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FREQUENCY OF ACUTE KIDNEY INJURY AMONG PATIENTS PRESENTING WITH ACUTE GASTROENTERITIS AT DHQ TEACHING HOSPITAL BANNU

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Abstract

OBJECTIVE: To find out the prevalence of acute kidney injury in patients admitted for acute gastroenteritis in DHQ teaching hospital Bannu. STUDY TYPE: Descriptive cross sectional study. PLACE OF STUDY & DURATION: DHQ Teaching Hospital Bannu & six months from 2 December 2024 to 2 June 2025. METHODOLOGY: A total of 126 patients of both sex aged 18-70 years with history of acute gastroenteritis were studied. Acute gastroenteritis was defined as diarrhoea (with or without vomiting) that started within 7 days or less. Diarrhoea was considered to be having 3 or more loose or watery stools in 24 hours or having an increased frequency of stools from their usual. Laboratory investigations were then undertaken to determine renal function and serum electrolyte levels to assess their suitability. The data collected were analysed with the aid of the Statistical Package for the Social Sciences (SPSS). RESULTS: Mean age of the participants was 51.87 ± 7.714 years. Of the 126 patients, 73 (57.9%) were female and 53 (42.1%) were male. 74 (58.7%) patients reported having a BMI greater than 27 kg/m^2. 54 (42.9%) had hypertension, 77 (61.1%) had diabetes mellitus and 39 (31%) had cardiovascular disease. 79 patients (62.7%) had symptoms for 7 days or less. Acute kidney injury (AKI) occurred in 34 patients (27%). CONCLUSION: Acute kidney injury was found in 27% of patients who presented with acute gastroenteritis to DHQ Teaching Hospital, Bannu.

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INTRODUCTION

Acute gastroenteritis is a very common gastrointestinal illness that presents with sudden onset of diarrhoea, vomiting and abdominal pain, and is often caused by an infection with an organism such as a virus, bacteria or a parasite that can be picked up from contaminated food or water.

The impact of acute gastroenteritis is significantly higher in developing countries where the availability of potable water could be restricted, sanitary facilities may be poor and health services are not easily accessible. All these environmental and healthcare risk factors, along with the high proportion of malnutrition and compromised immunity among children and older people, lead to a significant morbidity and mortality due to gastroenteritis.[3,4] The impact in areas with poor infrastructure to manage and prevent disease outbreaks is particularly high.[5]

Acute gastroenteritis can lead to a number of complications including electrolyte imbalance and dehydration. Acute kidney injury is generally characterised by a rapid deterioration in renal function. It can be recognized by elevated levels of serum markers of kidney injury (serum creatinine) or decreased urine output, or both, as per the Kidney Disease: Improving Global Outcomes criteria.[6,7]

Severe gastroenteritis often results in dehydration and hypovolaemia, which can lead to decrease in renal perfusion, increased stress on the kidney and ultimately to acute kidney injury. If not treated, acute kidney injury can lead to chronic kidney disease or to multiorgan failure. These complications are especially worrisome in people who are prone to them, including children, the elderly, and those with already compromised renal health.[6,8]

The prevalence of AKI in patients with AGE has been assessed in several studies. The results reported, however, have varied depending on the characteristics of the study population and the health care context. In high resource areas, the prevalence of acute kidney injury has been reported to be lower in comparison. For instance, one study recognized that 13.6% of individuals with gastroenteritis developed acute kidney injury. This lower prevalence could be due to the availability of timely health care services and easy access to rehydration treatment.[6]

Conversely, stool samples obtained in resource-limited settings (especially from developing countries) have shown greater prevalence of gastroenteritis-associated acute kidney injury. Acute kidney injury rates reported in studies of acute gastroenteritis were 54% in one study,[9] and 25% in another. The higher frequencies have often been associated with the delay in seeking health care as well as the lack of access to suitable health care facilities.

This differences in prevalence rates highlights the need to gather prevalence data specific to the context. Accessibility of health services, effectiveness of public health measures, and environmental conditions experienced by a specific population could impact the burden and outcomes of A.K.I associated with gastroenteritis.

Poor sanitation, limited access to safe drinking water and to health care services, are responsible for the high prevalence of acute gastroenteritis in the local region. These conditions also put the population at risk of developing acute kidney injury. Acute kidney injury is potentially fatal, irreversible and may be associated with gastroenteritis, so it is important to have an understanding of the prevalence of this in your area. Thus, the present study was designed to cover the knowledge gap on frequency of acute kidney injury in the patients complaining of acute gastroenteritis in DHQ Teaching hospital-Bannu.

The results will be used to gain general baseline data that could inform preventive and management measures. Finally, it is hoped that these would help to minimize one of the complications of acute gastroenteritis (AKI) in the local community as this is the first study of this type to have been undertaken in the area.

OBJECTIVE

The objective of the study was to find out the frequency of critical kidney injury in the patients coming DHQ Teaching Hospital, Bannu with acute gastroenteritis symptoms.

METHODOLOGY

The sample size was determined by World Health Organization's sample size calculator version 1.1. This was calculated based on an assumption that 13.6% of patients with acute gastroenteritis have acute kidney injury,[6] 95% confidence level and a margin of error of 6%. Based on these parameters, a calculated sample size of 126 patients was used.

Eligible patients were those aged 18-70 years with acute gastroenteritis of either sex. Patients with chronic diarrhoea (7 days or more) or patients with known chronic gastrointestinal disorders (inflammatory bowel disease or irritable bowel syndrome) were excluded.

Also, patients with any other chronic kidney disease or previous kidney disease that may have independently raised the risk for acute kidney failure were excluded. Pregnant women were excluded due to variation in physiological responses and risk factors for kidney injury in pregnancy. The Hospital Ethical Review Committee approved this study. The patients satisfying the inclusion criteria were selected from emergency and medicine departments of DHQ Teaching Hospital, Bannu.

Acute gastroenteritis was considered to be the abrupt onset of diarrhoea (with or without vomiting), for less than 7 days. Where a patient had three or more loose and watery stools in the last 24 hours or had an increase in the number of stools compared with their normal, diarrhoea was deemed 'present'. All patients or their legal representative gave informed written consent prior to participation. The study purpose, procedures, and confidentiality was explained prior to obtaining consent.

A detailed clinical history was taken, including the duration and type of symptoms including diarrhoea, vomiting, abdominal pain and fever. Data on risk factors were also obtained such as hypertension, diabetes mellitus and cardiovascular disease. All participants had a full physical examination. Appropriate laboratory tests were done to evaluate kidney function and electrolyte status. In the hospital laboratory serum creatinine, blood urea nitrogen, serum sodium and potassium were measured.

The definition of acute kidney injury was a rise in serum creatinine of $\geqslant$ 0.3 mg/dL within 48 hours or a decrease in urine output to < 0.5 mL/kg/hour for at least six consecutive hours. Demographic and anthropometric data were also obtained such as age, sex, place of residence, socioeconomic status, height, weight and body mass index of participants. The information collected was only made available to research staff in receipt of official permission to take part in the study.

The results were analysed and processed using the SPSS software (version 25.0). Continuous variables were reported as mean and standard deviation values, if they were

normally distributed, such as age, height, weight, body mass index and any laboratory measurements.

To check the normality of the quantitative data the Shapiro–Wilk test was used. Data for variables that did not follow a normal distribution (such as symptom duration, serum creatinine, blood urea nitrogen, and serum electrolyte concentrations) were presented as median values (and interquartile ranges). Data on categorical variables (sex, residential area, socioeconomic status, clinical manifestations, pre-existing medical conditions, including diabetes mellitus, hypertension, and cardiovascular disease, and acute kidney injury) were presented as frequencies and percentages.

Acute kidney injury severity was categorized by age, sex, geographical location, comorbidities, socioeconomic status, and the length of time that symptoms had been present. The association between the stratified variables and the severity of acute kidney injury was evaluated by chi-square test or Fisher's exact test, as appropriate. A 5% level of statistical significance was used and a p value of less than 0.05 was considered statistically significant. The results were presented in tables and figures.

RESULTS

Overall, 126 patients took part in the study. Most participants, 83 (65.9%), were between 46 and 70 years of age, while 43 (34.1%) were between 18 and 45 years. The average age of the study population was 51.87 ± 7.714 years.

Of the total participants, 73 (57.9%) were female and 53 (42.1%) were male. In terms of place of residence, 68 (54%) patients came from rural areas and 58 (46%) from urban areas. Socialally and economically, 77 (61.1%) participants were considered as poor, 35 (27.8%) as middle-class and 14 (11.1%) as rich as shown in Table 1. In 74 patients (58.7%), the BMI was over 27 kg/m^2. One-fifth (54, 42.9%) of the participants had hypertension, 77 (61.1%) had diabetes mellitus, and 39 (31%) had cardiovascular disease. As seen in Table 2, 79 (62.7%) of the patients had symptoms for 7 days or less.

Mean serum creatine level was 1.0 ± 0.18 mg/dl and the mean blood urea nitrogen was 13.17 ± 3.653 mg/dl. Table 3 shows that the mean serum sodium level was 139.48 ± 2.960 mg/dl while the mean serum potassium level was 4.05 ± 0.631 mg/dl. The frequency of acute kidney injury was 27% (34 patients).

No significant differences were found in relation to age, place of residence, socioeconomic status or body mass index with the corresponding p-values being >0.05. Statistically significant differences were seen with respect to sex, hypertension, diabetes mellitus, cardiovascular disease and duration of symptoms with the p values being less than 0.05 as shown in Tables 4 and 5.

Table No 1: *Age Distribution*

(n=126)

AGE	FREQUENCY	PERCENTAGE
18-45 years	43	34.1%
46-70 years	83	65.9%
Total	126	100%
GENDER	FREQUENCY	PERCENTAGE
Male	53	42.1%
Female	73	57.9%
Total	126	100%
RESIDENCE	FREQUENCY	PERCENTAGE
Rural	68	54%
Urban	58	46%
Total	126	100%
SES		
Poor	77	61.1%
Middle Class	35	27.8%
Rich	14	11.1%
Total	126	100%

Table No 2: *Co-Morbid Conditions*

(n=126)

CO-MORBID CONDITIONS	FREQUENCY	PERCENTAGE
BMI		
⩽ 27 Kg/m^2	74	58.7%
> 27 Kg/m^2	52	41.3%
Total	126	100%

Hypertension		
Hypertensive	54	42.9%
Non Hypertensive	72	57.1%
Total	**126**	**100%**
Diabetes		
Diabetic	77	61.1%
Non Diabetic	49	38.9%
Total	**126**	**100%**
Cardiovascular Disease		
Yes	39	31%
No	87	69%
Total	**126**	**100%**
Duration of symptoms		
⩽ 7 days	79	62.7%
> 7 days	47	37.3%
Total	**126**	**100%**

Table No 3: *Clinical Findings* (n=126)

CLINICAL FINDINGS	Mean and Standard deviation	Range
Serum Creatinine	1.0 ± 0.18 mg/dL	0.7 to 1.3 mg/dL
Blood Urea Nitrogen (BUN)	13.17 ± 3.653 mg/dL	7 to 20 mg/dL.
Serum Electrolytes		
Sodium (Na)	139.48 ± 2.960 mg/dL	135 to 145 mmol/L
Potassium (K)	4.05 ± 0.631 mg/dL	3.5 to 5.0 mmol/L

Table No 4: *Frequency of Acute Kidney Injury* (n=126)

ACUTE KIDNEY INJURY	Yes	No	Total
FREQUENCY	34	92	**126**
PERCENTAGE	27%	73%	**100%**

Table No 5. *Stratification Of Acute Kidney Injury With Respect To Co-Morbid Conditions* (n=126)

AGE	ACUTE KIDNEY INJURY		Total	* P Value
	Yes	No		
18-45 years	9(26.5%)	34(37.0%)	**43**	
46-70 years	25(73.5%)	58(63.0%)	**83**	0.270
Total	**34(100%)**	**92(100%)**	**126**	
GENDER				
Male	9(26.5%)	44(47.8%)	**53**	
Female	25(73.5%)	48(52.2%)	**73**	0.031
Total	**34(100%)**	**92(100%)**	**126**	
RESIDENCE				
Rural	18(52.9%)	50(54.3%)	**68**	
Urban	16(47.1%)	42(45.7%)	**58**	0.888
Total	**34(100%)**	**92(100%)**	**126**	
SES				
Poor	17(50%)	60(65.2%)	**77**	
Middle Class	10(29.4%)	25(27.2%)	**35**	0.093
Rich	7(20.6%)	7(7.6%)	**14**	
Total	**34(100%)**	**92(100%)**	**126**	
BMI				
⩽ 27 Kg/m^2	22(64.7%)	52(56.5%)	**74**	
> 27 Kg/m^2	12(35.3%)	40(43.5%)	**52**	0.408
Total	**34(100%)**	**92(100%)**	**126**	
Hypertension				
Hypertensive	34(100%)	20(21.7%)	**54**	
Non Hypertensive	0(00%)	72(78.3%)	**72**	< 0.0001
Total	**34(00%)**	**92(100%)**	**126**	

Diabetes				
Diabetic	34(100%)	43(46.7%)	**77**	< 0.0001
Non Diabetic	0(00%)	49(53.3%)	**49**	
Total	**34(100%)**	**92(100%)**	**126**	
Cardiovascular Disease				
Yes	31(91.2%)	8(8.7%)	**39**	< 0.0001
No	3(8.8%)	84(91.3%)	**87**	
Total	**34(100%)**	**92(100%)**	**126**	
Duration of symptoms				
< 7 days	5(14.7%)	74(80.4%)	**79**	< 0.0001
> 7 days	29(85.3%)	18(9.6%)	**47**	
Total	**34(100%)**	**92(100%)**	**126**	

***** Chi square test was applied

DISCUSSION

The incidence of acute gastroenteritis in the United States is around 179 million cases per year, and results in nearly 600,000 hospitalizations and around 5,000 deaths per year.[12] Acute gastroenteritis was seen more often in patients of the age group 46-70 years with 65.9% of the study population. Of the total participants, 73 (57.9%) were female and 53 (42.1%) were male.

As regards residential background, 68 (54%) patients came from rural areas and 58 (46%) patients came from urban areas. According to the socioeconomic categorisation, 77 (61.1%) patients were in the poor group, 35 (27.8%) in the middle group and 14 (11.1%) in the rich group. 74 (58.7%) patients reported having a BMI > 27 kg/m^2. 54 (42.9%) patients had hypertension, 77 (61.1%) had diabetes mellitus and 39 (31%) had cardiovascular disease. The symptoms had been present for seven days or less in 79 (62.7%) of participants. Thirty-four patients were found to have acute kidney injury, accounting for 27% of the study population.

Similar results were published by Jamal N et al, who gave the mean age of their participants as 38 ± 14 years. They have studied a total of 140 cases which include 60 females and 80 males. Forty-seven of the patients had hypertension, 19 had diabetes

mellitus, and 16 had cardiac disease. Regarding urinary output in the study by Jamal N et al.,[13] 13 (9.3%) patients produced less than 100 ml of urine per day, 46 (32.9%) produced between 100 and 400 ml per day, 37 (26.4%) produced between 400 and 1,200 ml per day, and 44 (31.4%) produced more than 1,200 ml per day. Thirty-five patients (25%) had serum creatinine levels over 2.8 mg/dl. 18 patients were in the range of 1.5< creatinine < 2.8, which is two times the normal range and 87 were in the range of 0.7< serum creatinine < 1.4, which is within the normal range. The definition of shock was used in 41 (29.3%) patients (systolic blood pressure below 90 mmHg). The total number of patients were 96 (68.6%) normotensive and three (2.1%) hypertensive.

According to Marzuillo et al.[14], acute kidney injury occurred in 24.6% of the paediatric patients in their study. They found the same children and adult patients who are admitted with acute gastroenteritis can be at risk of having acute kidney injury as well. Mostafi et al.15 found prevalence of critical kidney injury to be 23.8%. The frequency of 20% reported by Arshad et al. 16 was lesser as compared to the present study.

In one study, 41 patients (out of 300) with acute gastroenteritis were found to have acute kidney injury (13.6%).[27] They also discovered that patients aged > 60 were more likely to have acute kidney injury. Salmonella species were determined to be the root cause of severe gastroenteritis. The lowest rate of critical kidney injury was seen in patients with acute gastroenteritis (53.3%), and the highest rate in patients with acute gastroenteritis due to Clostridium difficile (51.2%).

In that study the most frequently reported associated disease was malignancy, mainly leukaemia and lymphoma. Mild dehydration, increased serum urea and decreased glomerular filtration rate were each independently connected with the risk of severe kidney injury. In another study, Imani PD et al.[18] assessed 422 people and discovered that 169 people (40%) experienced acute kidney injury. A separate study found that 82% of children developed acute kidney injury.

It was suggested by Moghtaderi M et al.[19] that the discrepancies among current and previous studies might be attributed to the developing countries' populations. Poor access to health care in these populations may influence the severity of dehydration and risk of acute kidney injury. Important mechanisms by which acute gastroenteritis can

worsen to acute kidney injury are severe dehydration, electrolyte disturbances and hypovolaemia. Appropriate criteria for early identification include KDIGO classification (increased serum creatinine and decreased urine output), for effective management.

The first step in treatment is rapid replacement of fluids with isotonic crystalloid solution such as normal saline or lactated Ringer's solution. Patients presenting with hypovolaemic shock may require fluid boluses. Treatment should be given with care, monitoring fluid balance, serum electrolytes and renal function closely to avoid further deterioration of renal function. NSAIDs and some antibiotics can be harmful for the kidneys and should be avoided in patients who may be at risk for acute kidney injury.

One of the renal replacement therapies may be required in severe cases with refractory hyperkalaemia, fluid overload or metabolic acidosis. It is important for these patients to have long-term follow-up to evaluate the potential progression of acute kidney failure to chronic kidney disease as well. Additional studies are needed to establish the best approaches to fluid management, to find the earliest clinical or laboratory markers of acute kidney injury associated with acute gastroenteritis, and to assess the long-term renal consequences of acute gastroenteritis-associated kidney injury. This evidence could help guide clinical decisions and care of patients.

There were several limitations that were present in the present study. It was a retrospective study and was not included actual baseline serum creatinine at the time of hospitalisation. It was also performed at one centre, and involved a relatively small number of patients. The post hoc statistical power of the analysis was deemed acceptable, given the sample size, but the lack of ability to use the KDIGO urine-output criterion was an additional limitation. This may have led to the underestimation of the prevalence of AKI.

CONCLUSION

This study reveals that the incidence of acute kidney injury among the patients of acute gastroenteritis at DHQ Teaching Hospital, Bannu is 27%. Overall, the results highlight the importance of careful clinical management of acute gastroenteritis patients since the illness could escalate and cause an acute kidney injury. These relationships need further investigation, especially between rural and lower income population groups, to better understand their underlying causes and long term implications.

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