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Clinical Profile, Laboratory Parameters And Outcome Of Acute Kidney Injury Patients Following Acute Gastroenteritis - A Retrospective Observational Study

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ABSTRACT

Background: *Nitrogenous substances and other waste products that the kidneys typically remove are retained as a result of a rapid reduction in kidney function that is known as acute kidney injury (AKI), formerly known as acute renal failure. Through hypoperfusion processes, acute gastroenteritis (AGE) can result in acute kidney damage (AKI). Mortality rates can be considerably reduced by detecting AGE-induced AKI early. Finding the correlation between the clinical profile, laboratory results, and prognostic outcome of AKI prevention through prompt and effective extracellular fluid restoration is the aim of this retrospective investigation.*

Materials and Methods: *There were sixty people in the study, which was a retrospective observational study. Data was collected using a semi-structured questionnaire that had been pre-tested and validated. Demographic data was also gathered, along with the patient's age and sex, other concomitant disorders, clinical examination, duration of hospitalization, cause of diarrhea, hemodialysis status, and laboratory results (serum creatinine, serum blood urea nitrogen [BUN], serum potassium, and serum sodium). In particular; on the first, third, and seventh days following admission, laboratory tests were acquired. The WHO scale's clinical signs and symptoms of dehydration are also used to classify patients.*

Results: *Most patients were aged 51–60, predominantly male (38) and from rural areas (65%). All had loose stools; only 6.6% showed jaundice. Obese Class I was common (33.3%), while just 10% had normal BMI. Hyponatremia (26.66%) and hypertension were key concerns, with severe dehydration in 16.6%. Significant associations were found between urine output and treatment (p=0.001), and age group and treatment (p=0.005), indicating better survival with adequate urine output.*

Conclusion: *Acute kidney injury (AKI) often follows gastroenteritis in developing nations but has a good prognosis with early detection. For preventive and prompt response, it is essential to improve clinical awareness, public education, and hygienic behaviors.*

Key words: *Acute Kidney Injury, acute gastroenteritis, extracellular fluid restoration*

INTRODUCTION

As stated by WHO Diarrhea caused by infections is prevalent in developing countries; approximately 780 million people worldwide lack access to safe drinking water, and 2.5 billion people lack proper sanitation.[1] A clinical diagnosis of Acute gastroenteritis (AGE) is usually made based on the clinical history, physical examination, and evaluation of risk factors. The diagnosis can be supported by the results of a basic metabolic panel, stool analysis and culture, serum electrolyte levels, and complete blood count (CBC).[2] Acute gastroenteritis can cause acute kidney injury (AKI) through hypoperfusion mechanisms. Early detection of AGE-induced AKI can significantly lower mortality rates.[3]

Acute Kidney Injury (AKI), formerly known as acute renal failure, is characterized by a fast decline in kidney function that results in the retention of nitrogenous chemicals and other waste products that the kidneys normally eliminate.[4] Any of the following is considered AKI. A 48-hour increase in Sr. creatinine of 0.3 mg/dl (≥26.5μmol/l) or a 1.5-fold increase in Sr. creatinine that is known or assumed to have happened in the previous seven days For six hours, urine volume < 0.5 ml/kg/h.[5] The damage may cause mild to severe renal failure, and in certain cases, renal replacement treatment may be required.[6]

Educating people about potential kidney issues and how to treat them is the single most economical approach. The current study helps estimate the burden of illness in the city to help fight it in the future. Few researches have looked at AKI caused by AGE that becomes pandemic during the monsoon season. The purpose of this

retrospective study is to determine the relationship between the clinical profile, laboratory data, and prognosis result of AKI prevention through quick and efficient extracellular fluid restoration.

MATERIALS AND METHODS

The study was carried out in a tertiary care hospital in Puducherry after receiving approval from the Institutional Human Ethical Committee and the Scientific Research Committee (Ref no: 46/SVMCH/IEC-Cert/May.25). The Purposive sampling technique was used to choose study participants who met the inclusion criteria. The study's sample size was 60 (based on retrospective data gathered from January 1, 2024, to February 15, 2025). The Medical Records Department (MRD) provided the case papers following the submission of the permission waiver.

A validated and pre-tested semi-structured questionnaire was used to gather data for the study in retrospect. Along with the patient's age and sex, other comorbid conditions, clinical examination, length of hospital stay, diarrheal cause, hemodialysis status, and laboratory results (serum creatinine, serum blood urea nitrogen [BUN], serum potassium, and serum sodium), demographic information was also collected. Specifically, laboratory tests were obtained on the first, third, and seventh days after admission. Additionally, patients are categorized using the WHO scale's clinical signs and symptoms of dehydration. The patient's BMI was determined using the WHO classification. The data collected were entered in Microsoft Excel 2019 and the results were analyzed using SPSS software version 23.0. Quantitative data was expressed in Mean, Range, Frequency and Distribution. Independent 't' test was used to find association and p value <0.05 was considered as significant. Pie charts and Bar diagrams were used to represent the data pictographically.

RESULTS

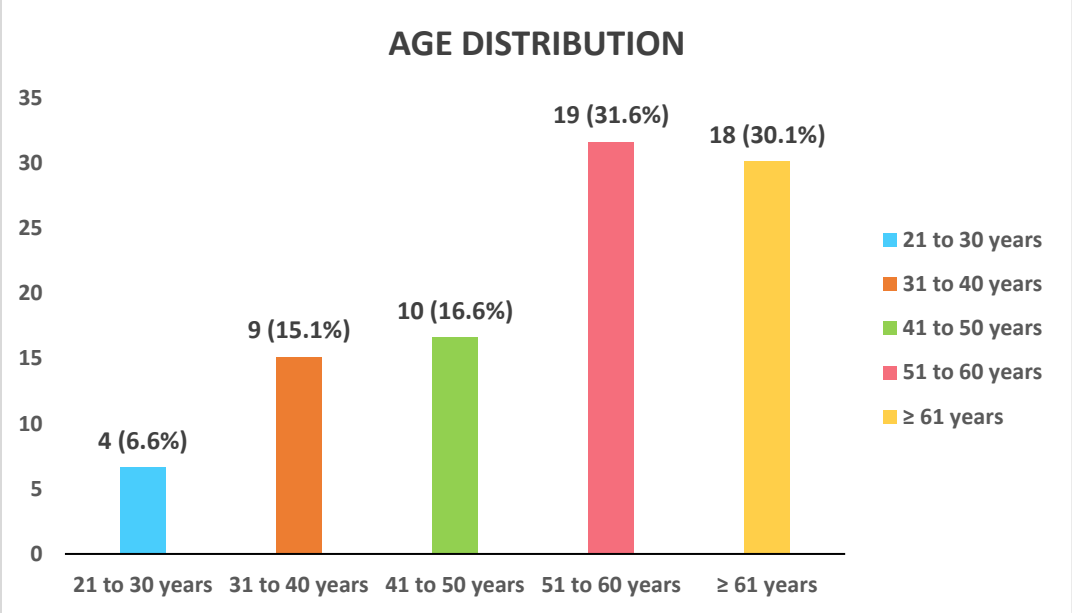

Figure 1: Frequency Distribution of Age among the Participants (n=60)Figure 1 depicts the frequency distribution of age among the participants. It shows that about 19 (31.6%) were in the 51-60 years of age group followed by 18 (30.1%) aged ≥61 years. About 10 (16.6%) were between 41-50 years, 9 (15.1%) between 31 to 40 years and 4 (6.6%) were in 21-30 years age group.

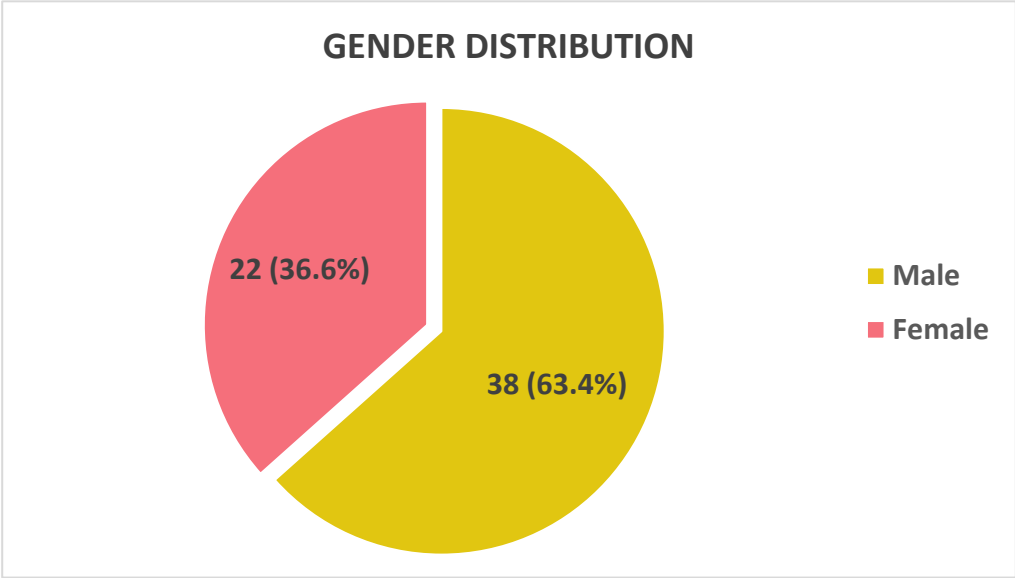

Figure 2: Frequency Distribution of Gender among the Participants (n=60)

Figure 2 presents a pie chart illustrating the gender distribution among the participants. The majority were male, comprising 38 individuals (63.4%), while the remaining 22 participants (36.6%) were female.

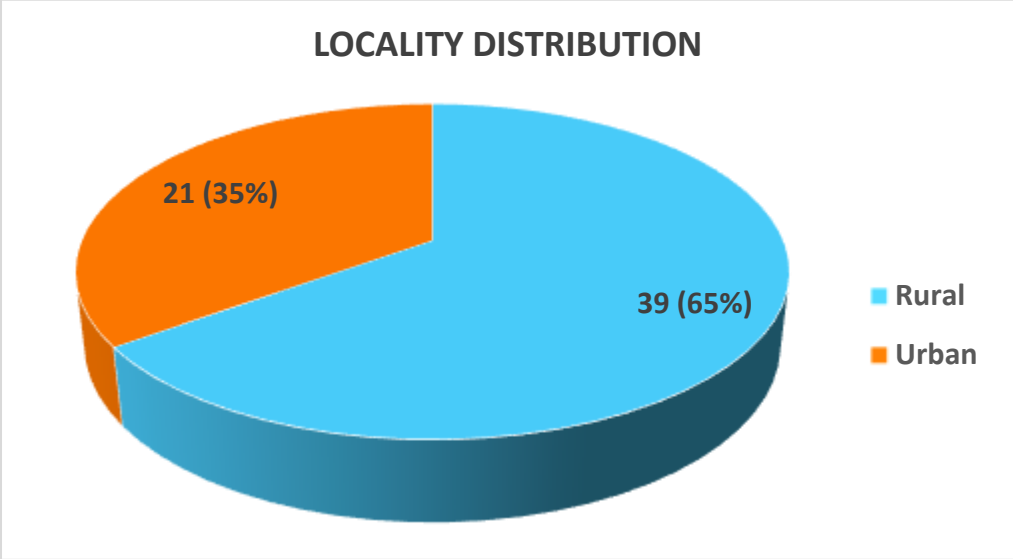

Figure 3: Frequency Distribution of Locality among the Participants (n=60)

Figure 3 illustrates the locality distribution of participants in the form of a pie chart. Majority of participants 39 (65%) were from rural area and 21 (35%) were from urban area.

Table 1: Frequency Distribution of Clinical features among the Participants (n=60)

Clinical features	Status	Frequency	Percentage (%)
Loose stools	Present	60	100%
	Absent	-	-
Vomiting	Present	25	41.60%
	Absent	35	58.40%
Fever	Present	37	61.70%
	Absent	23	38.30%
Fatigue	Present	47	78.30%
	Absent	13	21.70%

Decreased Micturition	Present	31	51.60%
	Absent	29	48.40%
Jaundice	Present	4	6.60%
	Absent	56	93.40%
Edema	Present	9	15.00%
	Absent	51	85.00%
Shortness of Breath	Present	14	23.30%
	Absent	46	76.70%
Altered sensorium	Present	11	18.30%
	Absent	49	81.70%

The distribution of clinical characteristics among the patients is shown in Table 1. The presenting symptom of loose stools was present in 60 (100%) of the participants. When they presented, about 25 (41.60%) reported vomiting symptoms. Of the majority, 37 (61.70%) developed a fever, and 47 (78.30%) were irritable. Thirty-one (51.60%) had reduced micturition. Just four (6.60%) had jaundice, nine (15%) had edema, fourteen (23.30%) had dyspnea, and eleven (18.30%) had altered sensorium.

Figure 4: Frequency Distribution of Blood pressure among the Participants (n=60)

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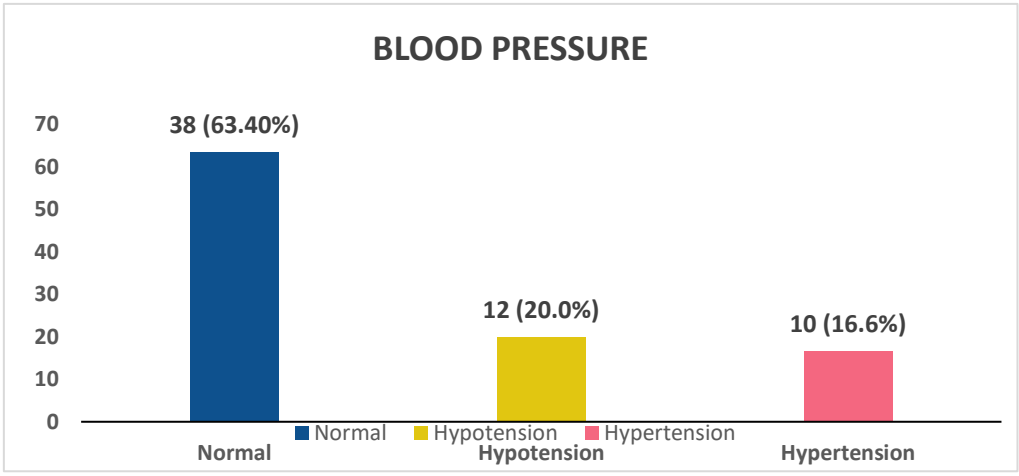

Figure 4 shows the frequency distribution of Blood pressure among the participants. Majority of participants 38 (63.40%) had Normal Blood pressure, while 12 (20.0%) were classified as Hypotension and 10 (16.6%) were diagnosed with Hypertension.

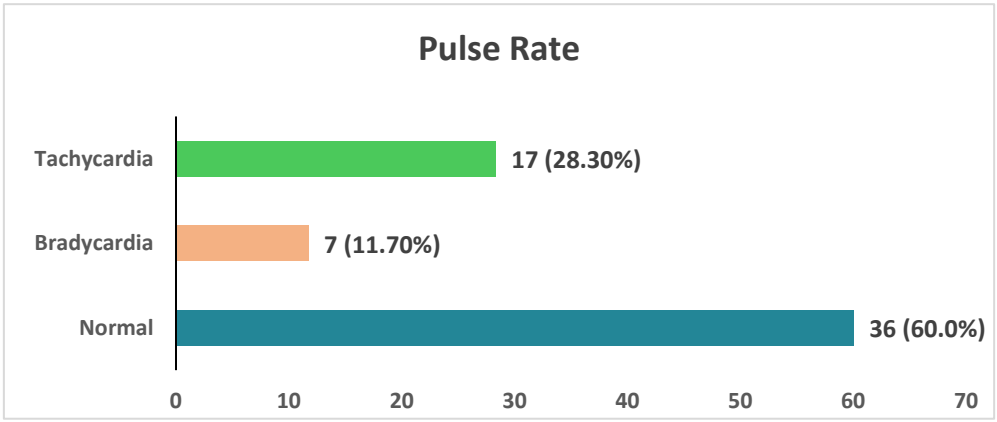

Figure 5: Frequency Distribution of Pulse Rate among the Participants (n=60)

Figure 5 shows the frequency distribution of Pulse Rate among the participants. Majority of participants 36 (60.0%) had Normal Pulse Rate; 17 (28.30%) had Tachycardia and 7 (11.70%) had Bradycardia.

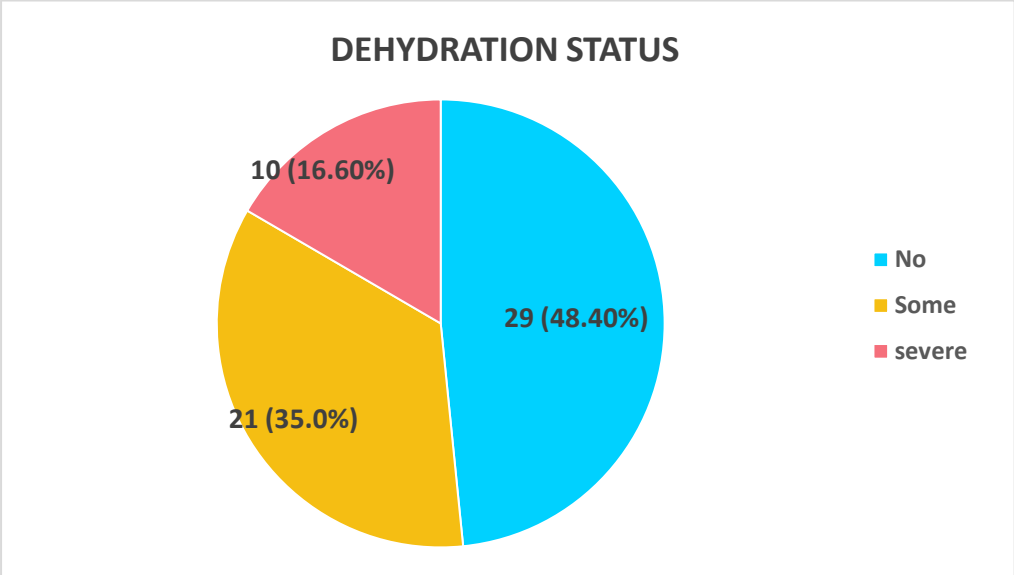

Figure 6: Frequency Distribution of dehydration status among the Participants (n=60)

The frequency distribution of participants' dehydration condition is shown in Figure 6. The majority of participants—29, or 48.40 percent—were categorized as not dehydrated. Ten (16.60%) were found to have severe dehydration, whereas 21 (35.0%) had some dehydration.

Table 2: Frequency Distribution of Management among the Participants

Management	Status	Frequency	Percentage (%)
Type of admission (n = 60)	ICU	27	45.10%
	Ward	33	54.90%
Mode of Treatment (n = 60)	Conservative	44	73.40%
	Hemodialysis	16	26.60%
Outcome (n = 60)	Survived	50	83.30%
	Died	10	16.70%
Discharge (n = 50)	< 1 week	28	56.0%
	1 to 3 weeks	17	34.0%
	> 3 weeks	5	10.0%

The frequency distribution of management among the participants is shown in Table 2; 33 (54.90%) of the participants were admitted to the ward, while 27 (45.10%) were admitted to the intensive care unit. In terms of treatment mode, the majority—44, or 73.40 percent—had conservative care, while 16 people, or 26.60 percent, received hemodialysis. Of the 60 participants, 10 (16.705) died and 50 (83.30%) survived. Of the 50 survivors, 28 (56.0%) were released within 1 week, 17 (34.0%) during 1 to 3 weeks, and 5 (10.0%) within > 3 weeks.

Table 3: Frequency Distribution of Complications among the Participants (n=60)

Complications	Frequency	Percentage (%)
Hyponatremia	16	26.66%
Hyperkalemia	14	23.30%
Hypokalemia	13	21.67%
Sepsis	11	18.34%
Pulmonary edema	8	13.30%
Bleeding Diathesis	7	11.66%

Encephalopathy	3	5.0%

Table 3 presents the frequency distribution of complications observed among the participants. Hyponatremia was the most common, affecting 16 participants (26.66%), followed by Hyperkalemia in 14 (23.30%), Hypokalemia in 13 (21.67%), and Sepsis in 11 (18.34%). Pulmonary edema was noted in 8 participants (13.30%), Bleeding diathesis in 7 (11.66%) and Encephalopathy in 3 (5.0%).

Table 4: Association between Urine output and Peak Urea value with Patient's outcome (n = 60)

Variables		Patient's outcome		P – Value (Ficher's exact)*
		Died	Survived	
Urine Output	Adequate	3	39	**0.005** (9.143)
	Inadequate	7	11	
S. Urea (Peak) > 100 mg/dl	Present	10	5	**0.045** (4.000)
	Absent	40	5	

*Fischer's exact test

Table 4 shows the association between Urine output and Peak urea value with Patient's outcome. It was found that there is association between Urine output and Patient's outcome with p-value of 0.005 (p-value < 0.05) which is statistically significant. Also association was noted between S. urea (peak) with Patient's outcome with p-value of 0.045 (p-value < 0.05) which is statistically significant.

Table 5: Association between Patient's outcome and Type of admission (n = 60)

Patient's outcome	Type of admission		P – Value (Ficher's exact)*
	ICU	Ward	
Died	9	1	**0.003** (9.818)
Survived	18	32	

*Fischer's exact test

Table 5 shows the association between Patient's outcome and Type of admission. It was found that there is association between Patient's outcome and Type of admission with p-value of 0.003 (p-value < 0.05) which is statistically significant.

Table 6: Association between Comorbidities and Urine output with Mode of treatment (n = 60)

Variables		Mode of treatment		P – Value (Chi square)*
		Conservative	Hemodialysis	
Comorbidities	Present	28	6	0.071 (3.264)
	Absent	16	10	
Urine output	Adequate	37	5	**0.001** (15.601)
	Inadequate	7	11	

*Chi square test

Table 6 shows the association between Comorbidities and Urine output with Mode of treatment. It was found that there is no association between Comorbidities and Mode of treatment with p-value of 0.071 which is not statistically significant (p-value < 0.05 is statistically significant), whereas association was found between Urine output and Mode of treatment with p-value 0.001 which is statistically significant.

Table 7: Association between Type of admission and Comorbidities (n = 60)

Type of admission	Comorbidities		P – Value (Chi square)*
	Present	Absent	
ICU	13	14	0.228 (1.451)
Ward	21	12	

*Chi square test

Table 7 shows the association between Type of admission and Comorbidities. It was found that there is no association between Type of admission and Comorbidities with p-value of 0.228 which is not statistically significant (p-value < 0.05 is statistically significant)

Table 8: Association between Age group and Mode of treatment (n = 60)

Age group	Mode of treatment		P – Value (Ficher's exact)*
	Conservative	Hemodialysis	
21 to 30 years	0	4	0.005 (13.340)
31 to 40 years	7	2	
41 to 50 years	9	1	
51 to 60 years	12	7	
≥ 61 years	16	2	

*Fischer's exact test

Table 8 shows the association between Age group and Mode of treatment. It was found that there is association between Age group and Mode of treatment with p-value of 0.005 (p-value < 0.05) which is statistically significant.

Table 9: Binary logistic regression between Age group and Mode of treatment (n = 60)

Correlates	B	Std. Error	Wald	Sig.	Exp(B)
Age group	-0.502	0.241	4.315	**0.038***	0.606
Constant	0.227	0.638	0.126	0.722	1.254

*p value less than 0.05 is statistically significant

The p-value of 0.038 indicates that this influence is statistically significant. The odds ratio of 0.61 indicates that one unit increase of the variable age will increase the odds that the dependant variable is Hemodialysis by 0.61 times. (Table 9)

Table 10: Correlation between Urine output and Patient's outcome (n = 60)

Variables	r value	p value
Urine output	0.390	0.002

With a p value of 0.002 (p value <0.05), Table 10 shows a strong link between the patient's outcome and urine output. This demonstrates a positive correlation between the chance of survival and urine production.

DISCUSSION

AKI is commonly seen in India following volume depletion caused by gastrointestinal fluid loss. The absence of medical services in rural areas and a delay in treating dehydration are the most common causes of AKI following Acute Gastro-enteritis (AGE).[7] The primary cause of ARF, according to Prakash et al., was volume depletion brought on by gastrointestinal fluid loss (35.2%).[8] Jayakumar et al. and Mahajan et al. reported similar findings.[9, 10] The clinical profile, laboratory parameters, and outcome of AKI caused by gastroenteritis are determined in this study.

A total of 60 patients were presented to tertiary care hospital with signs and symptoms of acute gastroenteritis within the age range of 21 to 80 years old with a mean value of 53 ± 14 years. Similar age distribution was noted in Kumar S et al, Inbanadhan et al, Mathew D M K et al., Khan Md Y et al., and Mahajan S et al.[7,9,11–13] In contrast lower mean age was noted in Jamal et al.[14] In our study 19 (31.6%) were in the 51 to 60 years age group followed by 18 (30.1%) aged ≥ 61 years. Similar findings were seen in Mahajan S et al., and Kumar S et al.[9,11] In the present study majority of participants (63.4%) were Male. Other studies like Rekha NH et al., Jamal et al and Jayakumar et al. also showed similar sex distribution.[10,14,15] Whereas in study done by Mahajan et al., male participants were 70.5% higher than our study and this variation may be due to varying etiology of study.[9]

The clinical features that were identified in our study were Loose stools (100%), Vomiting (41.60%), Fever (61.70%), Fatigue (78.30%) and Decreased micturition (51.60%). Other symptoms include Jaundice, Edema, Shortness of Breath and Altered sensorium. Studies such as Pajai AE et al., and Inbanadhan et al., found similarities.[7,16] In research by Pillai VSN et al. and Mahajan et al., oligouria was mentioned as a prevalent symptom.[9,17] Vomiting was the most common presenting complaint in research such as Singhal AS et al., Bernieh et al., and Liano F et al.[18–20]

According to blood pressure monitoring, 20% of participants in the current study had hypotension and 16.6% had hypertension. However, other studies, such as those by Jamal N et al., Rekha NH et al., Liano et al., and Pajai AE et al., demonstrate hypotension at 29.3%, 30%, 32%, and 60.4%, respectively.[14–16,20] According to our study, 28.30% have tachycardia. On the other hand, 52.8% of patients in the Pajai AE et al., research had tachycardia.[16] These discrepancies can result from the sample sizes used in different studies. Participants in this study were divided into three categories according to the WHO: No (48.40%), Some (35%) and Severe (16.6%) dehydration. similar finding were noted in Patil U et al., study where they have classified the participants into Mild (60%), Moderate (35.71%) and Severe (4.2%) dehydration.[21]

In the current study ICU admission was needed for 45% of patients. Out of 60 participants majority 73.40% required conservative management and remaining 26.60% Hemodialysis. This finding was similar to studies like Khan MD Y et al., Berniah B et al., Inbanathan J et al., Pajai AE et al., Pillai VSN et al., and Rekha NH et al.[7,13,15–17,19] In the current study death percentage was 16.70% (70% Conservative and 30% Hemodialysis) which is comparable with Hakim AL study.[22] While the mortality rate in Pajai AE et al., and Inbanathan J et al., was 3.8% and 4% respectively.[7,16] Out of 50 participants 56% got discharged in < 1 week, 34% in 1 to 3 weeks and 10% > 3 weeks. This finding was comparable with Inbanadhan J et al., Kumar S et al., and Pajai AE et al. [7,11,16] Contrast finding was noted in Swarna Gupta et al.[23]

The most common complication identified in this study is Hyponatremia 16 (26.66%) followed by Hyperkalemia 14 (23.30%), Hypokalemia 13 (21.67%) and Sepsis 11 (18.34%). Similar finding was noted in Patil U et al., and Kumar S et al.[11,21] Contrast finding was seen in Pajai AE et al., with Hypotension (60.4%) and sepsis (54.7%) as major complications.[16]

Urine output and peak blood urea levels were shown to be statistically significantly associated with patient outcomes in our study (p-values: 0.005 and 0.045, respectively), which is consistent with findings from Bhattacharya et al.[24] Urine output and treatment mode were also shown to be significantly correlated ($p = 0.001$), which is in line with the Yamamoto R et al., study.[25] On the other hand, comorbidities and treatment method did not significantly correlate ($p > 0.05$), which is consistent with the findings of Kumar S et al.[11] Similarly, no significant association was found between type of admission and comorbidities ($p = 0.228$). However, a significant association was detected between age group and mode of treatment ($p = 0.005$), with an odds ratio of 0.61, indicating that each unit increase in age increases the odds of requiring hemodialysis by 0.61 times. This finding contrasts with the results reported by Inbanadhan et al.[7]

LIMITATIONS OF THE STUDY

The primary limitations of the study were its relatively small patient population, confined to a single-center setting. There was no long term follow up of patients since it was a retrospective study design. Staging of AKI and association with risk factors could have been done.

RECOMMENDATIONS

It is recommended to increase the awareness regarding the acute gastroenteritis induced Acute Kidney injury and that prompt rehydration would alter the patient's outcome. Careful monitoring of urine output, serum creatinine, and blood urea levels should be conducted in all hospitalized patients, particularly those in critical care, to facilitate early detection of acute kidney injury (AKI). Timely diagnosis is crucial, as it can significantly improve patient outcomes and survival rates.

CONCLUSION

Acute kidney injury following acute gastroenteritis is common in developing countries and it has good prognosis if detected earlier. Educating the public on personal hygiene and sanitation can help reduce the incidence of acute gastroenteritis (AGE), while raising awareness among physicians about the potential of diarrheal illnesses to contribute to acute kidney injury (AKI) is equally important.

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