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Original Article

Patterns of Acute Coronary Syndrome and Risk Factor Profile Analysis in Patients with Impaired Renal Function

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ABSTRACT

Background: Acute coronary syndrome remains one of the cardinal causes of cardiovascular mortality, and renal dysfunction has become an important prognostic factor. This study aimed to assess the patterns of ACS and the risk factor profile of patients with impaired renal function who presented to a tertiary care hospital in Bangladesh. **Methods & Materials:** This prospective observational study was conducted in the Department of Cardiology, Mymensingh Medical College Hospital, from January 2022 to December 2022. They were grouped based on creatinine clearance into normal renal function (≥70 ml/min) and impaired renal function (<70 ml/min). Demography, cardiovascular risk factors, patterns of ACS presentation, and in-hospital course regarding heart failure, arrhythmias, cardiogenic shock, mechanical complications, and mortality were noted. Data were analyzed on SPSS version 26, with $p<0.05$ considered significant. **Results:** Of 100 patients, 69% had impaired renal function with a mean age of 53.4±8.4 years compared to 47.8±7.2 years in the normal function group (p=0.002). Diabetes mellitus was significantly more prevalent in patients with impaired renal function (56.5% vs 22.6%, p=0.002). Patients with reduced creatinine clearance experienced significantly higher rates of heart failure (28.9% vs 9.6%, p=0.03), ventricular tachycardia (28.9% vs 6.4%, p=0.01), post-MI angina (34.7% vs 6.4%, p=0.002), and cardiogenic shock (21.7% vs 3.2%, p=0.02). Overall morbidity was markedly elevated in the impaired renal function group (84.0% vs 29.0%, p=0.001). **Conclusion:** Impaired renal function is highly prevalent among patients with ACS and is strongly related to an increase at in-hospital cardiac complications and morbidity. Systematic assessment of renal function is crucial for risk stratification and optimization of management strategies in patients with ACS.

Keywords: *Acute coronary syndrome, Risk factor profile, Impaired renal function, Creatinine clearance*

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INTRODUCTION

Acute coronary syndrome remains one of the leading causes of cardiovascular morbidity and mortality in a global perspective, affecting millions of individuals annually and causing substantial healthcare burdens [1]. ACS represents a broad spectrum of clinical presentations, including STEMI, NSTEMI, and UA, all with the same pathophysiology, acute myocardial ischemia [2]. The prognosis of patients with ACS depends on many variables, such as age, comorbidities, hemodynamic status, and, importantly, renal function [3]. Renal dysfunction has emerged as a critical prognostic factor in the setting of ACS, where a growing body of evidence points to a significant inverse correlation between glomerular filtration rate and adverse cardiovascular outcomes [4]. Even for patients with mild or moderate impairment of creatinine clearance, there is an association with increased rates of in-hospital complications, longer hospital stays, and higher mortality [5]. The occurrence of impaired renal function varies between 30% and 40% of all populations presenting with ACS, hence being a very common clinical case in cardiology [6]. The pathophysiological mechanisms that link renal dysfunction to poor cardiovascular outcomes are multifactorial and complex. Renal impairment contributes to endothelial dysfunction, accelerated atherosclerosis, heightened oxidative stress, chronic inflammation, and disturbances in calcium-phosphate metabolism [7]. Furthermore, patients with reduced creatinine clearance usually present with several concomitant cardiovascular risk factors, including hypertension, diabetes mellitus, and dyslipidemia, which could further complicate their risk profile [8]. They also show altered pharmacokinetics of cardiovascular drugs, which can lead to suboptimal therapeutic interventions or increased vulnerability to adverse drug reactions. Despite the recognized importance of renal function to ACS prognosis, there is still a lack of data from South Asian populations, particularly from Bangladesh, where the burden of cardiovascular disease continues to rise [9]. Demographic characteristics, risk factor profiles, and clinical outcomes may substantially vary in ACS patients with impaired renal function across geographical regions and ethnic populations due to genetic predisposition, environmental factors, and healthcare accessibility [10]. Such regional variations should be understood for targeted prevention strategies and optimization of management protocols. Moreover, based on high-risk stratification according to renal function status, this can facilitate risk stratification and enable clinical decisions regarding intensive monitoring, aggressive medical therapy, and consideration for invasive interventions [11]. The use of renal function assessment as a prognostic determinant in the setting of ACS is an evolving concept, but local data are urgently needed to inform clinical practice and healthcare policy. This study was, therefore, aimed at assessing the clinical profile and analysis outcomes in acute coronary syndrome patients with impaired renal function attending a tertiary care hospital in Bangladesh. By comparing clinical features, cardiovascular risk factors, and in-hospital outcomes across patients with normal and lower creatinine clearance, we aimed to improve knowledge of the influence of renal dysfunction on the presentation and prognosis of ACS in our local population.

METHODS & MATERIALS

This prospective observational study was conducted in the Department of Cardiology, Mymensingh Medical College Hospital, over twelve months from January 2022 to December 2022. A total of 100 consecutively admitted patients presenting with acute coronary syndrome were enrolled through purposive sampling after obtaining informed written consent. Adult patients aged 18-65 years of both sexes presenting with their first episode of acute coronary syndrome (STEMI, NSTEMI, or unstable angina) within 24 hours of symptom onset were included in the study. Patients older than 65 years, those with a previous history of ACS, known valvular heart disease, cardiomyopathy, prior heart failure, history of previous revascularization procedures (percutaneous transluminal coronary angioplasty with stenting or coronary artery bypass grafting), and patients with incomplete data were excluded from the study. After enrollment, a detailed clinical history regarding cardiovascular risk factors (smoking, hypertension, diabetes mellitus, dyslipidemia, family history of ischemic heart disease) was obtained. Comprehensive physical examination, including vital signs and cardiovascular assessment, was performed. Baseline investigations, including 12-lead electrocardiography, cardiac biomarkers (troponin), serum creatinine, fasting blood glucose, and lipid profile, were completed for all participants. Creatinine clearance was calculated using the Cockcroft-Gault formula, and patients were stratified into two groups: Group I with creatinine clearance ≥70 ml/min (normal renal function) and Group II with creatinine clearance <70 ml/min (impaired renal function). All patients were monitored throughout hospitalization for in-hospital outcomes, including heart failure (Killip class II-IV), cardiogenic shock, significant arrhythmias (atrial fibrillation, ventricular tachycardia, ventricular fibrillation, heart blocks), mechanical complications, post-myocardial infarction angina, reinfarction, and mortality. Data were entered and analyzed using SPSS version 26. Categorical variables were compared using chi-square tests, while continuous variables were analyzed using Student's t-test and ANOVA where appropriate. A p-value <0.05 was considered statistically significant.

RESULTS

Table I shows the study population's baseline demographics and the distribution of cardiovascular risk factors. Of the 100 patients, 88% were men and 12% were women. The average age was 51.7±8.5 years, and 43% of them were between the ages of 50 and 59. The most common condition was smoking (71%), which was closely followed by hypertension (59%), diabetes mellitus (46%), dyslipidaemia (46%), and a family history of ischaemic heart disease (43%). The average number of risk factors per patient was 2.6±0.9, and there was no discernible difference between males and females (p=0.250). There was no significant gender difference in age distribution as well (p=0.230).

Table I
Demographic and distribution of the study patients (*n*=100).

Category	Male (n= 88)		Female (n=12)		Total(N=100)		p-value
	Number	%	Number	%	Number	%	-
Age (in years)	-	-	-	-	-	-	-
30 - 39	7	8.0	1	8.3	8	8.0	-
40 - 49	24	27.3	1	8.3	25	25.0	-
50 - 59	37	42.0	6	50.0	43	43.0	-
60 - 65	20	22.7	4	33.3	24	24.0	-
Mean ± SD (Range)	51.3±8.5 (30-65)		54.4±8.1 (30-65)		51.7±8.5 (30-65)		0.230
Risk Factors	-	-	-	-	-	-	-
Smoking	70	79.5	1	8.3	71	71.0	-
Hypertension	48	54.5	11	91.7	59	59.0	-
Diabetes mellitus	38	43.2	8	66.7	46	46.0	-
Dyslipidaemia	42	47.7	4	33.3	46	46.0	-
Family H/O IHD	39	44.3	4	33.3	43	43.0	-
Mean ± SD (Range)	2.7±0.9 (1-5)		2.3±1.1 (1-5)		2.6±0.9 (1-5)		0.250

Table II demonstrates demographic distribution according to renal function status. Out of 100 patients, 31% had normal creatinine clearance (≥70 ml/min), while 69% had impaired clearance (<70 ml/min). Patients with impaired renal function were significantly older (mean age 53.4±8.4 years) compared with patients with normal renal function (47.8±7.2 years, p=0.002). The 60-65 age group had the highest proportion with renal dysfunction, 33.3%. The gender distribution was similar in both renal function groups (p=0.63), males constituting approximately 88-90% in both groups, hence suggesting that renal impairment in this ACS population is proportionally.

Table II
Demographic distribution of the study population with normal and abnormal renal function (*n*=100).

Category	Creatinine Clearance						p value
	Normal clearance (≥70)		Abnormal clearance (<70)		Total		
	n	%	n	%	n	%	
Age (in years)	-	-	-	-	-	-	-
30 - 39	3	9.7	5	7.2	8	8.0	-
40 - 49	13	41.9	12	17.4	25	25.0	-
50 - 59	14	45.2	29	42.0	43	43.0	-
60 - 65	1	3.2	23	33.3	24	24.0	-
Total	31	100	69	100	100	100.0	-
Mean ± SD (Range)	47.8±7.2 (30-60)		53.4±8.4 (35-65)		51.7±8.5 (30-65)		0.002[s]
Sex	-	-	-	-	-	-	-
Male	28	90.3	60	87.0	88	88.0	0.63 [NS]
Female	3	9.7	9	13.0	12	12.0	-

Table III Risk factors, acute coronary syndrome patterns, and cardiac complications in patients with normal and impaired renal function are denoted in Table 3. Diabetes mellitus was observed to occur significantly more often in patients with impaired renal function (56.5% vs.22.6%, p=0.002), whereas other risk factors did not differ significantly. Impaired renal function was substantially higher in heart failure (28.9% vs 9.6%, p=0.03), as was ventricular tachycardia (28.9% vs 6.4%, p=0.01), angina post-MI (34.7% vs 6.4%, p=0.002), and cardiogenic shock (21.7% vs 3.2%, p=0.02). Other complications were also higher in the impaired renal function group but did not always reach statistical significance.

Table III
Risk factors, acute coronary syndrome patterns, and cardiac complications in patients with normal and abnormal creatinine clearance (*n*=100).

Category	Creatinine Clearance						p-value
	Normal clearance (≥70) (n=31)		Abnormal clearance (<70) (n=69)		Total (N=100)		
	n	%	n	%	n	%	
Risk factors	-	-	-	-	-	-	-
Smoking	22	71.0	49	71.0	71	71.0	0.99^{NS}
Hypertension	16	51.6	43	62.3	59	59.0	0.31^{NS}
Family history of IHD	15	48.4	28	40.6	43	43.0	0.46^{NS}
Diabetes mellitus	7	22.6	39	56.5	46	46.0	0.002^{S}
Dyslipidemia	17	54.8	29	42.0	46	46.0	0.23^{NS}
Mean ± SD (Range)	2.45±0.76 (1-4)		2.72±1.01 (1-5)		2.64±0.98 (1-5)		0.19^{NS}
Pattern of ACS	-	-	-	-	-	-	-
Anterior	19	61.3	27	39.1	46	46.0	0.20^{NS}
Inferior	9	29.0	34	49.3	43	43.0	
NSTEMI	1	3.2	4	5.8	5	5.0	
UA	2	6.5	4	5.8	6	6.0	
Complications	Creatinine Clearance						p-value
	Normal clearance (≥70) (n=31)		Abnormal clearance (<70) (n=69)		Total (N=100)		
	Number	%	Number	%	Number	%	
Heart failure (Killip II- IV)	3	9.6	20	28.9	23	23.0	0.03^{S}
Atrial fibrillation	3	9.6	14	20.2	17	17.0	0.19^{NS}
Ventricular tachycardia	2	6.4	20	28.9	22	22.0	0.01^{S}
Ventricular fibrillation	0	0.0	4	5.7	4	4.0	0.17^{NS}
Post MI angina	2	6.4	24	34.7	26	26.0	0.002^{S}
Heart Block	0	0.0	7	10.1	7	7.0	0.06^{NS}
Mechanical complication	0	0.0	2	2.9	2	2.0	0.33^{NS}
Cardiogenic shock	1	3.2	15	21.7	16	16.0	0.02^{S}

Table IV showcases the overall in-hospital mortality and morbidity. Mortality was seen only in the impaired renal function group, at a rate of 5.8% vs 0%, p=0.17, though this did not reach statistical significance, likely due to small sample size. However, overall morbidity was significantly higher in patients with impaired renal function, 84.0% vs 29.0%, p=0.001, indicating that the overwhelming majority of patients with reduced creatinine clearance suffered at least one major cardiac complication during their hospital stay, compared with less than one-third in the normal renal function group.

Table IV
In-hospital mortality and morbidity of the study population with normal and abnormal creatinine clearance (*n*=100).

Category	Creatinine Clearance						P value
	Normal clearance (≥70) (n=31)		Abnormal clearance (<70) (n=69)		Total		
	Number	%	Number	%	Number	%	
Mortality	-	-	-	-	-	-	-
Yes	0	0.0	4	5.8	4	4.0	0.17^{NS}
No	31	100	65	94.2	96	96.0	
Morbidity	-	-	-	-	-	-	-
Yes	9	29.0	58	84.0	67	67.0	0.001^{S}
No	22	71.0	11	16.0	33	33.0	

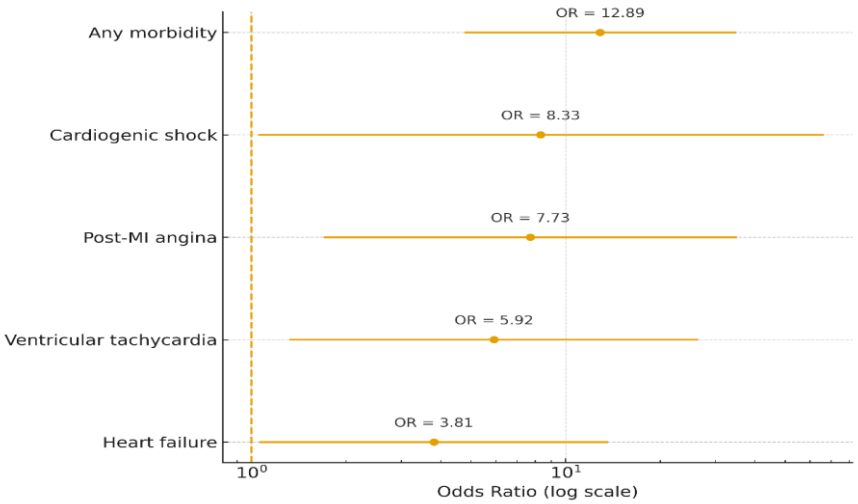

Figure 1 Unadjusted Odds Ratio for Major Cardiac Complications by Renal Function Status.

Figure 1 illustrates the unadjusted odds ratios for major cardiac complications comparing subjects with impaired versus normal renal function. The odds ratio (5.92) was seen for ventricular tachycardia, post-MI angina (7.73), cardiogenic shock (8.33), heart failure (3.81), and any morbidity (12.89). All the CIs exclude 1.0, suggesting all associations are statistically significant.

DISCUSSION

This prospective study demonstrated the patterns of acute coronary syndrome and associated risk factors in patients with impaired renal function, showing significant associations between reduced creatinine clearance and adverse cardiovascular outcomes. Our results showed that impaired renal function, as manifested by a creatinine clearance less than 70 ml/min, was found in 69% of ACS patients, which is much higher compared to a study by Santopinto et al. [12]. This high prevalence indicates a very substantial burden of renal dysfunction in our local ACS population and suggests that renal function assessment is a necessary task for all patients presenting with acute coronary events. In our results, only diabetes mellitus was identified among the traditional cardiovascular risk factors, showing a significant association with impaired renal function (56.5% vs 22.6%, p=0.002). It is consistent with Afkarian et al., where a bidirectional relationship is established between diabetes and chronic kidney disease; diabetes accelerates renal deterioration, while renal dysfunction accelerates glycemic control and cardiovascular risk [13]. The diabetic milieu promotes both microvascular and macrovascular complications via multiple pathways, including advanced glycation end-products, oxidative stress, and chronic inflammation, thus increasing susceptibility to renal impairment and coronary artery disease [14]. Our results showed that patients with impaired renal function were significantly older than those with normal renal function (53.4±8.4 years vs 47.8±7.2 years, p=0.002), in keeping with a study by Levey et al. [15]. Indeed, this age difference, though statistically significant, may well reflect the natural course of renal senescence, coupled with the long-term exposure to cardiovascular risk factors. The most notable findings emerged in the analysis of in-hospital complications. Patients with impaired renal function demonstrated significantly elevated rates of heart failure (28.9% vs 9.6%, p=0.03), ventricular tachycardia (28.9% vs 6.4%, p=0.01), post-MI angina (34.7% vs 6.4%, p=0.002), and cardiogenic shock (21.7% vs 3.2%, p=0.02). These findings are corroborated by Marenzi et al., who demonstrated that even mild-to-moderate renal dysfunction substantially increases the risk of major adverse cardiac events following ACS [16]. The mechanisms underlying these associations likely involve multiple factors, including endothelial dysfunction, heightened inflammatory states, increased thrombogenicity, volume overload, electrolyte imbalances, and altered drug metabolism [17]. Overall, morbidity was significantly higher in patients with impaired renal function, at 84% versus 29% (p = 0.001); hence, the vast majority of these patients developed at least one significant complication during their hospitalization. This finding has considerable implications for resource allocation, clinical monitoring intensity, and prognostic counseling. The odds ratio analysis further quantified this risk, demonstrating 4-8 fold increased odds of major cardiac complications in patients with reduced creatinine clearance as compared to those with preserved renal function. Although our study showed a trend for increased mortality in the impaired renal function group (5.8% versus 0%, p=0.17) [18]. Beattie et al. demonstrated increased short-term and long-term mortality associated with renal dysfunction in ACS patients [19]. Our study also identified noteworthy patterns in the ACS presentation, where anterior myocardial infarction was more common in patients with normal renal function and inferior MI predominated among those with impaired function, though these differences were not statistically significant. The findings from this study contribute significant South Asian data and further support the increasing body of evidence that renal dysfunction is a critical determinant of ACS outcomes in acute coronary syndrome.

LIMITATIONS

his was a single-center study with a relatively small sample size and short-term follow-up, restricted to in-hospital outcomes, which may not capture long-term mortality and morbidity patterns.

CONCLUSION

Impaired renal function occurs in a majority of patients with acute coronary syndrome and is a strong predictor of in-hospital adverse outcome. In fact, patients with impaired creatinine clearance had significantly higher rates of major cardiac complications, with overall morbidity exceeding 84%. Impaired renal function was also strongly associated with diabetes mellitus. Routine calculation of creatinine clearance should be done in all ACS patients for accurate risk stratification, prognostication, and individualization of treatment decisions to improve outcomes.

RECOMMENDATIONS

Long-term prognostic implications of renal dysfunction in ACS patients can be established in future multicenter studies with a larger sample size and for an extended follow-up period. Further study is needed to investigate the optimal

management strategy, including tailored pharmacological interventions and timing of revascularization procedures, specifically designed for ACS patients with varying degrees of renal impairment.

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CONFLICT OF INTEREST
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