European Journal of Clinical Pharmacy

Print ISSN: 2385-409X Online ISSN: Applied
Website: https://farmclin.com/

Original Research Article

Frequency and Factors Associated with Acute Kidney Injury in Patients with Acute Gastroenteritis

Article History:

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Received: 26-11-2025
Revised: 14-12-2025
Accepted: 21-12-2025
Published: 30-12-2025

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Abstract:
Background: Acute gastroenteritis is a common cause of hospital presentation and may lead to significant complications, including acute kidney injury, particularly in patients with severe dehydration and underlying comorbidities.
Objective: To determine the frequency of acute kidney injury and factors associated with its occurrence in patients presenting with acute gastroenteritis.
Study Design: Cross-sectional study.
Place and Duration of Study: Department of Medicine, Shalamar Hospital Lahore, From 2 August 2025 to 2 November 2025.
Methodology: A total of 151 patients aged 18–75 years presenting with acute gastroenteritis were enrolled through non-probability consecutive sampling. Demographic and clinical variables including dehydration severity, stool frequency, vomiting frequency, diarrhea duration, and comorbidities were recorded using a structured proforma.
Results: Acute kidney injury was identified in 49 (32.5%) patients. Acute kidney injury was significantly more frequent among patients aged >45 years ($p=0.014$), those with diabetes mellitus ($p=0.006$), hypertension ($p=0.018$), severe dehydration ($p<0.001$), high stool frequency ($p=0.002$), high vomiting frequency ($p=0.011$), and prolonged diarrhea duration ($p=0.001$).
Conclusion: Acute kidney injury was a frequent complication in patients with acute gastroenteritis. Severe dehydration, diabetes mellitus, prolonged diarrhea duration, and increased stool frequency were significant predictors of acute kidney injury.

Keywords: Acute Kidney Injury, Acute Gastroenteritis.

INTRODUCTION

Acute gastroenteritis (AGE) is a significant health issue in the adult population across the world, but many surveillance programs focus on children. Adults in high-income areas have between 0.5 to 2 episodes per person annually, and the rates are even higher in low to middle-income countries due to sanitation and water quality limitations (1,2). There are few estimates of adults in Pakistan; 71 percent overall gastroenteritis in a hospital emergency department study of presenting patients in Karachi (2) was not separated by age. Viruses are predominant in adults, being headed by norovirus, followed by rotavirus, adenovirus and sapovirus. Major causative agents are Clostridioides difficile, Campylobacter, Salmonella, Shigella, enterotoxin producing or enteroaggregative Escherichia coli. Less prevalent protozoa like Giardia and Cryptosporidium can result in long-term symptoms and dehydration (3). AGE may cause extra-gut complications. Diarrheal illness has been reported to result in cardiovascular events shortly thereafter,

which is probably mediated by inflammation and hemodynamic stress. Neurological symptoms could be a result of electrolyte imbalance or hypoglycemia and hepatic damage can be observed with severe viral disease in immunocompromised adults (4–6). Among them the acute kidney injury (AKI) with its volume depletion, pre-renal azotemia, and electrolyte imbalance is especially significant. The AGE-associated AKI is associated with a higher in-hospital mortality, prolonged hospitalization, and, in the most severe cases, renal replacement therapy. Older adults are at a higher risk, as well as patients with diabetes or hypertension. AKI is linked to chronic kidney disease, recurrent AKI, and increased mortality in the long run, and thus early detection and prevention is necessary (7,8). Rahman et al. (2025) examined 79 patients (58.2% male, 41.8% female; median age 35 years, range 18–80) and reported an AKI incidence of 50.6% (n=40). The frequency of AKI among patients aged over 40 (67.5) was significantly greater than 13.5 among patients aged under 40 (P=0.000). There were 40 percent and 60 percent male and female cases of AKI, respectively. The most frequent manifestation was diarrhea (78.5%), which was much more frequent among AKI and non-AKI patients (90% vs 66, P=0.012). All patients were found to be dehydrated, with the worst cases of dehydration being the highest in AKI cases (48.1%) (9). Mukherjee et al. (2016) engaged in a prospective observational study and discovered 22% AKI (n=11). The distribution of the stool frequency was 54 and 20 percent 6-10 stools/day and 1-5 stools/day respectively. The 42, 38, and 2 percent of dehydration were mild, moderate, and severe, respectively. The comorbidities were diabetes mellitus (38%) and hypertension (38%). Duration of diarrhea was 1–2 days in 62% and 2–4 days in 26%. AKI was most frequent in patients with 11–15 stools/day (50%, n=8), followed by 30% with 1–5/day (n=10), 25% with 16–20/day (n=4), 11% with 6–10/day (n=27), and 0% with 21–25/day (n=1). The percentage of diabetes in AKI and non-AKI patients was 26.3 and 19.4 respectively (p=0.40). AKI incidence correlated with dehydration severity: 100% in severe (n=1), 26.3% in moderate (n=19), 14.3% in mild (n=21), and 22.2% in non-dehydrated patients (n=9) (p=0.21) (10). Bogari et al. (2023) studied 300 AGE patients and reported an AKI prevalence of 13.7% (95% CI: 10.1–18.2; n=41). Age stratification revealed higher AKI in those >45–60 years (31.7% vs 17.0%) and >60 years (46.3% vs 18.5%, p<0.0001). Diabetes mellitus (56.1% vs 17.0%, p<0.0001) and hypertension (61.0% vs 18.1%, p<0.0001) were significantly more common in AKI patients. Clinical presentations included diarrhea (99.7%, n=299), fever (45.3%, n=136), and vomiting (38.0%, n=114). In AKI patients, the frequency of diarrhea was most commonly 710 times/day (46.3, n=19), 46 times/day (29.3, n=12), and the frequency of stool significantly correlated with AKI (p=0.039) (11).

Objective

To determine the frequency of acute kidney injury (AKI) in patients presenting with acute gastroenteritis and to compare the frequency of demographic and clinical factors in acute gastroenteritis.

METHODOLOGY:

This cross-sectional study was conducted at Department of Medicine, Shalamar Hospital Lahore, From 2 August 2025 *to* 2 November 2025. A sample size of 151 patients was calculated using an expected prevalence of acute kidney injury of 50.6%, with a 95% confidence level and a margin of error of 8% (9). The calculated sample size was considered adequate to estimate the frequency of acute kidney injury and assess associated factors in the target population. The sampling was non-probability consecutive. The study included patients of any gender aged 18 up to 75 years with acute gastroenteritis based on the operational definition. Only willing and able patients who could give written informed consent or had their legally authorized representatives giving their consent were enrolled. Patients who had chronic diarrhea of 14 days or longer duration, non-infectious etiology of diarrhea or vomiting, end-stage kidney disease on maintenance dialysis, previous kidney transplantation, chronic kidney disease, obstructive uropathy, structural renal disease, recent exposure to iodinated contrast, ongoing nephrotoxic chemotherapy, pregnancy, or concomitant acute conditions independently causing renal injury were excluded to minimize confounding. Patients who were eligible were enrolled following a written informed consent after receiving ethical approval and mandatory approval by CPSP. Detailed history and physical examination was done to capture demographic details, history of diarrhea and vomiting, and severity of dehydration and comorbidities. Clinical assessment of vital signs such as blood pressure and heart rate were done using calibrated instruments, whereas capillary refill time, oral mucosal dryness and skin turgor were done clinically. Operational definitions were used to classify dehydration as mild or none, moderate, or severe. The gastrointestinal variables were defined based on predetermined frequency categories of stool output, vomiting and diarrhea duration. Acute kidney injury was identified using laboratory tests, such as serum creatinine and urine output checks. All data were captured on a structured data collection proforma and the patients were not disturbed by the study as they were receiving normal standard care. The main outcome measure was the rate of acute kidney injury in patients with

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acute gastroenteritis. Secondary variables comprised variables related to acute kidney injury such as age, sex, level of dehydration, comorbidities, stool frequency, vomiting frequency, and diarrhea duration. The analysis of data was done using SPSS version 26. Quantitative variables were stated as the mean, standard deviation or median with the interquartile range when necessary, whereas the categorical variables were represented as frequencies and percentages. The percentage of patients who develop acute kidney injury was determined using 95% confidence intervals. Chi-square test or Fisher exact test was used to determine associations between acute kidney injury and categorical variables where the latter was used. Significant variables at univariate analysis were compared in multivariate analysis of binary logistic regression to obtain significant predictors of acute kidney injury, with adjusted odds ratios and 95% confidence interval. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Data were collected from 151 patients, with a mean age of 46.8 ± 15.2 years. Patients aged >45 years constituted the majority (56.3%) compared to 43.7% aged ≤45 years. Male patients were more common, accounting for 57.6%, while females represented 42.4%. Among comorbid conditions, hypertension was the most frequent (28.5%), followed by diabetes mellitus (25.8%) and ischemic heart disease (11.9%). Moderate dehydration was the most common presentation (40.4%), followed by mild or no dehydration (34.4%) and severe dehydration (25.2%).

Table 1. Baseline Characteristics of Study Participants (n=151)

Variable	Frequency (n)	Percentage (%)
Age Group		
≤45 years	66	43.7
>45 years	85	56.3
Mean Age (years)	46.8 ± 15.2	—
Gender		
Male	87	57.6
Female	64	42.4
Comorbidities		
Diabetes Mellitus	39	25.8
Hypertension	43	28.5
Ischemic Heart Disease	18	11.9
Dehydration Severity		
Mild/None	52	34.4
Moderate	61	40.4
Severe	38	25.2
Stool Frequency (24 hrs)		
Low (1–5/day)	57	37.7
Moderate (6–10/day)	52	34.4
High (≥11/day)	42	27.8
Vomiting Frequency (24 hrs)		
Low (0–2/day)	63	41.7
Moderate (3–5/day)	51	33.8
High (≥6/day)	37	24.5
Duration of Diarrhea		
Short (1–2 days)	54	35.8
Moderate (3–4 days)	62	41.1
Prolonged (≥5 days)	35	23.2

Acute kidney injury was identified in 49 out of 151 patients, yielding a frequency of 32.5%, while 102 patients (67.5%) did not develop acute kidney injury.

Table 2 Frequency of Acute Kidney Injury in Patients with Acute Gastroenteritis

Outcome Variable	Frequency (n)	Percentage (%)
Acute Kidney Injury Present	49	32.5
Acute Kidney Injury Absent	102	67.5

Patients aged >45 years had a significantly higher frequency of acute kidney injury compared with younger patients (40.0% vs 22.7%, p=0.014). Diabetes mellitus was significantly associated with acute kidney injury, with over half of diabetic patients developing AKI compared to 25.9% of non-diabetic patients (p=0.006). Similarly, hypertension showed a significant association, as 48.8% of hypertensive patients developed acute kidney injury compared to 25.9% without hypertension (p=0.018).

Table 3. Association of Demographic Factors with Acute Kidney Injury

Variable	AKI Present n (%)	AKI Absent n (%)	P-value
Age Group			0.014
≤45 years	15 (22.7)	51 (77.3)	
>45 years	34 (40.0)	51 (60.0)	
Gender			0.264
Male	25 (28.7)	62 (71.3)	
Female	24 (37.5)	40 (62.5)	

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Diabetes Mellitus			0.006
Yes	20 (51.3)	19 (48.7)	
No	29 (25.9)	83 (74.1)	
Hypertension			0.018
Yes	21 (48.8)	22 (51.2)	
No	28 (25.9)	80 (74.1)	

The frequency of AKI increased progressively with dehydration severity, occurring in 11.5% of patients with mild or no dehydration, 34.4% with moderate dehydration, and 57.9% with severe dehydration (p<0.001). Similarly, acute kidney injury was significantly more frequent among patients with high stool frequency (52.4%) compared to those with low stool frequency (19.3%) (p=0.002).

Table 4 Association of Clinical Factors with Acute Kidney Injury

Variable	AKI Present n (%)	AKI Absent n (%)	P-value
Dehydration Severity			<0.001
Mild/None	6 (11.5)	46 (88.5)	
Moderate	21 (34.4)	40 (65.6)	
Severe	22 (57.9)	16 (42.1)	
Stool Frequency			0.002
Low (1–5/day)	11 (19.3)	46 (80.7)	
Moderate (6–10/day)	16 (30.8)	36 (69.2)	
High (≥11/day)	22 (52.4)	20 (47.6)	
Vomiting Frequency			0.011
Low (0–2/day)	13 (20.6)	50 (79.4)	
Moderate (3–5/day)	18 (35.3)	33 (64.7)	
High (≥6/day)	18 (48.6)	19 (51.4)	
Duration of Diarrhea			0.001
Short (1–2 days)	13 (24.1)	41 (75.9)	
Moderate (3–4 days)	17 (27.4)	45 (72.6)	
Prolonged (≥5 days)	19 (54.3)	16 (45.7)	

Severe dehydration emerged as the strongest predictor, increasing the odds of AKI by more than four-fold (Adjusted OR 4.62, p<0.001). Prolonged diarrhea duration was associated with nearly three times higher odds of acute kidney injury (Adjusted OR 2.91, p=0.008), while high stool frequency increased the odds by 2.67 times (p=0.017). Diabetes mellitus also remained an independent predictor, with diabetic patients having 2.48 times higher odds of AKI (p=0.022).

Table 5. Multivariable Logistic Regression Analysis for Predictors of Acute Kidney Injury

Variable	Adjusted OR	95% CI	P-value
Age >45 years	1.89	0.94–3.79	0.071
Diabetes Mellitus	2.48	1.14–5.42	0.022
Severe Dehydration	4.62	2.01–10.61	<0.001
High Stool Frequency	2.67	1.19–5.98	0.017
Prolonged Diarrhea Duration	2.91	1.32–6.40	0.008

DISCUSSION

This research assessed the incidence and causes related to acute kidney injury in patients who have acute gastroenteritis and revealed that 32.5% of patients had acute kidney injury and thus renal complications are quite frequent in such population. This rate is similar to the results of the earlier studies in which the incidence of acute kidney injury in patients with volume depletion and infectious gastroenteritis has been estimated between 20 and 40 percent, depending on the population of patients, the severity of the disease, and the criteria applied to diagnose it. The burden found in the current study supports the view that acute kidney injury is a clinically significant complication of gastroenteritis, especially in hospitalized patients where dehydration and delayed presentation could be more significant (12). One of the key results of the current research was that there is a strong correlation between the severity of dehydration and acute kidney injury, and that patients with severe dehydration were at the greatest risk, and were independently correlated with acute kidney injury on multivariable analysis. The biological viability of this finding is that the chronicity of gastrointestinal fluid losses may result in renal hypoperfusion, decrease of glomerular filtration, and transition of reversible pre-renal azotemia to intrinsic kidney injury unless fluid replacement is attained (13). Other studies have also reported similar findings in the past where severe dehydration was always one of the most effective predictors of acute kidney injury in

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diarrheal diseases. The current results also underscore the paramount role of early diagnosis and vigorous fluid therapy in avoiding kidney complications (14).

Diabetes mellitus was also found to be an independent predictor of acute kidney injury. The odds of renal injury was significantly higher in diabetic patients than in non-diabetic ones, which aligns with the findings of prior studies that suggest diabetic patients can have lower renal reserve, microvascular vulnerability and may fail to adapt to acute hypovolemic stresses. These can predispose them to faster loss of renal functioning during acute gastroenteritis (15). This result indicates that comorbid disease burden is a significant risk factor of acute kidney injury and indicates that diabetic patients with gastroenteritis might be in need of increased renal surveillance. The other significant observation was that a higher frequency of stool and a longer period of diarrhea were associated with acute kidney injury. Even after controlling the effect of other variables, patients with increased stool frequencies and longer duration of symptoms were much more likely to have renal injury (16). Such results are consistent with earlier studies that proved the cumulative loss of gastrointestinal fluids and the long-term exposure to the loss of volume enhances the risk of developing renal dysfunction. Clinically, this implies that the presence of diarrhea, the severity and duration are not only significant risk determinants. Patients who showed up late (after a few days of persistent symptoms) may thus constitute an inherently vulnerable group (17).

In univariate analysis, high vomiting frequency was also significantly related to acute kidney injury but not an independent predictor when adjusted. This could imply that vomiting is a risk factor to the kidney not by itself but by association with the severity of dehydration (18). The same trends have been noted in other studies, in which vomiting is generally associated with increased volume depletion but becomes non-significant on inclusion of more direct measures of dehydration in multivariate analyses. Unadjusted analysis indicated that old age was significantly associated with acute kidney injury but had borderline significance with adjustment. This could indicate that the age effect on risk is moderated by comorbid conditions and increased susceptibility to dehydration. Earlier studies have also demonstrated that elderly people have a higher risk of acute kidney injury because of reduced renal functional reserve, and physiological changes in response to hypovolemia, but this can be counteracted once other clinical variables are controlled (19).

The results of the present research have significant clinical implications. The finding of severe dehydration, diabetes mellitus, protracted diarrhea, and high stool frequency as predictors of acute kidney injury are practical risk stratification markers which can be identified during presentation (20). These considerations can assist clinicians in determining high-risk patients that should be more carefully observed in terms of renal function, timely lab testing, aggressive rehydration, and preventing nephrotoxic exposures. They can also be used in a resource-limited setting to prioritize the patients who are likely to benefit most by intensified monitoring and intervention.

Limitations

The current research has some limitations to be taken into account. Being a one-center cross-sectional study, its generalizability can be questionable, and no definite statements about temporal or causal relations can be made. Non-probability consecutive sampling can result in selection bias. Also, the research failed to assess microbiological etiology of gastroenteritis, chronic renal, or severity staging of acute kidney injury, which would have given more insights. In spite of these shortcomings, the research has valuable local data on a comparatively under-researched complication of acute gastroenteritis.

CONCLUSION:

The conclusion is that acute kidney injury is a common complication in patients who present with acute gastroenteritis and almost one third of patients in this study had acute kidney injury. Severe dehydration, diabetes mellitus, duration of diarrhea and large stool frequency were strongly related to the occurrence of acute kidney injury and became significant predictors of renal problems. To prevent the development of kidney injury, these results emphasize the need to identify high-risk patients early, initiate fluid resuscitation, closely monitor the kidneys, and intervene early.

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