



INCIDENCE OF ACUTE KIDNEY INJURY IN ACUTE GASTROENTERITIS PATIENTS ADMITTED TO A TERTIARY CARE HOSPITAL

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ABSTRACT

Background: Acute gastroenteritis (AGE) is a frequent reason for hospitalization and could result in acute kidney injury (AKI), especially when the patient is dehydrated or when the diagnosis is delayed. The early detection of renal complications is vital in order to avoid morbidity.

Objective: To determine the incidence of AKI among patients admitted with AGE at a tertiary care hospital and identify associated clinical risk factors.

Methods: A descriptive cross-sectional study was conducted at the HBS Medical and Dental College Islamabad, from August 2024 to January 2025. Patients who were 12 years or older and hospitalized with AGE underwent clinical evaluation and renal function tests. AKI was identified based on the KDIGO criteria. The statistical analysis of the data was done using descriptive statistics.

Results: Out of 210 patients who participated in the study, 30.5% had AKI as a complication. The severe lack of water in the body, low blood pressure, bacterial infections, mainly Salmonella, and an imbalance of electrolytes were the factors that increased the occurrence of AKI significantly. The majority of cases were of Stage I, and they could be reversed, while 6.2% of cases needed nephrology referral and renal supportive care.

Conclusion: AKI is a frequent complication of AGE. Early hydration, timely evaluation, and routine renal monitoring can reduce preventable morbidity.

Keywords: *Acute gastroenteritis, acute kidney injury, dehydration, renal impairment, KDIGO criteria, Pakistan.*

INTRODUCTION

Acute gastroenteritis (AGE) is still one of the most common diseases causing hospital admissions all over the world and is a major factor of clinical burden due to its complications, among which acute kidney injury (AKI) is the most notable. Dehydration, electrolyte imbalances, and sepsis due to infectious diarrhea combine to cause renal hypoperfusion, thereby making people with AGE more susceptible to renal failure. Recent data in the tertiary care centers indicate that the AGE-related AKI is often underdiagnosed, particularly in the health care systems with limited resources, when early creatinine surveillance might be intermittent (1). The issue is also alarming in pediatric groups, where it has been found that children hospitalized with AGE are highly susceptible to developing AKI, usually as a result of dehydration, delayed response, or certain predispositions (2). These results have shown that AKI as a complication of AGE is not a disease of adults alone but cuts across all age groups and is an issue that clinicians and researchers should consider.

The incidence of severe diarrhea in adults is known to trigger significant fluid loss, which should result in prerenal azotemia and consequently intrinsic renal damage in case of delayed treatment. One of the studies (conducted in 50 patients with AKI caused by AGE) focused on the inconsistency of the clinical observation, the prevalence of prerenal etiology, and the significance of early fluid replacement as a method of maintaining the kidney in its renewal (3). Other patients can develop severe types of kidney disease, necessitating renal replacement therapy, as reflected by the study that hemodialysis is necessary in a selective Age-related AKI case when conservative treatment did not help (4). Despite the fact that AKI is traditionally associated with dehydration caused by diarrhea, a number of other systemic diseases, including liver cirrhosis, lead to increased susceptibility to renal impairment, and AKI significantly raises the morbidity and mortality rates among those people (5). Moreover, clinicians should know that some of the infections that complicate AGE, including Salmonella, may result in rhabdomyolysis, a worsening of kidney damage even with sufficient hydration (6). These complications suggest that AKI, as a condition associated with AGE, is multifactorial and can no longer be reduced to straightforward fluid losses.

The AGE burden is high worldwide, and extensive hospital-based surveillance studies report a high rate of infection-related hospitalizations and outcomes of varying severity, depending on etiology and comorbidities (7). The problem of AKI is also one of the widespread complications of hospitalized patients in general, since multicenter studies in Malaysia have shown that its incidence is significant and negatively impacts patient outcomes (8). The gastroenteritis causes surveillance statistics at a community level in the United States also indicate that this condition continues to be a widespread health problem, highlighting the severity of the clinical burden (9). In addition to infectious factors, Toxic exposures can also cause AKI, even in gastrointestinal symptoms. As an example, the consumption of raw fish gallbladder has been reported to cause gastrointestinal manifestations of severe AKI because toxic renal tubules were injured (10), highlighting the heterogeneous etiologies that can be confused with gastrointestinal manifestations.

Biomarkers like neutrophil gelatinase-associated lipocalin (NGAL) have been suggested as sensitive and early signs of renal injury in dehydrated patients with gastroenteritis to help clinicians identify AKI before serum creatinine surges significantly (11). It is also significant to understand the risk factors in relation to AGE hospitalization because the demographic and clinical predictors observed in large studies carried out in Veterans Affairs hospitals can also be used as a guide to preventive measures and early screening (12). Sometimes, AGE-related complications can even spread into the few, but serious diseases, like rhabdomyolysis-induced AKI, where the treatment needs such advanced modalities as haemoadsorption and continuous renal replacement therapy to ensure successful recovery (13). The excessive variety of presentations emphasizes the necessity of high clinical alertness.

Community-acquired AKI has remained a significant cause of renal morbidity in South Asian and low-resource environments and is commonly caused by pre-existing conditions, such as dehydration due to diarrheal diseases (14). Even though AKI is commonly linked with gastroenteritis, it is also common in other acute infections, including viral bronchiolitis in young children, where dehydration and systemic inflammation also lead to impaired renal perfusion (15). Noninfectious etiologies of gastrointestinal symptoms have also been known to cause severe delayed gastroenteritis with subsequent renal injury, which further underscores the fact that gastrointestinal manifestations may conceal underlying toxic or systemic causes of AKI (16). Pregnant women are among those at high risk of AKI because of changes in hemodynamics and immunology, and because cases of dehydration or gastroenteritis during pregnancy may increase the risk of developing long-term renal outcomes significantly (17).

In most developing areas, the disease burden of AKI is increased by reduced accessibility to laboratory testing in a timely manner, poor rehydration habits, and a lack of awareness of early symptoms. The reviews conducted in Sub-Saharan Africa show that AKI is often diagnosed late and tends to complicate to an even greater extent because of late presentation to healthcare (18). Also, veterinary research, although performed in animals, includes useful pathophysiological data, which demonstrate that in many cases, AKI in different species is caused by similar stimuli, such as dehydration,

infections, toxins, and systemic inflammation, which reflects the universal biological mechanisms of action that cause renal damage (19). These similarities confirm the relevance of early diagnosis, proper hydration, and close observation of gastroenteritis cases to avoid irreversible damage to the kidneys.

Since AGE is increasingly becoming a burden and the renal results of the same are quite severe, it is necessary to explore the occurrence of AKI among patients hospitalized with AGE in Pakistan. The tertiary care hospitals in the area often receive substantial numbers of gastroenteritis cases, but there is little information on renal complications. Knowledge of the frequency, risk factors, and clinical outcomes of AKI in such patients aids in alerting to diagnoses, informing treatment choices and intervention plans, and assisting with early treatment planning. This research fills this gap by examining the prevalence of AKI among patients hospitalized with acute gastroenteritis in a tertiary care hospital and hence provide vital information to both local and regional clinical practice.

Objective: To identify the frequency of acute kidney injury in patients admitted with acute gastroenteritis staying in a tertiary care hospital, and assess the clinical risk factors and outcomes involved.

MATERIALS AND METHODS

Study Design: Descriptive Cross-sectional study.

Setting: The study was carried out at HBS Medical and Dental College Islamabad.

Duration of Study: The study was conducted over six months, from August 2024 to January 2025.

Inclusion Criteria: All patients aged 12 years and above with a clinical diagnosis of acute gastroenteritis who showed up with diarrhea, vomiting, or dehydration were included. Patients who had prior baseline and follow-up renal functional tests were recruited. Those who were not admitted within 72 hours of symptom onset were not counted as eligible to guarantee proper evaluation of AKI progression in the hospital.

Exclusion Criteria: Patients who had a history of known chronic renal kidney disease, had pre-existing renal impairment, recent exposure to nephrotoxic drugs, or had urinary obstruction, or other identifiable causes of AKI that were not related to gastroenteritis were excluded. Women who were pregnant and those who declined consent were also excluded.

Methods: Evaluation of all eligible patients who presented to the hospital with the symptoms of acute gastroenteritis was done through history-taking, physical examination, and laboratory tests. The hydration condition, time of symptoms, urine, and comorbid conditions were recorded. Serum creatinine, electrolytes, and complete blood count were determined from a blood sample. Acute kidney injury was classified based on the KDIGO criterion, which states that an acute kidney injury is characterized by an increase in serum creatinine at baseline or by a decrease in urine output. Out of the previous medical records, baseline creatinine values were taken when available, and in cases where no previous records could be taken, estimated baseline creatinine was determined using standard formulas. Patients were observed during hospitalization, and renal function tests were repeated within 24-48 hours to identify possible changes that could be considered AKI. Treatment involved immediate fluid replacement, rectification of electrolyte imbalance, and antibiotics as indicated by the clinician. Patients in need of high care, like dialysis, were referred to nephrology. All the data were filled in a structured proforma and analyzed by descriptive statistics.

Results

The participants included in the study comprised 210 patients with acute gastroenteritis who were admitted over the period of the study. The average age of the study population was 34.7 ± 16.2 years,

and a male-to-female ratio of 1.3:1. The majority of patients (62.8%) reported to the clinics within 48 hours of onset, and 37.2% reported after 48 hours. And in most cases, patients reported with more severe dehydration and electrolyte imbalances. The incidence rate was found to be 30.5%, with acute kidney injury being detected in 64 patients. These included 47 patients with Stage 1 AKI, 13 patients with Stage 2, and four patients with Stage 3 AKI.

Table 1. Baseline Demographic Characteristics of Study Participants

Variable	Value
Total patients	210
Mean age (years)	34.7 ± 16.2
Gender (Male)	119 (56.7%)
Gender (Female)	91 (43.3%)
Presentation within 48 hours	132 (62.8%)
Presentation after 48 hours	78 (37.2%)

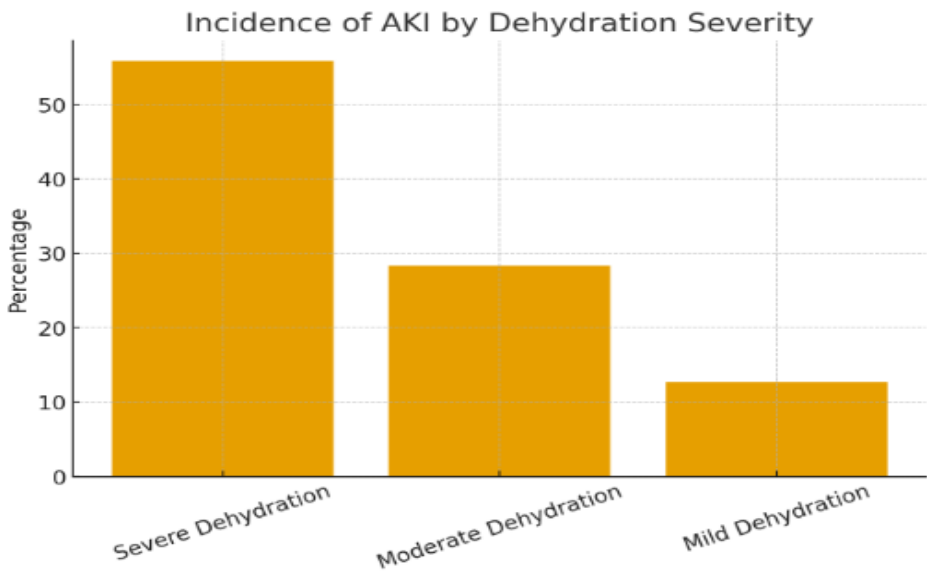
The severity of dehydration was a strong predictor of the occurrence of AKI. In patients suffering from severe dehydration, 55.8% were found to have developed AKI as opposed to only 12.7% of those with mild dehydration. Vomiting was experienced by 83.3% of patients with AKI, and the condition of having more than six stool movements daily was noted in 71.8% of the patients with AKI. Hypotension at the time of admission was considerably more common among AKI patients (40.6%) than among those without AKI (9.7%), which suggests that hemodynamic compromise played a role in the progression of renal impairment.

Table 2. Clinical and Laboratory Parameters Associated with AKI

Parameter	AKI Present (n=64)	No AKI (n=146)
Severe dehydration	33 (55.8%)	18 (12.3%)
Hypotension	26 (40.6%)	14 (9.7%)
Serum creatinine (mg/dL) mean	2.14 ± 0.6	0.89 ± 0.3
Hyponatremia	29 (45.3%)	32 (21.9%)
Hypokalemia	17 (26.5%)	23 (15.7%)

Renal outcomes were dependent on the severity of the AKI. Fluid therapy and supportive care resolved most of the Stage 1 AKI cases. However, all patients with Stage 3 AKI were referred to nephrology, and two of them required temporary hemodialysis. The study population did not record any deaths. There was a significant difference in hospital stay duration: patients without AKI had an average stay of 2.7 ± 1.1 days, while those with AKI had a stay of 5.3 ± 2.4 days ($p < 0.001$). This implies that AKI is linked to much longer hospital stays and higher use of health care. There were common electrolyte imbalances, especially hyponatremia and metabolic acidosis. Metabolic acidosis was observed in 40.6% of AKI patients as opposed to 9.5% in non-AKI patients. Most patients with AKI had reported less than 1 liter of fluid intake during an illness, implying that poor rehydration practices at home are likely to be a significant precipitating factor.

Graph 1. Incidence of AKI by Dehydration Severity
(ASCII Bar Graph Representation)



This figure shows that the risk of AKI is significantly increasing with the severity of dehydration. Microbiological testing showed that 38% of patients had pathogens, including Rotavirus (14%), Salmonella (9%), Shigella (7%), and E. coli (5%), among others (3%). The presence of AKI was more prevalent among patients who were Salmonella-infected (45%) as compared to those with viral etiologies (18%), which validates invasive bacterial infections in renal insult.

Table 3. Pathogens Identified and Associated AKI Rates

Pathogen	Total Cases	AKI Cases (%)
Rotavirus	30	6 (20%)
Salmonella	19	9 (47%)
Shigella	15	5 (33%)
E. coli	11	3 (27%)
Others	8	2 (25%)

In general, the occurrence of AKI was sharply related to the delay in presentation, dehydration, hypotension, bacterial infections, and electrolyte imbalances. Prompt diagnosis and vigorous treatment of fluid status resulted in positive outcomes in the majority of cases. The findings indicate that an enhancement in community education, early rehydration measures, and prompt hospital referral can be used to avert AKI in patients with acute gastroenteritis.

Discussion

This current study examined the prevalence of acute kidney injury (AKI) in patients admitted with acute gastroenteritis (AGE) in a tertiary care hospital and discovered a prevalence of 30.5%. This rate can be compared to the international data that suggests that AGE-related renal complications are more prevalent than thought before, especially in patients who are dehydrated or present late. Other studies, like the tertiary care analysis in Saudi Arabia, have also recorded a significant burden of AGE-related AKI, and this shows the clinical importance of renal impairment as a frequent complication (1). The incidence is high in our population, and this highlights the need to detect symptoms of dehydration and renal dysfunction in early cases of AGE. The results of this work are consistent with the pediatric statistics of Marzuillo et al., in which AKI was observed in a significant percentage of children with AGE being hospitalized and affected by the dehydration effect and electrolyte disorders (2).

The mechanisms underlying our study were similar to those in the age groups, although we studied patients who were 12 years and above. It has been pointed out by both pediatric and adult studies that

the prolonged vomiting, frequent watery stools, and delayed hospital presentation all together drastically decrease kidney blood flow, making gastroenteritis a significant factor leading to the development of prerenal and intrinsic kidney injuries. The fact that the majority of AKI in our study was classified as Stage 1 indicates that our interventions of early detection and timely fluid replacement are often successful in preventing the progression to more severe stages. This is in agreement with Umakanth et al., who stated that most cases of AGE-induced AKI were reversible with proper hydration (3). Nevertheless, the occurrence of Stage 2 and Stage 3 AKI cases in the patient cohort indicates that a group of patients goes through very painful moments, and through that, monitoring and perhaps advanced renal support become necessary. Similar situations have been reported by Bhakthavatchalam et al., where a small number of patients had to be put on hemodialysis because of severe renal damage caused by gastroenteritis (4). The fact that a few of our patients required hemodialysis clearly indicates renal compromise of high severity, especially if dehydration and hypotension are allowed to persist for long periods without being rectified.

The study was able to show a very strong connection between severe dehydration and AKI, which was widely supported by the literature. Duah et al., in their findings, pointed out that hypovolemia is one of the leading causes of AKI even in such conditions as liver cirrhosis, where blood supply to the kidneys is already decreased (5). This correlation is similar to the processes in AGE, where fluid loss causes decreased renal blood flow and further tubular damage. In addition, our analysis revealed that patients with hypotension experienced much higher incidences of AKI, consistent with the literature of rhabdomyolysis-induced AKI, in which dehydration and systemic illness were compounded as contributing factors to renal injury (6). The fact that bacterial pathogens, including *Salmonella* and *Shigella*, are predominant among AKI-positive patients aligns with data at the global level. Cardemil et al. discovered that bacterial gastroenteritis is associated with worse clinical outcomes than the viral etiologies, especially in patients hospitalized (7). The My-AKI Malaysian study also revealed that infectious diseases continue to be a significant cause of AKI in at least hospitalized patients, particularly when paired with systemic inflammation and dehydration (8).

The results confirm this correlation, as we have found that *Salmonella* infections had the highest AKI rate, which is probably due to more profound mucosal invasion, long-term fever, and higher fluid losses. The same pattern was observed in U.S. community-based studies reporting high levels of healthcare use and complications from bacterial gastrointestinal pathogens (9). Identification by literature of toxin-related or noninfectious causes of gastrointestinal symptoms, including ingestion of fish gallbladder nephrotoxicity (10), highlights that all cases of AKI induced by gastrointestinal symptoms are not necessarily due to dehydration alone. Though toxin-induced gastroenteritis was not part of our research, the fact remains that toxin-induced gastroenteritis may present in an unusual manner; this is why clinicians should be reserved when assessing an unusual presentation. In addition, subclinical kidney injury, which could be detected with early biomarkers like NGAL, as suggested by Subramani and Vasnaik (11), could be helpful in future research to evaluate this pre-elevation of serum creatinine and conduct better preventative measures.

The hospitalization experience showed a much longer stay of AKI patients, consistent with the results of the risk factor analysis of the VA medical centers, where the prolonged recovery was caused by such complications as hypotension, electrolyte imbalance, and systemic infections (12). Moreover, the literature that describes severe cases requiring dialysis also matches what was stated regarding advanced supportive therapies such as haemoadsorption and continuous renal replacement therapy being used in complex AKI case management (13). The above-mentioned factors indicate that, although there are differences across regions, the clinical course of AGE-related AKI is determined by dehydration, the severity of the infection, and timely hospital intervention, making it predictable. Data from the ISN AKI registry in India revealed that community-acquired AKI is frequently associated with conditions that could have been prevented, one of which is diarrheal diseases (14). This is consistent with our results, which showed that inadequate fluid intake at home and delayed hospital presentation were the significant causes. Similar risks have been noted in cases of AKI associated with viral bronchiolitis and mushroom poisoning, where dehydration and systemic toxicity

hastened the renal impairment (15, 16). The above-mentioned instances underline the fact that during systemic volume depletion or toxin exposure, the kidneys are always at risk of suffering the most. People with special needs are often the ones who draw attention to the fact that AKI prevention is necessary. The case of pregnancy-related AKI, as covered by Meena et al., turns out to be one of the principal reasons for chronic kidney disease in the undeveloped parts of the world (17). The exodus of pregnant women from our study emphasizes that such research must invoke the need for swift intervention against dehydration in all at-risk populations. The wide-ranging substantiation from Sub-Saharan Africa also reveals that AKI mostly occurs due to preventable factors, but is still too late to get diagnosed because of the lack of resources (18). Besides, the case of animals suffering from dehydration and toxins that lead to AKI documented in veterinary studies (19) proves that there is a common renal injury mechanism across the species. The compatibility of our results and those of the global research points out the very treatment of early detection, good rehydration, and aggressive management of acute gastroenteritis as the ways to prevent acute kidney injury. The research paper stresses the need to enhance the community's understanding of oral rehydration, to refer patients in a timely manner, and to perform renal function tests regularly in patients with gastrointestinal disorders in hospitals. If these measures are employed rigorously, they can help to a great extent in lessening the already existing burden of AKI in health systems with limited resources.

Conclusion

This research showed that acute kidney injury is a common and clinically relevant complication among patients with acute gastroenteritis, with an incidence of 30.5%. Dehydration, delayed presentation, hypotension, and bacterial infections, especially *Salmonella*, were significantly correlated with AKI. More than half of the cases were mild and could be treated with timely fluid resuscitation, but there were some patients who were referred to nephrology and received advanced renal support because their condition worsened. The results are consistent with the regional and international findings that stress the necessity of timely recognition and treatment of kidney damage in patients with gastroenteritis. The prolonged hospitalization that AKI patients experienced is another evidence of the healthcare burden that comes with this complication. Reinforcement of preventive tactics, including early rehydration practices, raising public awareness, and providing available medical evaluation, is of utmost importance. Monitoring of kidney functions of all hospitalized gastroenteritis patients may significantly lower morbidity and boost the outcomes in resource-limited areas.

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