

Acute Coronary Syndrome Complicating Acute Diarrheal Illness During a Large Diarrheal Outbreak in Bangladesh: A Hospital-Based Case-Control Study

Shoeb Bin Islam

shoeb@icddr.org

International Centre for Diarrhoeal Disease Research

Md. Shabab Hossain

International Centre for Diarrhoeal Disease Research

Monira Sarmin

International Centre for Diarrhoeal Disease Research

Jafrin Ferdous

International Centre for Diarrhoeal Disease Research

Haimanti Saha

International Centre for Diarrhoeal Disease Research

Mehreen Chowdhury

International Centre for Diarrhoeal Disease Research

Md. Ali Amin Nabin

International Centre for Diarrhoeal Disease Research

Saad Mohammad Quaish

International Centre for Diarrhoeal Disease Research

Mohammad Khalid Hasan

International Centre for Diarrhoeal Disease Research

Mohammad Jobayer Chisti

International Centre for Diarrhoeal Disease Research

Md Sadaqul Islam Sikder

Tahmeed Ahmed

International Centre for Diarrhoeal Disease Research

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Title: Acute Coronary Syndrome Complicating Acute Diarrheal Illness During a Large Diarrheal Outbreak in Bangladesh: A Hospital-Based Case-Control Study

Shoeb Bin Islam¹; Md. Shabab Hossain¹; Monira Sarmin¹; Jafrin Ferdous¹; Haimanti Saha¹; Mehreen Chowdhury¹; Md. Ali Amin Nabin¹; Saad Mohammad Quaish¹; Mohammad Khalid Hasan¹; Mohammad Jobayer Chisti¹; Md Sadaqul Islam Sikder²; Tahmeed Ahmed¹

1. International Centre for Diarrhoeal Disease Research, Dhaka, Bangladesh
2. National Institute of Cardiovascular Diseases (NICVD)

Corresponding Author:

Dr Shoeb Bin Islam

Assistant Scientist,

Dhaka Hospital, icddr,b

68 Shaheed Tajuddin Ahmed Sarani, Mohakhali, Dhaka 1212, Bangladesh

Tel # 880-2-9827001-10 extension: 2307;

Email: shoeb@icddr.org

Abstract

Background: Recent observations indicate a growing number of individuals experiencing acute coronary syndrome (ACS) during episodes of diarrheal illness, specially in outbreak situations. During the 2022 diarrheal outbreak in Bangladesh, an increased number of ACS events were observed among hospitalized diarrheal patients. This study aimed to evaluate the clinical characteristics and risk factors associated with ACS among adults presenting with acute diarrheal illness.

Method: We enrolled 139 adult diarrheal patients who developed ACS during hospitalization and were subsequently referred to the National Institute of Cardiovascular Diseases (NICVD) as cases. The control group consisted of 139 adult diarrheal patients who were discharged without any clinical and laboratory evidence of cardiac events. ACS was diagnosed based on

internationally accepted clinical criteria, including ischemic symptoms, electrocardiographic changes, and/or elevated Troponin-I levels. Multivariable logistic regression was performed to identify factors independently associated with ACS.

Results: From March 1, 2022, to April 20, 2022, Dhaka Hospital treated 53,622 patients, of whom 26,321 were aged >18 years. 139 developed ACS, corresponding to an incidence of 5.2 cases per 1,000 adult patients with diarrheal illness. The mean age of ACS patients was 56.3 ± 15.6 years, and 64.8% were male. Compared with controls, ACS patients more frequently had hypertension (70.6% vs 28.1%), diabetes mellitus (61.9% vs 27.3%), pre-existing heart disease (35.5% vs 5%), and development of rapid dehydration within 24 hours of symptom onset (61.9% vs 10.1%) (all $p < 0.001$). In multivariate analysis, pre-existing heart disease (adjusted odds ratio [aOR] 13.06, 95% CI 5.91-28.89), hypertension (aOR 6.15, 95% CI 3.51-10.80), diabetes mellitus (aOR 4.27, 95% CI 2.56-7.14), and rapid dehydration (aOR 4.70, 95% CI 2.07-10.59) were independently associated with ACS. The combination of diabetes and rapid dehydration conferred the highest risk (aOR 24.47, 95% CI 8.54-70.12). Overall mortality among ACS patients with follow-up data was 45.2%.

Conclusion: ACS is an important and potentially fatal complication of acute diarrheal illness.

Patients with pre-existing cardiovascular disease, hypertension, diabetes mellitus, and rapid dehydration are at particularly high risk. Early cardiovascular assessment and prompt correction of dehydration may improve outcomes during large diarrheal outbreaks.

Keywords: Acute coronary syndrome; Diarrheal illness; Dehydration; Hypercoagulability; Diabetes mellitus; Cardiovascular complications.

Introduction:

Ischemic heart disease (IHD) remains the leading cause of mortality worldwide, accounting for approximately ten million deaths annually and posing a substantial global public health burden (1).. According to a 2020 survey in Bangladesh, IHD was identified as a primary contributor to adult male mortality (25.9%), reflecting a broader trend where non-communicable diseases dominate the top causes of death (2). Acute coronary syndrome (ACS), encompassing unstable angina and myocardial infarction, describes a spectrum of conditions characterized by sudden, reduced blood flow to the heart, leading to myocardial damage(3) . ACS can manifest as a new phenomenon even in individuals without a pre-existing history of heart disease (4). Various factors, including physical exertion, emotional stress, respiratory infections, and hypercoagulable states, are known triggers for ACS (5, 6).

Concurrently, diarrheal illnesses, such as gastroenteritis, represent a significant global health challenge. In 2017, gastroenteritis caused an estimated 6 billion infections and 1.5 million deaths worldwide (7, 8). Frequent diarrhea can have serious consequences on the body. Not only does it cause excessive fluid loss, but it also worsens systemic inflammation. These factors increase the risk of blood clotting, leading to potentially dangerous thromboembolic complications. Additionally, dehydration resulting from diarrhea causes a decrease in circulating blood volume, forcing the heart to pump harder to compensate. This added strain puts extra pressure on the heart. Furthermore, rapid dehydration that occurs within 24 hours(9) of experiencing diarrhea can cause a sudden and significant increase in blood viscosity. This heightened viscosity contributes to the formation of blood clots, further highlighting the urgency of addressing diarrhea and its effects(8, 10).

Bangladesh recently experienced one of the worst cholera outbreaks in its history. The icddr,b hospital has treated a record number of patients (more than 1400 per day)(11, 12). From March

1 to April 20, 2022, Dhaka Hospital alone managed over 53,622 patients, with 26,321 aged 18 years or older (13). Given the observed co-occurrence of diarrheal illness and cardiac events during this outbreak, we conducted a case-control study. The objectives of this study were to determine the incidence of ACS among hospitalized adult patients with diarrhea, to describe their clinical characteristics, identify factors independently associated with ACS, and assess patient outcomes. Improved understanding of these associations may facilitate earlier recognition of high-risk patients and contribute to strategies aimed at reducing cardiovascular morbidity and mortality during future diarrheal outbreaks.

Materials and methods:

Study design: This was a case-control study. We enrolled 139 participants presenting with diarrhea during the 1st March-20th April 2022 outbreak and who developed major cardiac events and were referred to the National Institute of Cardiovascular Diseases (NICVD) hospital as cases. The 139 controls were randomly selected from the discharged patients of the hospital using SPSS random sampling.

Study site: Dhaka Hospital, icddr,b, is the largest diarrheal disease hospital in the world, which treated more than 200,000 patients in 2022. The healthcare professionals at icddr,b are utilizing their specialized knowledge in managing diarrhea, severe acute malnutrition (SAM), and pneumonia. The patients who developed ACS were referred to a specialized cardiac hospital for further treatment after initial stabilization.

Inclusion Criteria:

For case:

1. Age > 18 years of either sex
2. Diagnosed case of acute coronary syndrome based on any two of the following criteria:
 1. Typical chest pain related to ischemia

2. ECG change
3. Increased Troponin-I levels
3. Referred to the National Institute of Cardiovascular Diseases (NICVD) Hospital

For Control:

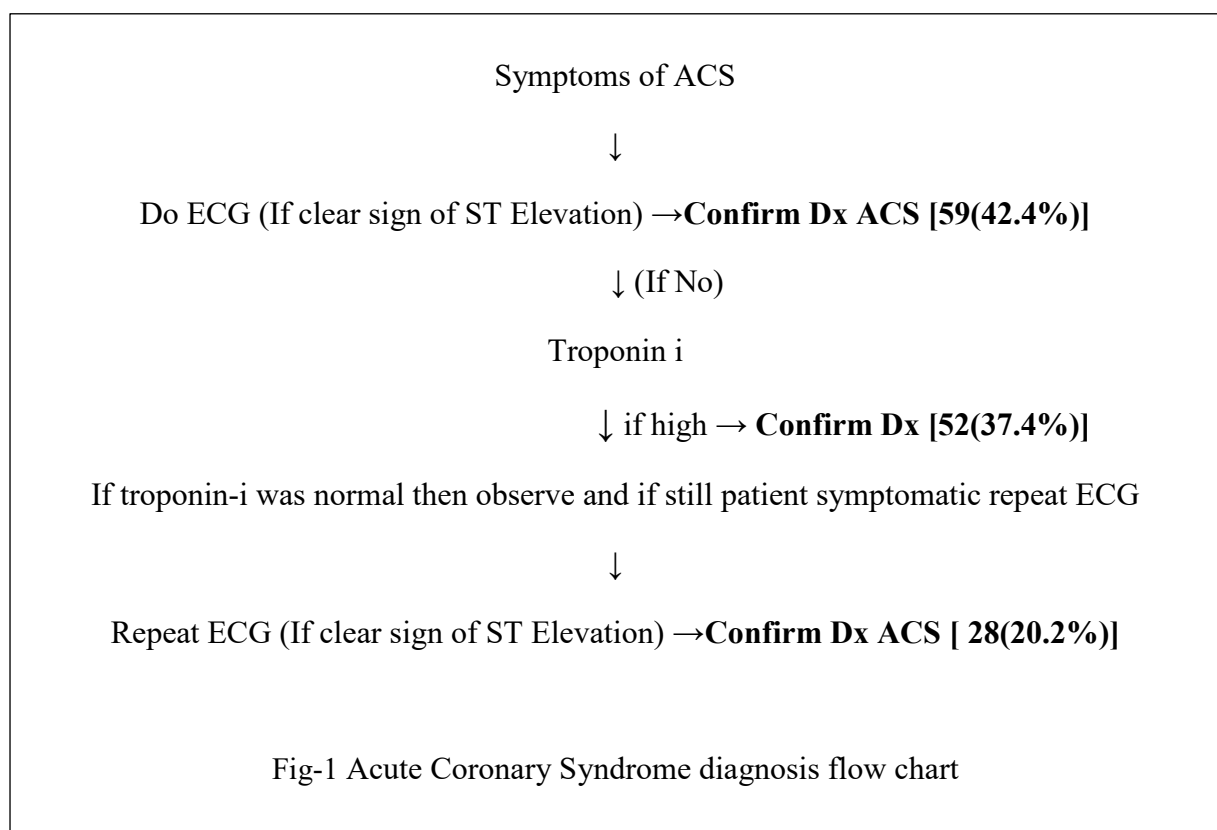
- 1) Age > 18 years of either sex
- 2) No history of cardiac involvement with normal ECG.

Exclusion Criteria for Selecting Cases:

1. Age < 18 years of either sex
2. No abnormalities in ECG and routinely discharged without any cardiac involvement

Diagnosis Flow chart of ACS: Out of 139 cases of Acute Coronary Syndrome (ACS), Troponin-I was tested for 80 cases, out of which 52 showed high levels and 28 were normal. So, 139 cases of ACS was diagnosed by (Fig-1)-

- 1) Typical Symptom+ Troponin I= **52 (37.4%)**
- 2) Typical Symptom+ ECG change= **87 (62.6%) [59(42.4%) + 28(20.2%)]**



Case Definition and Diagnostic Criteria for ACS: Acute coronary syndrome (ACS) was diagnosed using internationally accepted clinical criteria from the European Society of Cardiology (ESC)(14) and American Heart Association (AHA) guidelines(15). Patients were considered to have ACS if at least two of the three criteria were fulfilled at least two of the following three criteria: (1) typical ischemic chest pain or equivalent symptoms suggestive of myocardial ischemia, (2) electrocardiographic (ECG) changes consistent with ACS, including ST-segment elevation, ST-segment depression, T-wave inversion, or new ischemic changes, and/or (3) elevated serum Troponin-I levels above the institutional reference range(14, 15). The study included patients with ST-elevation myocardial infarction (STEMI), non-ST-elevation myocardial infarction (NSTEMI), and unstable angina. Troponin-I testing was not available in all patients due to resource limitations and the emergency outbreak setting; therefore, some cases were diagnosed based on compatible clinical presentation and dynamic ECG findings despite normal or unavailable troponin results, particularly when patients presented early after symptom onset before biomarker elevation could occur. In this study, patients with alternative causes of myocardial injury, including clinically suspected myocarditis, septic shock–related myocardial dysfunction, or isolated demand-related ischemia (Type 2 myocardial infarction) without supportive ECG evidence of ACS, were excluded as far as clinically feasible based on available medical records, clinical assessment, and cardiology evaluation at referral centers.

Selection of Controls: Controls were selected from adult (>18years) diarrheal patients admitted during the same study period (1 March–20 April 2022) who did not develop any clinical evidence of acute coronary syndrome (ACS) and were discharged routinely from the hospital. A 1:1 case-control ratio was maintained to ensure comparability between groups. Controls were randomly selected from the electronic database (SHEBA) of Dhaka Hospital, icddr,b, using the SPSS random sampling function, with frequency matching by age group and sex to minimize potential confounding between cases and controls. Clinical records of all control participants were retrospectively reviewed. According to hospital protocol, ECG were performed during their hospital care if patients presented with symptoms such as chest pain or discomfort, but no clinical or ECG features of ACS were identified. Troponin-I testing was not performed in asymptomatic controls due to resource limitations and low clinical suspicion. Selection bias was minimized by recruiting controls from the same source population and study period as the cases using identical eligibility criteria except for the absence of ACS.

Statistical analyses

The data were analyzed using Stata-14 software (StataCorp LP, College Station, TX, USA). Categorical variables were presented as frequencies with percentages, while mean and standard deviation were used for homogeneous data and median with interquartile range for skewed data. Various characteristics such as age, sex, diarrhea and its duration, dehydration status, stool consistency, and fever, as well as outcomes (improved/death in hospital/major complications), were compared. Chi-square tests were utilized for comparing categorical variables. For continuous main outcome measures, analysis of variance (ANOVA) and the Kruskal–Wallis test were employed for parametric and nonparametric variables, respectively, to assess the statistical significance of differences. To evaluate the association between all exposure variables and the outcome variable—Cardiovascular Thromboembolic Manifestations—simple logistic regression was conducted. Finally, adjusted Odds Ratios were estimated using multiple logistic regression, employing a separate model for each exposure variable, with adjustments made for age, sex, religion, and the presence of fever.

Results:

During the study period, the overall incidence of acute coronary syndrome (ACS) was 5.2 cases per 1,000 adult diarrheal patients (aged >18 years). Among them, the mean (SD) age was 56.3(±15.6) years, 64.8% (n=90) were male, and 41 % (n=57) were aged >60 years (Table 1). Median (IQR) duration of diarrhea was 23 (12–48) hours; 89.2% had watery stools, and 92.8% presented with dehydration (some: 38.1%, severe: 54.7%). Here, 37.4% of patients with ACS were diagnosed by suggestive symptoms + ECG change + increased troponin-I, and 62.6% were diagnosed by symptoms and ECG changes (Table 1).

Table 1 Clinical and Demographic Characteristics of Adult Diarrheal Patients Who Developed Acute Coronary Syndrome (ACS)

Characteristics	n (%) or median (IQR) or mean (SD)
Incidence of ACS cases n/1000 patients	5.2
Age, mean($\pm$ SD) years	56.3($\pm$ 15.6)
Age category	
▪ 18-45 years	35 (25.2)
▪ 46-60 years	47 (33.8)
▪ >60 years	57 (41)
Sex, male n (%)	90(64.8)
Duration of diarrhea, median (IQR) hours	23 (12-48)
Dehydration status, n (%)	
▪ No	10 (7.2)
▪ Some	53 (38.1)
▪ Severe	76 (54.7)

* Study year- 2022: during outbreak

Compared with non-ACS controls (n=139), patients in the ACS group were significantly older (>60 years: 41.0% vs. 28.8%, p=0.023) and exhibited a significantly higher prevalence of baseline comorbidities: Hypertension: 70.6% vs. 28.1% (p<0.001); Diabetes Mellitus (DM): 61.9% vs. 27.3% (p<0.001); Pre-existing heart disease: 35.5% vs. 5.0% (p<0.001). At triage, ACS patients were more likely to present with a lethargic appearance (36.0% vs. 5.0%, p<0.001), rapid onset of dehydration (<24 hours: 61.9% vs. 10.1%, p<0.001), and random blood sugar (RBS) >11 mmol/L} (37.8% vs. 23.2%, p=0.018). Serum sodium levels $\geq$ 135 mmol/L} (47.4% vs. 18.6%, p=0.002) and acute kidney injury (elevated serum creatinine: 92.5% vs. 75.9%, p=0.028) were also significantly more common in the ACS group (Table 2).

Table 2 Clinical and Laboratory Characteristics of Adult Diarrheal Patients With ACS and Non-ACS Controls

Characteristics	ACS (139), n (%)	Non-ACS (139), n (%)	Overall	P-value
Sex				
Male	90 (64.8)	85 (61.2)	175 (63)	0.535
Female	49 (35.3)	54 (38.9)	103 (37.1)	
Religion				
Muslim	136 (97.8)	131 (94.2)	267 (96)	0.124
Hindu	3 (2.2)	8 (5.8)	11 (4)	
Age category				
(18-45) years	35 (25.2)	55 (39.6)	90 (32.4)	0.023
(46-60) years	47 (33.8)	44 (31.7)	91 (32.7)	
(>60) years	57 (41)	40 (28.8)	97 (34.9)	
General Appearance				
Normal	10 (7.2)	40 (28.8)	50 (18)	<0.001
Lethargic	50 (36)	7 (5)	57 (20.5)	
Irritable	79 (56.8)	92 (66.2)	171 (61.5)	
Fever				
No	111 (79.9)	100 (71.9)	211 (75.9)	0.123
Yes	28 (20.1)	39 (28.1)	67 (24.1)	
Hypertension				
No	32 (29.36)	100 (71.94)	132 (53.23)	<0.001
Yes	77 (70.64)	39 (28.06)	116 (46.77)	
History of Heart Disease				
No	89 (64.5)	132 (95)	221 (79.8)	<0.001
Yes	49 (35.5)	7 (5)	56 (20.2)	
Diabetics				
No DM	53 (38.13)	101 (72.66)	154 (55.40)	<0.001
Yes DM	86 (61.87)	38 (27.34)	124 (44.60)	
Diarrhea Stool characteristics				
Watery	124 (89.2)	104 (74.8)	228 (82)	0.002
Mucoid or Bloody	15 (10.8)	35 (25.2)	50 (18)	
Duration of Diarrhea in hours				
(<24) hours	64 (46.04)	88 (63.31)	152 (54.68)	<0.001
(>=24) hours	75 (53.96)	51 (36.69)	126 (45.32)	
Dehydration status				
No	10 (7.2)	7 (5)	17 (6.1)	0.45
Yes (Some/Severe)	129 (92.8)	132 (95)	261 (93.9)	
Rapid (<24 hours) development of dehydration				
Yes	86(61.9)	14 (10.1)	100 (64)	0.001
No	53(38.1)	125(89.9)	178(64)	
RBS Triage				
>11	34 (37.8)	32 (23.2)	66 (29)	0.018
<=11	56 (62.2)	106 (76.8)	162 (71.1)	
Rapid DH (<24 hours) with DM				
<24 hours with DM	51 (46.0)	2 (1.5)	53 (21.3)	<0.001

Others	60 (54.1)	136 (98.6)	196 (78.7)	
Rapid DH (<24 hours) with DM with High RBS at triage				
Yes	25(22.5)	2(1.4)	27(10.8)	<0.001
No	86(77.5)	136(98.6)	222 (89.16)	
Sodium				
(<135)	20 (52.6)	70 (81.4)	90 (72.6)	0.002
(>=135)	18 (47.4)	16 (18.6)	34 (27.4)	
Potassium				
<3.5	12 (30.8)	21 (24.7)	33 (26.6)	0.7
3.5-5	23 (59)	52 (61.2)	75 (60.5)	
>5	4 (10.3)	12 (14.1)	16 (12.9)	
S. Creatinine				
Increase	37(92.5)	63(75.9)	100(81.3)	0.028
Normal	3(7.5)	20(24.1)	23(18.7)	

In a multivariable logistic regression model adjusted for age, sex, religion, and fever, several independent clinical features and comorbidities were strongly associated with increased odds of developing acute coronary syndrome (ACS) during acute diarrhea (Table 3). Pre-existing heart disease demonstrated the highest independent odds (a OR = 13.06, 95% CI: 5.91--28.89, $p < 0.001$), followed by hypertension (a OR = 6.15, 95% CI: 3.51-10.80, $p < 0.001$), an abnormal appearance at triage (irritable, restless, or lethargic; a OR = 5.12, 95% CI: 2.43-10.77, $p < 0.001$), rapid onset of dehydration in less than 24 hours (a OR = 4.70, 95% CI: 2.07-10.59, $p < 0.001$), and diabetes mellitus (a OR = 4.27, 95% CI: 2.56-7.14, $p < 0.001$). Additional independent predictors included presenting with watery stool (a OR = 2.60, 95% CI: 1.31-5.14, $p = 0.006$) and a random blood sugar level >11 mmol/L at triage (a OR = 2.33, 95% CI: 1.35-4.00, $p = 0.002$). Furthermore, notable synergistic clinical profiles substantially amplified risk, specifically the combination of rapid dehydration and diabetes mellitus (a OR = 24.47, 95% CI: 8.54-70.12, $p < 0.001$) as well as rapid dehydration, diabetes mellitus, and triage random blood sugar >11 mmol/L (a OR = 14.29, 95% CI: 4.24-48.17, $p < 0.001$).

Table 3 Factors Associated With Acute Coronary Syndrome in Adult Diarrheal**Patients: Logistic Regression Analysis**

Exposure variables	Unadjusted OR (95% CI)	p-value	Adjusted OR* (95% CI)	p-value
General appearance at triage				
Normal	Reference		Reference	
Irritable/Less active/Restless	5.40 (2.58, 11.31)	<0.001	5.12 (2.43, 10.77)	<0.001
Hypertension				
No	Reference		Reference	
Yes	6.17 (3.55, 10.74)	<0.001	6.15 (3.51, 10.8)	<0.001
Preexisting heart diseases				
No	Reference		Reference	
Yes	13.19 (5.99, 29)	<0.001	13.06 (5.91, 28.89)	<0.001
DM				
No	Reference		Reference	
Yes	4.31 (2.60, 7.16)	<0.001	4.27 (2.56, 7.14)	<0.001
Diarrheal stool characteristics				
Bloody and/or mucoid	Reference		Reference	
Watery	2.69 (1.41, 5.12)	0.003	2.6 (1.31, 5.14)	0.006
Diarrhea duration <24 hours				
More than 24 hours	Reference		Reference	
Less than 24 hours	2.02 (1.25, 3.27)	0.004	1.97 (1.21, 3.21)	0.006
Dehydration status				
Dehydration	Reference		Reference	
No Dehydration	1.49 (0.62, 3.61)	0.377	1.61 (0.65, 3.99)	0.306
Duration of development of DH				
> 24 hours or No DH	Reference		Reference	
< 24 hours	2.04 (1.30-7.9)	<0.001	4.7 (2.07, 10.59)	<0.001
RBS at triage				
<11	Reference		Reference	
>11	2.37 (1.39, 4.07)	0.002	2.33 (1.35, 4.00)	0.002
Rapid DH (<24 hours) with DM				
No	Reference		Reference	
Yes	24.89 (8.71, 71.11)	<0.001	24.47 (8.54, 70.12)	<0.001
Rapid DH (<24 hours) with DM with High RBS at triage				
No	Reference		Reference	
Yes	14.11 (4.21, 47.28)	<0.001	14.29 (4.24, 48.17)	<0.001
S. Sodium				
<135	Reference		Reference	
>135	3.94 (1.71, 9.09)	<0.001	4.36 (1.83, 10.39)	<0.001
S. Potassium				
>5	Reference		Reference	
<3.5	1.71 (0.45, 6.52)	0.429	2.05 (0.53, 7.96)	0.300
3.5-5	1.33 (0.39, 4.56)	0.653	1.38 (0.40, 4.80)	0.613
Creatinine category				
<119	Reference		Reference	
>120	3.92 (1.09, 14.08)	0.037	3.61 (0.99, 13.17)	0.052

*Adjusted Odds Ratios were estimated using multiple logistic regression; a separate model was employed for each exposure variable listed in the first column, with adjustments made for age, sex, religion, and the presence of fever

The outcome of the patients who developed acute coronary syndrome during diarrheal illness showed that out of 84 patients, death was 45.2%, among whom 34.5% died during the hospital stay and 10.7% died after discharge. On the other hand, 54.7% of patients were alive, and among them, 44% maintained a normal life after taking treatment, and 10.7% were alive with major complications (Table 4)

Table 4: Follow-up Outcomes of the patients who developed ACS during diarrheal illness

	Follow-up (n=84) outcome	Events (n)	Percentages (%)
Alive, n=46 (54.7%)	Alive with Normal life	37/84	44
	Alive with major Complication	9/84	10.7
Death, n=38 (45.2%)	Death during hospital stay	29/84	34.5
	Death after discharge	9/84	10.7

Discussion:

Acute coronary syndrome (ACS), including myocardial infarction, is a global health concern with significant implications for public health and the healthcare system (16). Diarrhea may

lead to cardiovascular complications, which have been overlooked in several studies. Our study sheds light on the concerning association between diarrheal episodes and the development of Acute Coronary Syndrome (ACS), particularly during outbreaks. In this study, we observed a notable incidence of 5.2 ACS events per 1000 diarrheal patients among adults, presenting with acute diarrheal illness during a major cholera outbreak in Bangladesh. The findings highlight the potential clinical importance of recognizing cardiovascular complications in diarrheal patients, particularly those with pre-existing cardiovascular risk factors.

Our results highlight several key risk factors significantly associated with the development of ACS during a diarrheal episode. Pre-existing heart diseases emerged as the strongest predictor, increasing the odds of ACS by over 13 times (aOR: 13.06, 95% CI: 5.91-28.89, $p < 0.001$). This is consistent with existing literature, where patients with underlying cardiovascular conditions are known to be more vulnerable to thrombotic events triggered by systemic stressors. Similarly, hypertension (aOR: 6.15, 95% CI: 3.51-10.8, $p < 0.001$) and diabetes mellitus (aOR: 4.27, 95% CI: 2.56-7.14, $p < 0.001$) were identified as significant independent risk factors. These chronic conditions are well-established contributors(17) to cardiovascular disease, and their presence likely exacerbates the hypercoagulable and inflammatory state induced by diarrheal illness.

A particularly striking finding was the strong association between the rapid development of dehydration (<24 hours) and ACS. While dehydration itself is a known consequence of severe diarrhea, our study showed that patients who experienced rapid dehydration in conjunction with diabetes and high random blood sugar (RBS) at triage had a substantially elevated risk of ACS (aOR: 14.29, 95% CI: 4.24-48.17, $p < 0.001$). This suggests a critical interplay between fluid loss, glycemic control, and the onset of cardiac events. Rapid fluid shifts and hemoconcentration due to dehydration can increase blood viscosity, promote platelet aggregation, and lead to a hypercoagulable state(18), thereby precipitating thrombotic events

like ACS(19). The combination with uncontrolled diabetes further compounds this risk due to the pro-thrombotic and inflammatory effects of hyperglycemia.

Our findings are also supported by previous reports describing an association between gastroenteritis and myocardial infarction(20). Several studies have suggested that acute gastrointestinal infections may trigger ACS through inflammatory cytokine release, sympathetic activation, dehydration, and coagulation abnormalities. Additionally, diarrheal illness may precipitate Type 2 MI due to hypotension, reduced coronary perfusion, and increased myocardial oxygen demand during severe systemic stress(21). These mechanisms are particularly relevant in elderly patients and those with underlying cardiovascular disease.

The high mortality rate of 45.2% observed in patients who developed ACS during diarrheal illness is alarming and underscores the severity of this comorbidity. This high fatality rate highlights the urgent need for early recognition and aggressive management of ACS in diarrheal patients, especially those with identified risk factors.

However, our study had some limitations. First, the single-center design and small sample size may limit the generalizability of our findings. The lack of relevant data makes it difficult to establish a link between diarrhea etiology and acute coronary syndrome. In addition, troponin-I testing was not performed in all patients, and myocarditis or sepsis-related myocardial injury could not be completely excluded in some cases. The lack of routine echocardiography and coronary angiography limited confirmation of the underlying mechanism of myocardial injury and differentiation of Type 2 myocardial infarction from obstructive coronary disease. Therefore, causality between diarrheal illness and ACS cannot be definitively established. Further multicenter prospective studies are needed to better understand the underlying mechanisms linking severe diarrheal illness with acute cardiovascular events.

Conclusion: Acute coronary syndrome is an underrecognized yet life-threatening complication of acute diarrheal illness. During the 2022 Bangladesh diarrheal outbreak, ACS was associated with high mortality and occurred predominantly among patients with pre-existing cardiovascular disease, hypertension, diabetes mellitus, and rapidly developing dehydration. The markedly elevated risk observed among patients with concurrent diabetes and rapid dehydration highlights the critical interplay between metabolic vulnerability and acute fluid loss. Our findings underscore the need to expand the clinical focus of diarrheal disease management beyond rehydration alone to include cardiovascular risk assessment and monitoring in high-risk adults. Integrating early cardiac evaluation into the management of severely dehydrated patients may facilitate timely diagnosis and improve outcomes. Recognition of ACS as a potential complication of acute diarrheal illness has important implications for patient care, outbreak preparedness, and public health strategies in resource-limited settings. Large multicenter prospective studies are warranted to validate these findings and clarify the causal relationship between severe diarrheal illness and acute cardiovascular events.

Declarations

Abbreviations

- **ACC:** American College of Cardiology
- **ACS:** Acute Coronary Syndrome
- **AHA:** American Heart Association
- **aOR:** Adjusted Odds Ratio
- **CI:** Confidence Interval
- **DH:** Dehydration
- **DM:** Diabetes Mellitus
- **ECG:** Electrocardiogram
- **ESC:** European Society of Cardiology
- **icddr,b:** International Centre for Diarrhoeal Disease Research, Bangladesh
- **IHD:** Ischemic Heart Disease
- **IQR:** Interquartile Range
- **MI:** Myocardial Infarction
- **NICVD:** National Institute of Cardiovascular Diseases

- **NSTEMI:** Non-ST-Elevation Myocardial Infarction
- **OR:** Odds Ratio
- **RBS:** Random Blood Sugar
- **SD:** Standard Deviation
- **SPSS:** Statistical Package for the Social Sciences
- **STEMI:** ST-Elevation Myocardial Infarction

Ethical approval and consent to participants:

This study was conducted by evaluating archived medical records from the electronic database (SHEBA) at Dhaka Hospital, icddr,b. Participants referred to another healthcare facility during their care were contacted once by telephone to determine their final clinical outcome. The study protocol was approved by the hospital authorities and the Institutional Review Board of icddr,b (Research Protocol Number: PR-23152, Version-1), authorizing the use of the data for analysis and manuscript preparation. Informed verbal consent was obtained during telephone follow-ups for outcome assessment.

Consent for publication

Not applicable. The manuscript contains anonymized retrospective clinical data and does not contain any person's details, images, or videos.

Availability of data and materials

The datasets used and/or analyzed in the current study are available from the corresponding author upon reasonable request and subject to approval by the institutional data repository committee at icddr,b.

Competing Interests

The authors declare no competing interests.

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for clinical research initiatives. The authors undertook this work voluntarily, in their personal time, to address this clinically important question using existing hospital records.

Clinical trial registration: Not applicable.

Authors' contributions

TA and SBI conceived the research ideas. SBI, MJC, MSH, TA, MS, MC, MAAN, SMQ, and MKH contributed to the study design. SBI, MC, MAAN, SMQ, JF, and MKH performed patient recruitment. Data analysis and the first draft were prepared by SBI and MS. All authors read, contributed to, and approved the final manuscript.

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