

ASSESSMENT OF SERUM ELECTROLYTE ABNORMALITIES IN CHILDREN WITH ACUTE GASTROENTERITIS.

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Abstract

Background: Acute gastroenteritis is one of the leading causes of morbidity and hospitalization among children, particularly in developing countries. It commonly presents with diarrhea, vomiting, fever, and dehydration, resulting in significant fluid and electrolyte loss. Electrolyte disturbances such as hyponatremia, hypernatremia, hypokalemia, and metabolic acidosis may contribute to serious complications if not identified early. Assessment of serum electrolyte abnormalities is therefore essential for appropriate fluid management and improved clinical outcomes in children with acute gastroenteritis. **Aims:** To assess serum electrolyte abnormalities among children with acute gastroenteritis and evaluate their association with severity of dehydration and clinical outcome. **Materials and Methods:** This prospective observational study was conducted over a period of 15 months in the Department of Paediatrics at Sree Mookambika Institute of Medical Sciences. A total of 85 children aged 6 months to 12 years admitted with acute gastroenteritis were included in the study. Detailed demographic and clinical information were recorded. Clinical assessment of dehydration was performed according to World Health Organization guidelines. Laboratory investigations were carried out in all patients. Management included oral rehydration therapy, intravenous fluids, zinc supplementation, and supportive care according to standard pediatric treatment protocols. Statistical analysis was performed using chi-square test and independent t-test, with $p < 0.05$ considered statistically significant. **Results:** The majority of children belonged to the age group of 6 months to 3 years, accounting for 52 (61.2%) cases. Some degree of dehydration was observed in 71 (83.5%) children, with moderate dehydration being the most common presentation in 39 (45.9%) cases. Serum electrolyte abnormalities were identified in 47 (55.3%) children. Hyponatremia was the most common electrolyte disturbance, observed in 24 (28.2%) patients, followed by hypokalemia in 17 (20.0%) children and hypernatremia in 6 (7.1%) cases. Metabolic acidosis was present in 29 (34.1%) children and showed significant association with severe dehydration ($p < 0.01$). Significant association was observed between electrolyte imbalance and duration of hospital stay ($p = 0.02$). **Conclusion:** Hyponatremia and hypokalemia were the most frequent disturbances observed. Early recognition and correction of electrolyte imbalance are essential to prevent complications and improve clinical outcomes.

Keywords: Acute gastroenteritis; Children; Dehydration; Electrolyte imbalance; Hyponatremia; Hypokalemia; Metabolic acidosis.



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INTRODUCTION

Acute gastroenteritis is one of the most common pediatric illnesses worldwide and remains a major cause of morbidity and mortality among children, particularly in developing countries.¹ It is characterized by sudden onset of diarrhea with or without vomiting, fever, abdominal pain, and dehydration. Acute gastroenteritis contributes significantly to hospital admissions, nutritional deficiencies, electrolyte imbalance, and mortality in children under five years of age.^{2,3}

The etiology of acute gastroenteritis includes viral, bacterial, and parasitic infections. Rotavirus remains one of the leading causes of severe diarrhea in young children, although other pathogens such as norovirus, adenovirus, Escherichia coli, Shigella, Salmonella, and Vibrio cholerae also contribute significantly.⁴ Transmission commonly occurs through contaminated food, water, poor sanitation, and inadequate hand hygiene. Children are particularly vulnerable because of immature immunity, poor nutritional status, and increased exposure to infectious agents.⁵

Clinical manifestations of acute gastroenteritis vary depending on the causative organism and severity of illness. Common symptoms include frequent loose stools, vomiting, fever, irritability, abdominal cramps, reduced oral intake, and lethargy.⁶ The most important complication associated with acute gastroenteritis is dehydration resulting from excessive loss of water and electrolytes through stool and vomitus. Dehydration may range from mild to severe and can rapidly progress to shock, metabolic disturbances, renal dysfunction, and death if not managed promptly.^{7,8}

Electrolytes play a vital role in maintaining fluid balance, neuromuscular function, acid-base equilibrium, and cellular metabolism. Children with acute gastroenteritis are highly susceptible to electrolyte abnormalities because of ongoing gastrointestinal losses and inadequate replacement.⁹ Common electrolyte disturbances include hyponatremia, hypernatremia, hypokalemia, hyperkalemia, hyponatremia, and metabolic acidosis. These abnormalities may worsen clinical condition and contribute to complications such as seizures, altered sensorium, cardiac arrhythmias, muscle weakness, and circulatory collapse.¹⁰

Early assessment and correction of electrolyte imbalance are essential components in the management of acute gastroenteritis. Clinical evaluation alone may not accurately predict underlying electrolyte abnormalities, making laboratory assessment important, especially in hospitalized children with moderate or severe dehydration. Appropriate fluid therapy guided by electrolyte estimation can reduce morbidity, shorten hospital stay, and improve outcomes.¹¹

Although oral rehydration therapy has significantly reduced mortality associated with diarrheal diseases, electrolyte disturbances continue to be an important cause of complications in hospitalized children. Regional data regarding the pattern of electrolyte abnormalities in children with acute gastroenteritis are limited. Understanding the prevalence and clinical association of electrolyte imbalance may help improve early diagnosis and optimize treatment strategies in pediatric patients.

AIMS AND OBJECTIVES

- To assess serum electrolyte abnormalities among children with acute gastroenteritis and evaluate their association with severity of dehydration and clinical outcome.

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of Paediatrics at Sree Mookambika Institute of Medical Sciences over a period of 15 months from January 2025 to March 2026. The study included 85 children aged between 6 months and 12 years who were admitted with acute gastroenteritis during the study period. Written informed consent was obtained from parents or guardians of all participating children.

Inclusion Criteria

- Children aged 6 months to 12 years.
- Children admitted with acute gastroenteritis presenting with diarrhea with or without vomiting.
- Children with duration of illness less than 14 days.
- Parents or guardians willing to provide informed consent.

Exclusion Criteria

- Children with chronic diarrheal diseases.
- Children with chronic kidney disease or renal tubular disorders.
- Children with congenital gastrointestinal anomalies.
- Children with endocrine or metabolic disorders affecting electrolyte balance.
- Children with severe protein energy malnutrition.
- Children receiving diuretic therapy or electrolyte supplementation prior to admission.
- Children with associated systemic illnesses such as meningitis or septic shock.

Detailed demographic and clinical information including age, gender, socioeconomic status, duration and frequency of diarrhea, vomiting, fever, feeding history, intake of oral rehydration solution, and previous treatment history were recorded using a structured proforma. A detailed clinical examination was performed in all children at admission. Assessment included hydration status, pulse rate, respiratory rate, blood pressure, capillary refill time, urine output, level of consciousness, body weight, and signs of dehydration such as sunken eyes, decreased skin turgor, dry mucous membranes, and lethargy. Dehydration was classified as no dehydration, some dehydration, or severe dehydration according to World Health Organization guidelines.

Laboratory investigations were carried out in all patients under aseptic precautions and included serum sodium, potassium, chloride, bicarbonate, blood urea, serum creatinine, random blood sugar, and complete blood count. Stool examination and

culture were performed in selected patients whenever clinically indicated. Serum electrolyte abnormalities were categorized according to standard pediatric reference values. Hyponatremia, hypernatremia, hypokalemia, hyperkalemia, and metabolic acidosis were documented and correlated with clinical severity and dehydration status.

All children received treatment according to standard pediatric management protocols for acute gastroenteritis. Management included oral rehydration therapy, intravenous fluid replacement, zinc supplementation, nutritional support, and symptomatic treatment. Intravenous fluids were administered in children with moderate to severe dehydration or inability to tolerate oral feeds. Clinical monitoring was continued throughout hospitalization to assess improvement in hydration status, urine output, electrolyte correction, and occurrence of complications. Duration of hospital stay and final outcome were also recorded.

All collected data were entered into a master chart and analyzed using appropriate statistical methods. Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were expressed as frequencies and percentages. Statistical analysis was performed using chi-square test and independent t-test wherever applicable. A p-value less than 0.05 was considered statistically significant.

RESULTS

Most children affected with acute gastroenteritis were below 3 years of age, indicating greater susceptibility in younger children and males constituted a slightly higher proportion of the study population. Moderate and severe dehydration together accounted for the majority of cases, reflecting delayed presentation and significant fluid loss. (Table 1)

Table 1: Demographic and Clinical Characteristics of Study Population

Variable	Category	Number (n)	Percentage (%)	p-value
Age Group	6 months–3 years	52	61.2	<0.01*
	4–7 years	21	24.7	
	8–12 years	12	14.1	
Gender	Male	49	57.6	0.22
	Female	36	42.4	
Dehydration Status	No dehydration	14	16.5	<0.01*
	Some dehydration	39	45.9	
	Severe dehydration	32	37.6	

Vomiting and fever were commonly associated symptoms along with diarrhea. Clinical signs such as sunken eyes and decreased skin turgor were frequently observed among dehydrated children, emphasizing the importance of early clinical assessment. (Table 2)

Table 2: Clinical Presentation of Children with Acute Gastroenteritis

Clinical Feature	Number (n)	Percentage (%)
Diarrhea	85	100
Vomiting	61	71.8
Fever	47	55.3
Reduced oral intake	39	45.9
Lethargy	28	32.9
Abdominal pain	19	22.4
Sunken eyes	36	42.4
Decreased skin turgor	31	36.5

Hyponatremia was the most common electrolyte abnormality observed, followed by metabolic acidosis and hypokalemia. Electrolyte disturbances were significantly associated with severe gastrointestinal fluid loss and dehydration. (Table 3)

Table 3: Serum Electrolyte Abnormalities Among Study Population

Electrolyte Abnormality	Number (n)	Percentage (%)	p-value
Hyponatremia	24	28.2	0.01*
Hypernatremia	6	7.1	0.18
Hypokalemia	17	20.0	0.03*
Hyperkalemia	4	4.7	0.29
Metabolic acidosis	29	34.1	<0.01*
Normal electrolyte levels	38	44.7	

The mean serum sodium and bicarbonate levels were lower among children with acute gastroenteritis, indicating significant fluid and bicarbonate loss. Elevated blood urea values reflected dehydration-related renal hypoperfusion in several children. (Table 4)

Table 4: Mean Laboratory Parameters Among Study Population

Parameter	Mean $\pm$ SD
Serum sodium (mEq/L)	133.8 $\pm$ 5.6
Serum potassium (mEq/L)	3.5 $\pm$ 0.8
Serum bicarbonate (mEq/L)	18.9 $\pm$ 3.7
Blood urea (mg/dL)	34.2 $\pm$ 9.4
Serum creatinine (mg/dL)	0.7 $\pm$ 0.2

Children with severe dehydration demonstrated significantly higher frequency of electrolyte abnormalities compared to those with mild or no dehydration. Increasing dehydration severity was strongly associated with metabolic and electrolyte disturbances. (Table 5)

Table 5: Correlation of Dehydration Severity with Electrolyte Abnormalities

Dehydration Status	Electrolyte Abnormality Present n (%)	Electrolyte Abnormality Absent n (%)	p-value
No dehydration	3 (21.4%)	11 (78.6%)	<0.01*
Some dehydration	22 (56.4%)	17 (43.6%)	
Severe dehydration	22 (68.8%)	10 (31.2%)	

Electrolyte abnormalities were significantly more common among children with prolonged diarrhea lasting more than three days. Persistent gastrointestinal losses increased the risk of sodium, potassium, and bicarbonate depletion. (Table 6)

Table 6: Correlation of Duration of Diarrhea with Electrolyte Abnormalities

Duration of Diarrhea	Electrolyte Abnormality Present n (%)	Electrolyte Abnormality Absent n (%)	p-value
≤ 3 days	14 (38.9%)	22 (61.1%)	0.02*
>3 days	33 (67.3%)	16 (32.7%)	

Children with electrolyte abnormalities had significantly longer hospital stay compared to those with normal electrolyte levels. Presence of metabolic disturbances contributed to delayed recovery and increased need for intravenous fluid therapy and monitoring. (Table 7)

Table 7: Correlation of Electrolyte Abnormalities with Hospital Stay

Duration of Hospital Stay	Electrolyte Abnormality Present n (%)	Electrolyte Abnormality Absent n (%)	p-value
≤ 3 days	12 (36.4%)	21 (63.6%)	0.02*
>3 days	35 (67.3%)	17 (32.7%)	

DISCUSSION

A total of 85 children admitted with acute gastroenteritis were included in the present study. Most children belonged to the age group of 6 months to 3 years, accounting for 52 (61.2%) cases, indicating greater vulnerability of younger children to diarrheal illnesses due to immature immunity, poor hygiene practices, and increased risk of dehydration. Male children constituted 49 (57.6%) cases, showing a slight male predominance among hospitalized children with acute gastroenteritis. Similar age distribution and male predominance were reported by Zehra VU et al.¹² Shah SJ et al.¹³ and Shankar P et al.¹⁴ who also observed higher frequency of acute gastroenteritis among younger male children.

Diarrhea was present in all children in the present study, while vomiting was observed in 61 (71.8%) and fever in 47 (55.3%) patients. Reduced oral intake, lethargy, abdominal pain, sunken eyes, and decreased skin turgor were common clinical features associated with dehydration. Similar clinical manifestations were documented by Khan O et al.¹⁵ and Soni A et al.¹⁶ who identified vomiting and fever as frequent presenting symptoms among patients with acute gastroenteritis. The presence of dehydration-related signs in the present study highlights the importance of prompt fluid replacement therapy in paediatric diarrheal illness.

Some degree of dehydration was present in 71 (83.5%) children, with moderate dehydration accounting for 39 (45.9%) cases and severe dehydration observed in 32 (37.6%) children. These findings indicate the substantial burden of fluid loss among hospitalized children with acute gastroenteritis. Comparable observations were made by Shah SJ et al.¹³ who reported severe dehydration in 38.6% of children, while Shankar P et al.¹⁴ documented dehydration in the majority of paediatric patients admitted with diarrhoea. Noreen T et al.¹⁷ similarly observed that severe dehydration was strongly associated with electrolyte abnormalities.

Electrolyte abnormalities were identified in 47 (55.3%) children in the present study, indicating that more than half of the hospitalized patients developed measurable biochemical disturbances. Hyponatremia was the most common electrolyte abnormality, observed in 24 (28.2%) children, followed by hypokalemia in 17 (20.0%) cases and hypernatremia in 6 (7.1%) patients. Similar findings were reported by Noreen T et al.¹⁷ who documented hyponatremia as the most frequent electrolyte abnormality followed by hypokalemia and hypernatremia. Zehra VU et al.¹² and Shah BK et al.¹⁸ also observed hyponatremia as the predominant electrolyte disturbance among paediatric patients. Shah SJ et al.¹³ reported even higher frequencies of hyponatremia and hypokalemia among children with acute diarrhoea and dehydration.

Metabolic acidosis was present in 29 (34.1%) children in the present study and showed significant association with severe dehydration. Ongoing gastrointestinal fluid loss through diarrhoea and vomiting likely contributed to sodium, potassium, and bicarbonate depletion. Similar findings were documented by Hamid SM et al.¹⁹ who reported decreased bicarbonate levels in nearly all children admitted with acute gastroenteritis. Khan O et al.¹⁵ also observed significantly lower bicarbonate levels among severely dehydrated children, emphasizing the metabolic consequences of prolonged fluid loss. The mean serum sodium level among study participants was 133.8 ± 5.6 mEq/L, while the mean serum potassium level was 3.5 ± 0.8 mEq/L. Reduced bicarbonate levels reflected metabolic acidosis secondary to bicarbonate loss in stools and impaired tissue perfusion caused by dehydration. Elevated blood urea levels suggested dehydration-related renal hypoperfusion and increased catabolic state during illness. Similar biochemical alterations were reported by Soni A et al.¹⁶ who demonstrated significantly lower electrolyte values among patients with moderate to severe dehydration. Khan O et al.¹⁵ also identified elevated urea and creatinine levels in severe dehydration.

Electrolyte abnormalities in the present study were significantly more common among children with severe dehydration. Among children with severe dehydration, 22 (68.8%) demonstrated electrolyte imbalance, compared to only 3 (21.4%) children without dehydration. Persistent diarrhoea lasting more than three days also showed significant association with electrolyte disturbances. Comparable findings were observed by Soni A et al.¹⁶ who demonstrated a strong correlation between dehydration severity and electrolyte abnormalities, with disturbances increasing progressively from mild to severe dehydration. Shankar P et al.¹⁴ similarly noted declining sodium and potassium levels with increasing severity of dehydration.

Children with electrolyte abnormalities in the present study had longer duration of hospitalization. Among patients with hospital stay exceeding three days, 35 (67.3%) had electrolyte imbalance, suggesting that metabolic disturbances contribute to prolonged illness and delayed recovery. Similar findings were reported by Hamid SM et al.¹⁹ who demonstrated significant association between electrolyte disturbances and increased length of hospital stay. Zehra VU et al.¹² also observed prolonged hospitalization among children with hyponatremia.

CONCLUSION

Electrolyte abnormalities were commonly observed among children hospitalized with acute gastroenteritis, particularly in younger children with moderate to severe dehydration. Hyponatremia, hypokalemia, and metabolic acidosis were the most frequent disturbances identified. Electrolyte imbalance showed significant association with prolonged diarrhea, severe dehydration, and increased duration of hospital stay. Early clinical assessment and routine evaluation of serum electrolytes are important for prompt diagnosis and appropriate fluid management. Timely correction of electrolyte disturbances can help prevent serious complications, reduce morbidity, and improve recovery in children with acute gastroenteritis. Regular monitoring remains essential, especially in children presenting with severe dehydration and persistent symptoms.

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CONFLICTS OF INTEREST

There are no conflicts of interest.

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