failure was the primary clinical presentation in CKD cohort (55.9%), whereas acute coronary syndrome (ACS) was more common in the non-CKD group (57.6%). Unstable angina and arrhythmias presented with similar frequency in both groups (Table-III).

Table-I: Baseline demographic characteristics of the study patients (N=193)

Variables	Total (n=193)	CKD group (n=68)	Non-CKD group (n=125)	p-value
Age in years (Mean±SD)	60.8±10.4	65.4±8.7	58.1±9.9	0.001
Male gender, n (%)	124 (64.2%)	42 (61.8%)	82 (65.6%)	0.598
BMI (kg/m²) (Mean±SD)	25.1±3.8	25.8±3.5	24.7±3.9	0.054

p-value derived from independent t-test for age and BMI and Chi-square test for gender

Table-II: Distribution of cardiovascular risk factors

Risk factors	CKD group n (%)	Non-CKD group n (%)	p-value
Hypertension	61 (89.7%)	91 (72.8%)	0.005
Diabetes mellitus	46 (67.6%)	60 (48.0%)	0.008
Smoking	28 (41.2%)	55 (44.0%)	0.697
Family history of CVD	15 (22.1%)	32 (25.6%)	0.585
Dyslipidemia	50 (73.5%)	80 (64.0%)	0.172

p-value derived from Chi-square test.

Table-III: Primary clinical presentation at admission (N=193)

Variables	CKD group n (%)	Non-CKD group n (%)	p-value
Acute coronary syndrome	22 (32.4%)	72 (57.6%)	0.001
Heart failure	38 (55.9%)	46 (36.8%)	0.01
Unstable angina	5 (7.4%)	4 (3.2%)	0.175
Arrhythmia	3 (4.4%)	3 (2.4%)	0.44

p-value derived from Chi-square test.

Laboratory tests revealed that the mean serum creatinine level in the CKD group was much higher compared to non-CKD patients (2.1±0.6 mg/dL vs. 0.9±0.2 mg/dL; p=0.001) in the non-CKD group. Similar differences were observed in eGFR (42.3±10.1 mL/min/1.73m² vs. 78.9±12.4 mL/min/1.73m²), hemoglobin conc. (10.2±1.5 g/dL vs. 13.1±1.8 g/dL) and serum potassium level (4.6±0.5 mmol/L vs. 4.2±0.4 mmol/L) (p=0.001) (Table-IV). In-hospital outcomes were substantially worse for patients with CKD. The all-cause mortality rates were 14.7% and 4.0%, respectively in CKD group and non-CKD group (p=0.006). The composite endpoint of mortality, acute heart failure, or life-threatening arrhythmia occurred much more in CKD patients (29.4% vs. 11.2%; p=0.001). Hospital stay was also significantly prolonged for the CKD cohort (8.5±3.1 days vs. 5.7±2.4 days; p=0.001). Readmission was also more prevalent in CKD patients (17.6% vs. 8.0%; p=0.41) (Table-V). Following multivariate logistic regression analysis, after adjusting for age, hypertension, and diabetes, the presence of CKD remained an independent predictor for both in-hospital mortality and the composite adverse outcome (Table-VI).

Table-IV: Laboratory investigations on admission (N=193)

Variables	CKD group (Mean±SD)	Non-CKD group (Mean±SD)	p-value
Serum creatinine (mg/dL)	2.1±0.6	0.9±0.2	0.001
eGFR (mL/min/1.73m²)	42.3±10.1	78.9±12.4	0.001
Hemoglobin (g/dL)	10.2±1.5	13.1±1.8	0.001
Serum potassium (mmol/L)	4.6±0.5	4.2±0.4	0.001

p-value derived from independent t-test.

Table-V: Comparison of in-hospital outcomes (N=193)

Outcomes	CKD Group	Non-CKD Group	p-value
All-cause mortality n (%)	10 (14.7%)	5 (4.0%)	0.006
Composite adverse event n (%)	20 (29.4%)	14 (11.2%)	0.001
Hospital stays, days (Mean±SD)	8.5±3.1	5.7±2.4	0.001
Re-hospitalization (within 30 days) n (%)	12 (17.6%)	10 (8.0%)	0.041

p-value derived from Chi-square test for proportions and independent t-test for length of stay.

Table-VI: Multivariable logistic regression for predictors of in-hospital mortality

Variables	Adjusted Odds Ratio (aOR)	95% Confidence Interval	p-value
Presence of CKD	3.82	1.42–10.28	0.008
Age (per year increase)	1.05	1.00–1.10	0.043
Diabetes mellitus	1.98	0.78–5.01	0.151
Heart failure at presentation	2.91	1.15–7.35	0.024

Model adjusted for age, diabetes, hypertension, and primary diagnosis. The Hosmer-Lemeshow test indicated a good model fit (p=0.412).

Discussion

This prospective cohort study provides compelling evidence from a tertiary care setting in Bangladesh that comorbid chronic kidney disease (CKD) profoundly shapes the clinical profile and worsens the in-hospital prognosis of patients hospitalized for cardiovascular disease (CVD). Our findings confirm that CKD is not merely a coincidental finding but a critical determinant of patient outcomes in this population, aligning with and extending the global literature on cardiorenal interactions.[4,12,14] The high

prevalence of CKD (35.2%) among our CVD patients underscores the significant burden of this comorbidity in Bangladesh, potentially exceeding rates reported in some Western cohorts[15,16] and reflecting the growing dual epidemic of non-communicable diseases in South Asia.[9,10,17] The demographic and risk factor profile of the CKD cohort – significantly older with a greater burden of hypertension and diabetes mellitus – corroborates the shared pathophysiology and common soil of these conditions.[4,14,17] This clustering of risk factors necessitates integrated, rather than siloed, clinical management strategies from the outset. The altered clinical presentation observed, with a predominance of heart failure over acute coronary syndrome in CKD patients, is a critical finding. It may be attributed to several factors: the high prevalence of underlying left ventricular hypertrophy and diastolic dysfunction in CKD, atypical symptom presentation leading to delayed diagnosis of ischemia, and a higher baseline risk for volume overload.[18] This pattern highlights the need for heightened clinical suspicion for non-ACS cardiovascular events in CKD patients presenting with acute symptoms. The stark contrast in in-hospital outcomes constitutes the most significant result of our study. The threefold higher mortality and the significantly increased rate of composite adverse events in the CKD group are consistent with international data identifying CKD as a powerful prognostic marker.[6,12.18] The mechanisms are multifactorial, encompassing greater disease severity, limited therapeutic options due to contraindications or dose limitations (e.g., for anticoagulants, contrast agents), and increased susceptibility to complications like electrolyte disturbances and infections.[8,13,14] The significantly longer hospital stay among CKD patients further amplifies the healthcare economic burden associated with this comorbidity.[19-21] Notably, even after adjusting for key confounders like age and diabetes, CKD remained an independent predictor of mortality, reinforcing its direct role in adverse outcomes beyond its association with traditional risk factors. This is consistent with studies demonstrating that reduced eGFR itself is an independent risk factor for cardiovascular events and death.[15,20]

The strengths of our study include its prospective design, use of standardized diagnostic criteria, and focus on a representative sample from a real-world clinical setting in an understudied region. However, certain limitations must be acknowledged. The single-center design and relatively modest sample size may limit generalizability of the findings in country's vast population. The purposive sampling technique, while pragmatic, may introduce selection bias. The study was powered to assess in-hospital outcomes; thus, the lack of long-term follow-up data on mortality, cardiovascular events, and renal progression is a limitation. Furthermore, we did not quantify proteinuria, which is an important component of CKD staging and an independent cardiovascular risk factor.

Conclusion

To conclude, CKD significantly modifies the clinical profile and exacerbates the in-hospital prognosis of CVD patients in Bangladesh. The condition is associated with distinct risk factors, a higher prevalence of heart failure, and substantially increased mortality and complication rates. These findings underscore the critical need for integrated cardiorenal risk assessment and tailored management protocols to improve outcomes for this high-risk population. We recommend implementation of mandatory renal function screening for all CVD inpatients to enable early risk stratification as well as

development and adoption of multidisciplinary clinical care pathways specifically for cardiorenal patients and strengthening of primary prevention programmes targeting hypertensive and diabetic patients to mitigate the shared risk burden.

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