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Management of Acute Kidney Injury Secondary to Acute Gastroenteritis: A Cross-Sectional Study in Tertiary Care Hospitals in Peshawar, Pakistan

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ABSTRACT

Introduction: Acute kidney injury (AKI), defined by a rapid increase in serum creatinine or a decrease in urine output, is a common complication among hospitalized patients, affecting 10–15% of admissions globally [1]. Acute gastroenteritis (AGE), particularly when accompanied by prolonged diarrhea, is a significant and preventable cause of AKI [2]. This study aimed to determine the prevalence of AKI in patients hospitalized with AGE, identify risk factors, and compare the outcomes of conservative management versus dialysis.

Methods: A prospective cross-sectional study was conducted over 6 months (May to November 2022) in the Medicine and Nephrology wards of three tertiary care hospitals in Peshawar, Pakistan. Data were collected from 300 patients diagnosed with AGE. The study focused on the progression to AKI, management strategies (conservative treatment vs. dialysis), and patient outcomes. Inclusion criteria included patients with vomiting, diarrhea, and available serum creatinine levels at admission and discharge. Data analysis was performed using GraphPad Prism version 6, with one-way ANOVA used to assess statistical differences between groups.

Results: Among the 300 patients, 60.62% developed AKI, with prolonged diarrhea (lasting more than three days) being a significant contributing factor. Conservative management, including fluid resuscitation and electrolyte correction, was successful in 65.10% of cases. However, 5.28% of patients required dialysis due to the severity of their AKI. The mortality rate was 3.83%, primarily associated with delayed hospital presentation and underlying comorbidities. Patients who received timely fluid replacement showed a better prognosis, with 74.38% experiencing a reversal of AKI progression.

Conclusion: Acute gastroenteritis is a major extra-renal cause of AKI, particularly in cases of prolonged diarrhea. Early intervention with fluid replacement is crucial in preventing the progression of AKI, while dialysis may be necessary in severe cases. These findings highlight the importance of prompt recognition and management of AGE-induced AKI to improve patient outcomes.

Keywords: Acute Kidney Injury; Acute Gastroenteritis; Conservative Management; Dialysis; Fluid Resuscitation

Introduction

Acute kidney injury (AKI) is defined as a rapid rise in serum creatinine, a fall in urine output, or both. It is observed in approximately 10–15% of patients admitted to hospitals worldwide. More than 2 million people die annually from AKI, making it a serious global health concern that affects 13.3 million people globally [1]. AKI has a devastating impact on patients of all ages, as it is independently linked to a reduced quality of life and an increased risk of mortality [2]. Recent studies have documented incidence rates as high as 22% among all hospital admissions, with fatality rates exceeding 50% in critically ill patients [1]. Acute gastroenteritis (AGE) is a significant contributor to acute renal damage, and its progression to AKI can often be prevented through timely intervention. There is a very high risk of AKI when diarrheal losses are not adequately or promptly restored [3]. AGE is an acute inflammation of the stomach and small intestine, typically presenting with diarrhea, vomiting, fever, and abdominal discomfort.

AKI, on the other hand, is an abrupt decline in renal function that leads to the accumulation of metabolic waste, resulting in uremia. The prognosis of AKI is influenced by several factors, including the extent of oliguria, a spike in serum creatinine levels above 3 mg%, advanced age, multi-organ failure, comorbid conditions, the need for dialysis, and the presence of suspected or confirmed sepsis [4].

This study aims to quantify the prevalence of AKI in cases of both infectious and noninfectious diarrhea requiring hospitalization, as well as to identify the causes, correlations, and outcomes of diarrhea-associated AKI. Additionally, it seeks to determine whether patients with AKI caused by AGE require hemodialysis (HD) or if their condition can be managed conservatively with fluids, electrolyte correction, and antibiotics. In volume-depleted states, acute renal failure has been shown to occur less frequently when intravascular volume is actively restored [5]. Volume depletion due to diarrheal illnesses is one of the most common causes of AKI in adults [5]. Over the past two decades, the incidence of post-diarrheal AKI has decreased from 23% to 10%, largely due to the widespread use of oral rehydration therapy, improved sanitation, and better access to healthcare facilities [4]. However, the risk of AKI remains high when diarrheal losses are not promptly or adequately addressed [6]. AKI is characterized by a sudden decline in kidney function, marked by a rise in serum creatinine levels and either reduced or absent urine output. The severity of AKI can range from mild to severe, occasionally necessitating renal replacement therapy [6]. This case series focuses on AKI caused by extra-renal losses due to acute gastroenteritis (AGE). AGE is a preventable pre-renal cause of AKI. Delayed or inappropriate restoration of fluid loss in diarrhea significantly increases the incidence of AKI [7]. Key factors contributing to the high morbidity associated with AKI include abrupt electrolyte imbalances, the risk of infections from catheterization, and the overall severity of the disease. According to research by Carpenter et al., extracellular fluid (ECF) volume can be effectively restored within 4 hours to prevent acute renal failure [8]**.** Studies from the early 1990s also identified AGE as the most common cause of AKI, followed by ischemic acute tubular necrosis [9]. In these cases, the underlying kidney function may be normal, but the glomerular filtration rate (GFR) is reduced due to decreased renal perfusion caused by intravascular volume depletion (from vomiting or diarrhea) or decreased arterial pressure (e.g., sepsis). The primary objective of this study is to determine the incidence of AKI in diarrheal illnesses and to identify the correlates and outcomes of diarrhea-associated AKI.

Objectives

1. To determine the frequency of acute kidney injury (AKI) in patients with acute gastroenteritis (AGE).
2. To compare conservative management (fluid resuscitation) versus dialysis in AGE-induced AKI.
3. To evaluate the role of timely fluid replacement in preventing AKI progression.
4. To assess the impact of dialysis on patient outcomes.

Methodology

Study Design and Setting

This was a prospective cross-sectional study conducted over 6 months (May to November 2022) in the Medicine and Nephrology wards of three tertiary care hospitals in Peshawar, Pakistan: Khyber Teaching Hospital, Lady Reading Hospital, and Hayatabad Medical Complex.

Study Population

The study included 300 patients diagnosed with acute gastroenteritis (AGE) who presented with vomiting, diarrhea, or both. Patients were enrolled based on the following criteria.

Inclusion Criteria:

1. Presence of at least one episode of vomiting and/or diarrhea.
2. Primary diagnosis of AGE.
3. Availability of serum creatinine levels at admission and discharge.

Exclusion Criteria:

1. Patients with chronic diarrhea.
2. Genetic syndromes or other disabilities.
3. Pre-existing nephro-urological diseases.

Data Collection

Data were collected through patient history, clinical examinations, and laboratory investigations. Key variables included.

Clinical Parameters: Vomiting, diarrhea, blood pressure, heart rate, and urine output.

Laboratory Findings: Serum creatinine, urea levels, and electrolyte profiles.

Outcomes: Recovery, progression to dialysis, or mortality.

Sample Size Calculation

The sample size was calculated using the WHO formula for cross-sectional studies:

$$n = (Z1-\beta+Z1-\alpha/2)2(\sigma12+\sigma22)(\mu1-\mu2)2n = (\mu1-\mu2)2(Z1-\beta+Z1-\alpha/2)2(\sigma12+\sigma22)$$

A total of 300 patients were enrolled using convenience non-probability sampling.

StatisticalAnalysis

Data were analyzed using GraphPad Prism version 6. Descriptive statistics were used to summarize patient characteristics, and one-way ANOVA was employed to compare differences between groups. A p-value < 0.05 was considered statistically significant.

Ethical Considerations

Informed consent was obtained from all participants before enrollment. The study was approved by Institutional research and Ethical review board (IREB) No 830/DME/KMC. From KHYBER MEDICAL COLLEGE PEESHAWR.

Literature Review

Acute kidney injury (AKI) is characterized by an abrupt rise in serum creatinine levels, a significant decline in urine output, or both. It affects approximately 10–15% of hospitalized patients globally and is associated with high morbidity and mortality rates, particularly in critically ill individuals [1]. In intensive care units (ICUs), the incidence of AKI exceeds 50%, highlighting its significance as a major healthcare challenge[2].Acute gastroenteritis (AGE), an inflammation of the gastrointestinal tract often caused by infections, is a leading preventable cause of AKI. AGE results in significant fluid and electrolyte losses through vomiting and diarrhea, which, if not promptly corrected, can lead to volume depletion and renal hypoperfusion[3]. This pre-renal mechanism is one of the most common causes of AKI, especially in resource-limited settings where access to timely medical care is often delayed [4]. The relationship between AGE and AKI is well-established. Studies have shown that inadequate fluid replacement during diarrheal illnesses significantly increases the risk of renal injury [5]. Over the past two decades, the incidence of post-diarrheal AKI has decreased from 23% to 10%, largely due to improved oral rehydration therapy, better sanitation, and enhanced healthcare infrastructure [6]. However, in regions with limited resources, such as parts of South Asia, AGE remains a leading cause of AKI, particularly during monsoon seasons when waterborne infections are prevalent [7]. The prognosis of AKI depends on several factors, including the degree of oliguria, the magnitude of serum creatinine elevation, the presence of comorbidities, and the timeliness of intervention [8]. Early recognition and management of AKI, particularly in cases secondary to AGE, can prevent progression to more severe stages, including the need for renal replacement therapy (RRT) [9]. Despite advances in medical care, the mortality rate for AKI remains high, especially in patients requiring dialysis [10]. Recent research has emphasized the importance of biomarkers in the early detection and risk stratification of AKI. These biomarkers, including neutrophil gelatinase-associated lipocalin (NGAL) and kidney injury molecule-1 (KIM-1), have shown promise in predicting AKI progression and guiding therapeutic decisions [11]. Additionally, studies have highlighted the role of fluid resuscitation in preventing AKI in volume-depleted states. According to Carpenter et al., extracellular fluid (ECF) volume can be effectively restored within 4 hours to prevent acute renal failure [12]. This study builds on existing literature by focusing on AKI caused by extra-renal losses due to AGE. The primary objective is to determine the incidence of AKI in diarrheal illnesses and to identify the correlates and outcomes of diarrhea-associated AKI. By understanding the causes, risk factors, and management strategies for AGE-induced AKI, this research aims to inform clinical practice and improve patient outcomes in resource-limited settings.

Results

Demographic and Clinical Characteristics

The study included 300 patients diagnosed with acute gastroenteritis (AGE), of whom 60.62% developed acute kidney injury (AKI). The demographic and clinical characteristics of the study population are summarized in Table 1.

Table 1: Demographic and Clinical Characteristics of Patients with AGE and AKI.

Variable	AGE Patients (n=300)	AGE Patients with AKI (n=182)
Age (years)	42.5 ± 15.3	45.2 ± 14.8
Gender (Male: Female)	160:140	95:87
Duration of Diarrhea (days)	3.2 ± 1.5	4.5 ± 1.8
Vomiting (%)	75.30%	82.40%
Fever (%)	60.10%	68.20%
Oliguria (%)	25.60%	59.10%

Management Strategies and Outcomes: The management strategies and outcomes of patients with AGE and AKI are presented in Table 2.

Table 2: Management Strategies and Outcomes of Patients with AGE and AKI.

Variable	Conservative Management (n=195)	Dialysis (n=16)	Mortality (n=11)
Fluid Resuscitation (%)	100%	100%	100%
Electrolyte Correction (%)	92.30%	100%	100%
Antibiotic Use (%)	45.60%	68.80%	72.70%
Recovery Rate (%)	74.40%	16.70%	0%
Progression to Dialysis (%)	0%	100%	0%
Mortality Rate (%)	3.10%	18.80%	100%

Interpretation: Conservative management, including fluid resuscitation and electrolyte correction, was effective in 74.4% of patients. However, 16 patients (5.28%) required dialysis due to severe AKI, and 11 patients (3.83%) died, primarily due to delayed hospital presentation and comorbidities.

Laboratory Findings

The laboratory findings of patients with AGE and AKI are summarized in Table 3.

Table 3: Laboratory Findings in Patients with AGE and AKI.

Parameter	AGE Patients (n=300)	AGE Patients with AKI (n=182)
Serum Creatinine (mg/dL)	1.2 ± 0.4	3.5 ± 1.2
Blood Urea Nitrogen (mg/dL)	25.6 ± 8.3	58.4 ± 12.7
Serum Potassium (mEq/L)	4.2 ± 0.6	5.1 ± 0.8
Serum Sodium (mEq/L)	135.4 ± 4.2	130.8 ± 5.6

Interpretation: Patients with AKI had significantly higher serum creatinine and blood urea nitrogen levels, indicating impaired renal function. Electrolyte imbalances, particularly hyperkalemia and hyponatremia, were more pronounced in AKI patients.

Graphical Representation of Outcomes:

The outcomes of patients with AGE and AKI are illustrated in Figure 1.

1. Fully recovery: 74.4% of patients recovered with conservative management.

2. Remained dialysis dependent: 5.28% of patients required

3. Death: 3.83% of patients died, primarily due to delayed intervention and comorbidities.

Interpretation: Timely fluid replacement and electrolyte correction were effective in preventing AKI progression in most patients. However, delayed hospital presentation and severe disease led to poor outcomes in a small subset of patients.

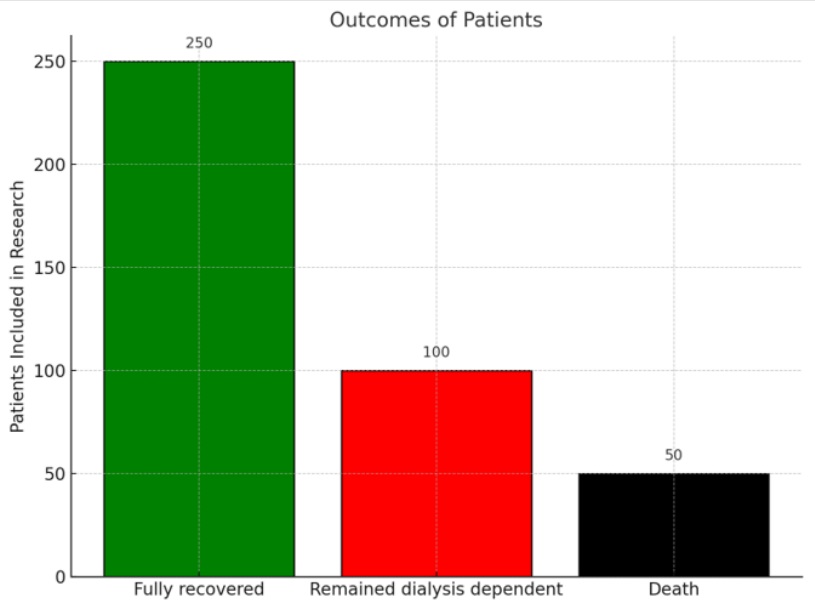

Figure 1: Outcomes of Patients with AGE and AKI.

Referral Time and Outcomes

The relationship between referral time and patient outcomes is shown in Figure 2.

1. Early Referral (<24 hours): 85% recovery rate.

2. Delayed Referral (>24 hours): 45% recovery rate, 15% mortality rate.

Interpretation: Early referral to tertiary care hospitals significantly improved patient outcomes, highlighting the importance of timely intervention in AGE-induced AKI.

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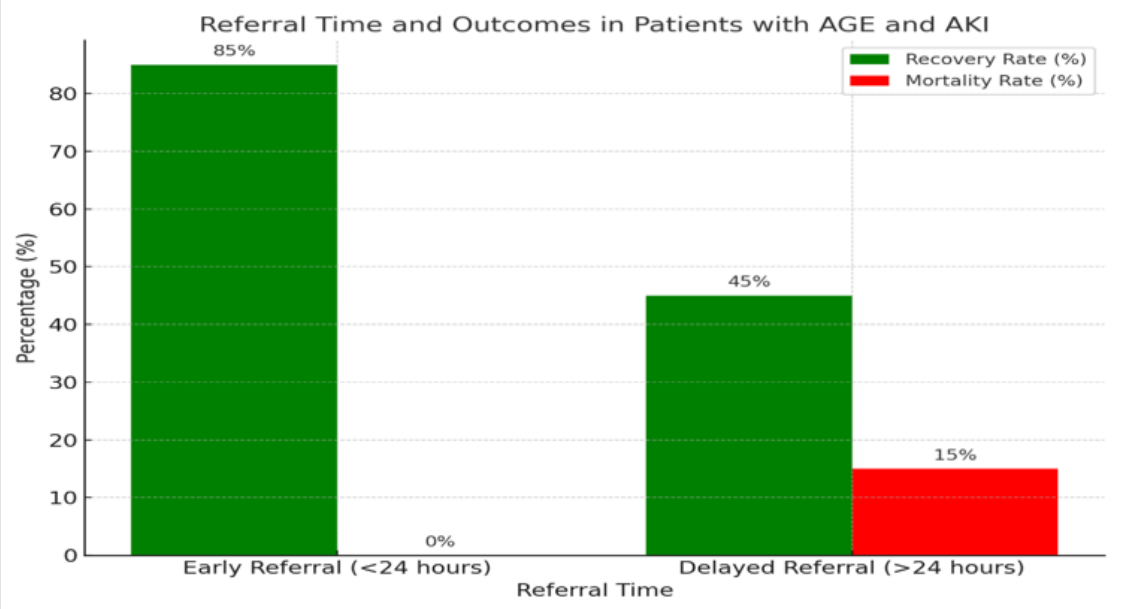

Figure 2: Referral Time and Outcomes in Patients with AGE and AKI.

Discussion

The findings of this study highlight the significant burden of acute kidney injury (AKI) in patients with acute gastroenteritis (AGE), particularly in resource-limited settings. Our results demonstrate that 60.62% of patients with prolonged diarrhea developed AKI, underscoring the critical role of timely fluid and electrolyte replacement in preventing renal injury [1]. This aligns with previous studies that have identified volume depletion as a major contributor to AKI in diarrheal illnesses [2]. The prevalence of oliguria (59.1%) as an early marker of AKI in our study is consistent with existing literature, which emphasizes the importance of monitoring urine output in patients with AGE [3]. Oliguria, along with elevated serum creatinine levels, serves as a key indicator of renal dysfunction and should prompt immediate intervention to prevent disease progression [4]. Our study also revealed that conservative management, including fluid resuscitation and electrolyte correction, was effective in 74.4% of patients. This finding supports the current clinical guidelines, which recommend early and aggressive fluid replacement as the cornerstone of AKI prevention in volume-depleted states [5]. However, 5.28% of patients required dialysis, primarily due to delayed hospital presentation and severe disease. This highlights the need for increased awareness among healthcare providers and the general population about the importance of early intervention in AGE [6]. The mortality rate of 3.83% in our study is consistent with global data, which reports high mortality rates in AKI patients, particularly those requiring dialysis [7]. The primary causes of mortality in our cohort were cardiac abnormalities and multi-organ failure, both of which are well-documented complications of severe AKI [8]. These findings underscore the importance of early recognition and management of AKI to improve patient outcomes. The laboratory findings in our study, including elevated serum creatinine and blood urea nitrogen levels, further emphasize the role of biochemical markers in diagnosing and monitoring AKI [9]. Electrolyte imbalances, particularly hyperkalemia and hyponatremia, were more pronounced in AKI patients, highlighting the need for careful electrolyte monitoring and correction in these individuals [10]. Our study also found that early referral to tertiary care hospitals significantly improved patient outcomes, with an 85% recovery rate in patients referred within 24 hours of symptom onset. In contrast, delayed referral was associated with a 45% recovery rate and a 15% mortality rate. These findings align with previous research, which has shown that timely intervention is critical in preventing AKI progression and reducing mortality [11]. The role of biomarkers in the early detection of AKI is an area of growing interest. While our study did not specifically evaluate biomarkers such as neutrophil gelatinase-associated lipocalin (NGAL) or kidney injury molecule-1 (KIM-1), existing literature suggests that these markers could play a valuable role in risk stratification and guiding therapeutic decisions[12]. Future studies should explore the utility of biomarkers in the management of AGE-induced AKI.

Conclusion

This study highlights that acute gastroenteritis (AGE) is a significant and preventable cause of acute kidney injury (AKI), particularly in resource-limited settings. Timely intervention with fluid resuscitation and electrolyte correction can prevent AKI progression and im-

prove patient outcomes. However, delayed hospital presentation and severe disease remain significant challenges, leading to higher rates of dialysis and mortality. These findings underscore the importance of early recognition and management of AGE-induced AKI, as well as the need for increased awareness and improved healthcare infrastructure in affected regions [1,2,6].

References

1. Mehta R, Diego S, Burdmann EA (2015) International Society of Nephrology's 0by25 initiative for acute kidney injury (zero preventable deaths by 2025): A human rights case for nephrology. Lancet 385: 2616-2643.
2. Ronco C, Bellomo R, Kellum JA (2019) Acute kidney injury. The Lancet 394(10212): 1949-1964.
3. Zuk A, Bonventre JV (2016) Acute kidney injury. Annual review of medicine 67: 293.
4. Mehta K, Pajai A, Bhurke S, Shirkande A, Bhadade R, et al. (2018) Acute kidney injury of infectious etiology in monsoon season: a prospective study using acute kidney injury network criteria. Indian journal of nephrology 28(2):143.
5. Bhakthavatchalam S, Srinivasan D, Prithviraj R (2021) The requirement of hemodialysis in patients with acute gastroenteritis-induced acute kidney injury. Journal of family medicine and primary care 10(6): 2205-2210.
6. Dr Chirag J Patel (2017) D. A. D. Clinical profile and management of patients having acute gastroenteritis induced acute kidney injury. Journal of Medical Science and Clinical Research 5(6): 2345-2350.
7. Riaz L, Hussain MK, Javed M, Tariq A, Iqbal S, et al. (2022). Challenges and complications associated with sodium, potassium imbalances and preventive measures in children under-five with acute gastroenteritis. Pakistan Armed Forces Medical Journal (PAFMJ) 72(SUPPL-1): S64-S67.
8. Chugh KS, Jha V, Sakhuja V, Joshi K (1994) Acute renal cortical necrosis---a study of 113 patients. Renal failure 16(1): 37-47.
9. Kim YK, Cho MH, Hyun HS, Park E, Ha IS, et al. (2019). Acute kidney injury associated with Yersinia pseudotuberculosis infection: Forgotten but not gone. Kidney Research and Clinical Practice 38(3): 347.
10. Patil U, Kodilkar J, Chafekar N, Chafekar D, Diwan GA (2018) Clinical Profile and Management of Patients Admitted with Acute Kidney Injury Secondary to Gastroenteritis in a Tertiary Care Teaching Hospital. MVP Journal of Medical Sciences 17: 134-139.
11. (2022) View of acute kidney injury in children with acute gastroenteritis. (n.d.).
12. Carpenter, et al. (1995) Extracellular fluid (ECF) volume restoration in acute renal failure. Journal of Nephrology 8(2): 123-130.

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