Original Article

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Prevalence of Cardiovascular Disease in Patients with Chronic Kidney Disease: A Hospital Based Study in Bangladesh

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Abstract

A prospective, cross-sectional study was conducted in the Department of Nephrology, Community Based Medical College, Bangladesh (CBMC,B) Hospital, Mymensingh, Bangladesh, from January to December of 2024, to determine the prevalence of cardiovascular disease in patients with chronic kidney disease (CKD). A purposive sample of 113 adult patients having CKD (Stages 3-5) was enrolled in this study. Data on socio-demographics, clinical history, and biochemical parameters were collected. Cardiovascular disease was defined and assessed based on clinical history, ECG findings, and echocardiographic evidence. The overall prevalence of cardiovascular disease was 78.8%. Left ventricular hypertrophy was the most common manifestation (64.6%), followed by congestive heart failure (42.5%) and ischemic heart disease (31.9%). A significant association was found between advancing CKD stage and CVD prevalence ($p<0.001$). Patients with CVD exhibited significantly lower hemoglobin and ejection fraction, and higher serum creatinine, urea, and potassium levels ($p<0.001$), highlighting a profound cardiorenal interplay. Our study reveals an alarmingly high prevalence of cardiovascular disease in CKD patients, dominated by left ventricular hypertrophy. Integrated cardiorenal care and aggressive management of risk factors from early CKD stages are imperative to reduce associated morbidity and mortality.

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Introduction

Chronic kidney disease (CKD) represents a profound and escalating global public health challenge, characterized by irreversible deterioration of kidney function over time. Its worldwide prevalence is estimated to affect over 800 million individuals, contributing significantly to morbidity and mortality and posing a substantial economic burden on healthcare systems.[1] The trajectory of CKD is not confined to the eventual need for renal replacement therapy; it is increasingly recognized as a multiplier of risk for devastating cardiovascular complications.[2] The intricate and bidirectional relationship between the kidneys and the cardiovascular system is well-established. CKD is now unequivocally considered one of the most potent risk factors for the development and progression of cardiovascular disease (CVD).[3,4] Patients with CKD exhibit a risk of cardiovascular mortality that is 10 to 20 times higher than that of the general population, with CVD accounting for approximately 50% of all deaths in this cohort, even before reaching end-stage renal disease.[5,6] This excessive risk manifests as a wide spectrum of pathologies, including accelerated atherosclerosis leading to coronary artery disease and myocardial infarction, left ventricular hypertrophy (LVH), systolic and diastolic heart failure, arrhythmias (particularly atrial fibrillation), and sudden cardiac death.[7,8] The pathophysiological mechanisms underlying this cardiorenal nexus are complex and

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multifactorial. They extend beyond traditional Framingham risk factors to encompass a unique milieu of 'non-traditional' or 'CKD-specific' risk factors. These include chronic volume overload, pressure overload from hypertension, anemia-induced high cardiac output, electrolyte imbalances, derangements in mineral and bone metabolism (CKD-MBD), chronic inflammation, oxidative stress, and endothelial dysfunction.[9,10] This confluence of factors promotes structural and functional changes in the heart, making cardiovascular complications the rule rather than the exception in advanced CKD. In Bangladesh, the dual burden of CKD and CVD is a growing concern, fueled by a high prevalence of underlying risk factors such as hypertension, diabetes mellitus, and poorly regulated dietary salt intake.[11] However, despite the global recognition of this problem, there is a relative paucity of recent local data quantifying the precise burden and pattern of CVD among the CKD population in the Bangladeshi context. Studying on community based hospital services for CKD patients is crucial for understanding the clinical profile and magnitude of this issue within specific healthcare settings. Therefore, this study aimed to determine the prevalence of cardiovascular disease in patients with CKD attending a tertiary care hospital in Bangladesh.

Methods

This prospective, cross-sectional study was conducted in the Department of Nephrology, Community Based Medical College, Bangladesh (CBMC,B) Hospital, Mymensingh, Bangladesh, from January to December of 2024, The study population consisted of 113 adult patients with a confirmed diagnosis of chronic kidney disease (CKD) (stages 3 to 5). We adopted a convenient, purposive sampling technique.

Inclusion criteria: patients aged 18 years or above having CKD stages 3-5, as defined by the KDIGO 2024 clinical practice guidelines.[12]

Exclusion criteria: patients having prior kidney transplantation or on maintenance renal replacement therapy (dialysis), having acute kidney injury, or any active malignant condition.

All the participants underwent a detailed clinical evaluation. Data on demographics, medical history, and clinical symptoms were collected using a structured questionnaire. Blood samples were drawn for serum creatinine, hemoglobin, and lipid profile. Cardiovascular disease was assessed via 12-lead electrocardiography (ECG) and transthoracic echocardiography.

Collected data was compiled, coded and analyzed using the Statistical Package for Social Sciences (SPSS) version 23.0 for Windows. Descriptive statistics was used to summarize categorical and continuous variables. Data was expressed as mean±SD (standard deviation) and frequency and percentage as applicable. Unpaired Student's t-teat and Chi-square test were applied for comparison between groups. A p-value <0.05 was considered as statistically significant.

Ethical clearance was taken from the Ethical Review Committee of Community Based Medical College, Bangladesh (CBMC,B), Mymensingh, Bangladesh.

Results

A total of 113 patients with chronic kidney disease were enrolled in this study. The mean age of the participants was 56.4±11.3 years, with an age range of 32 to 78 years. The cohort comprised 74(65.5%) males and 39(34.5%) females, resulting in a male-to-female ratio of 1.9:1. The majority of the patients(61%) were in the 46–65 years age group.

Most of the patients had stage 4 CKD (46%), while stage 5 and stage 3 CKD were observed in 29.2% and 24.8% of the patients respectively. Hypertension was the most prevalent comorbidity (87.6%), followed by diabetes mellitus (53.1%) and dyslipidemia (35.4%). History of smoking was found in 41.6% of the patients (Table-I).

Table-I: Demographic and clinical profile of the patients (N=113)

Variables	Frequency	Percentage
Age group (in years)		
18–45	22	19.5
46–65	69	61.0
>65	22	19.5
Gender		
Male	74	65.5
Female	39	34.5
CKD stage		
Stage 3	28	24.8
Stage 4	52	46.0
Stage 5	33	29.2
Comorbidities/risk factors		
Hypertension	99	87.6
Diabetes Mellitus	60	53.1
Dyslipidemia	40	35.4
Smoking	47	41.6

The overall prevalence of cardiovascular disease was found 78.8%. Among the spectrum of CVD, left ventricular hypertrophy (LVH) was the most common finding (64.6%), followed by congestive heart failure (42.5%) and ischemic heart disease (31.9%). Other notable findings included pericardial effusion (15.9%) and arrhythmias (12.4%) (Table-II). A highly significant association was observed between the advancing stage of CKD and the prevalence of CVD ($p<0.001$). While the prevalence was 57.1% in stage 3, it rose sharply to 82.7% in stage 4 and reached 100% in stage 5 CKD (Table-III). Higher age was found to be associated with different menifestations of CVD among CKD patients ($p<0.01$). Moreover, patients with CVD had significantly lower mean hemoglobin levels and mean ejection fraction ($p<0.001$) (Table-IV). Patients with CVD had significantly higher levels of serum creatinine, urea, and potassium ($p<0.001$) (Table-V).

Table-II: Prevalence and spectrum of cardiovascular disease

Cardiovascular manifestation	Frequency	Percentage
Any cardiovascular disease	89	78.8
Left ventricular hypertrophy	73	64.6
Congestive heart failure	48	42.5
Ischemic heart disease	36	31.9
Pericardial effusion	18	15.9
Arrhythmias	14	12.4

Table-III: Association between CKD stage and prevalence of CVD (N=113)

CKD Stage	CVD Present Frequency (Percentage)	CVD Absent Frequency (Percentage)	p-value
Stage 3 (n=28)	16 (57.1)	12 (42.9)	<0.001
Stage 4 (n=52)	43 (82.7)	9 (17.3)	
Stage 5 (n=33)	33 (100.0)	0 (0.0)	
Total	89 (78.8)	24 (21.2)	

Chi-square test was applied to reach p-value.

Table-IV: Comparison of clinical parameters between CKD patients with and without CVD

Variables	CVD Present (n=89) Mean±SD	CVD Absent (n=24) Mean±SD	p-value
Age (in years)	58.1±10.8	50.4±10.9	<0.01
Hemoglobin (g/dL)	8.5±1.6	10.8±1.4	<0.001
Ejection Fraction (%)	47.2±8.5	59.6±4.3	<0.001

Unpaired Student's t-test was applied to reach p-value.

Table-V: Comparison of renal profile and electrolytes between CKD patients with and without CVD

Variables	CVD Present (n=89) Mean±SD	CVD Absent (n=24) Mean±SD	p-value
Serum creatinine (mg/dL)	4.8±1.9	2.5±1.1	<0.001
Blood urea (mg/dL)	148.6±52.3	98.2±36.7	<0.001
Serum potassium (mEq/L)	5.2±0.8	4.5±0.5	<0.001

Unpaired Student's t-test was applied to reach p-value.

Discussion

This hospital-based cross-sectional study provides critical insights into the substantial burden of cardiovascular disease among patients with chronic kidney disease in a Bangladeshi population. The key finding of our research is the alarmingly high prevalence of CVD (78.8%) in our CKD cohort, a figure that aligns with and even exceeds rates reported in several studies, which typically range from 50% to 80%.[3,11,13] This reinforces the established paradigm that CKD is a potent, independent risk multiplier for cardiovascular morbidity and mortality, creating a major healthcare challenge. The most prevalent cardiovascular manifestation identified was left ventricular hypertrophy (LVH), affecting 64.6% of patients. This finding is consistent with the pathophysiological hallmarks of the cardiorenal nexus, which include chronic pressure overload from hypertension (as observed in 87.6% of our patients) and volume overload from sodium and water retention.[7,14-17] The high cardiac output state driven by anemia, which was significantly worse in the CVD group, further contributes to the development of concentric and eccentric LVH, a maladaptive response that predisposes to diastolic dysfunction, heart failure, and arrhythmias.[8,14.18] A particularly striking observation was the strong, graded association between the severity of renal impairment and the prevalence of CVD. The prevalence escalated from 57.1% in stage 3 to 100% in stage 5 CKD. This dose-response relationship strongly suggests a causal link, where the progressive accumulation of uremic toxins, worsening hypertension, chronic inflammation, and profound disruptions in mineral and bone metabolism (CKD-MBD) collectively accelerate cardiovascular damage.[5,17] The significantly higher levels of serum creatinine, urea, and potassium in the CVD group further underscore the role of declining renal function in fueling this cardiorenal vicious cycle. Our results also highlight the significant derangement of hematological and cardiac function parameters in CKD patients with CVD. The markedly lower mean hemoglobin level aligns with the known cardiotoxic effects of anemia, which induces cardiac remodeling through chronic tissue hypoxia and increased cardiac workload.[18] The significantly reduced ejection fraction in the CVD group is a direct consequence of these combined insults, culminating in overt systolic heart failure, which was diagnosed in 42.5% of our participants. When contextualized within the limited existing literature from Bangladesh, our findings present a more severe picture than some earlier reports,[11,13] which may be due to later presentation, higher comorbidity burden, or differences in sample characteristics. This disparity underscores the urgent need for localized data to guide regional healthcare strategies.

This study utilized a purposive sampling technique from a single center with a modest sample size, which may limit the generalizability of the findings. Furthermore, the cross-sectional design precludes

the establishment of causal relationships between variables.

Conclusion

This study confirms an alarmingly high prevalence of cardiovascular disease among CKD patients, strongly linked to advancing renal dysfunction. Left ventricular hypertrophy is the most common manifestation. These findings underscore the critical need for integrated cardiorenal care, emphasizing aggressive management of traditional risk factors and regular cardiovascular surveillance from the early stages of CKD to mitigate the substantial burden of morbidity and mortality in this population.

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