Original Article

Prevalence and Clinical Correlates of Electrolyte Disturbances in Children Hospitalized with Acute Gastroenteritis

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Abstract

Background: Acute gastroenteritis (AGE) remains a leading cause of paediatric hospitalization and is frequently complicated by potentially severe electrolyte disturbances. This study aimed to determine the prevalence, specific patterns, and clinical correlates of serum electrolyte abnormalities in children admitted with AGE. **Material and Methods:** A retrospective cross-sectional study evaluated 50 children aged 6 months to 12 years hospitalized with AGE. Patient demographics, clinical dehydration status (classified via World Health Organization guidelines), and admission serum sodium and potassium levels were analysed. Statistical measures, including relative risk (RR) and odds ratios (OR), were utilized to quantify the clinical impact of dehydration on the likelihood of developing electrolyte imbalances. **Results:** Overall, 18% of the cohort exhibited serum electrolyte abnormalities. Hyponatremia emerged as the most common derangement, comprising 66.7% of all detected abnormalities and affecting 12% of the overall study population. Conversely, hypokalaemia (4%) and hypernatremia (2%) were infrequent. A highly significant statistical association was established between clinical dehydration and biochemical derangement. Electrolyte disturbances occurred in 75 % of clinically dehydrated children, compared to merely 7.1% of those presenting without dehydration. Consequently, dehydrated children faced a profoundly elevated risk of electrolyte imbalance, demonstrated by a relative risk of 10.5 and an exceptionally high odds ratio of 39. **Conclusion:** While electrolyte imbalances are uncommon in well-hydrated children with AGE, the presence of clinical dehydration drastically amplifies the risk of biochemical derangements, particularly hyponatremia. These findings highlight the critical need for targeted electrolyte monitoring in all dehydrated paediatric AGE patients to optimize fluid resuscitation protocols and prevent systemic complications.

Keywords: Acute gastroenteritis; Electrolyte disturbance; Hyponatremia; Paediatric dehydration; Relative risk; Odds ratio.

Received: 15 march 2026 **Revised: 10 April 2026** **Accepted: 01 June 2026** **Published: 22 June 2026**

Introduction

Acute gastroenteritis remains one of the leading causes of morbidity and mortality in pediatric population across the globe. Managing such conditions is particularly challenging in resource limited settings.[1,2] The condition is characterized by rapid onset of diarrhea often accompanied by vomiting femur and abdominal pain that quickly culminate in severe volume depletion in children. Pediatric population is exceptionally vulnerable to fluid shift and electrolyte imbalances due to their limited physiological reserves higher surface area to body weight ratio and immature renal capacity to conserve fluids and electrolytes.[3]

Beyond simple volume loss any electrolyte disturbances including hyponatremia hypernatremia and hypokalemia are frequently associated with critical complications.[4–7] These biological derailments are clinically significant because they can exacerbate disease severity complicate rehydration efforts prolonged duration of the hospital stay and substantially influence morbidity and mortality. Therefore early recognition and prompt targeted correction of such electrolyte abnormalities are essential step in pediatric care to prevent severe systemic consequences including neurological and cardiac complications.[8]

Despite such established the dangers of electrolyte derangements there are notable gaps in current literature. A vast majority of previous research has restricted its focus predominantly to children under five years of age or strictly to critically ill population admitted to pediatric intensive care units.[1,2,9–11] By expanding the study population to include children up to 12 years of age abroad and more representative clinical profile can be evaluated. In addition association between dehydration and electrolyte imbalances is conceptually understood There is a paucity of studies precisely quantifying their relationship like relative risk or odds ratio In pediatric ward setting. Such quantification directly correlates clinical dehydration signs with biochemical danger signals, and Provide evidence based rationale for laboratory testing and resource

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DOI:
10.21276/amit.2026.v13.i2.764

How to cite this article: Devender S, Khan K, Ramya K, Krishna BVS. Prevalence and Clinical Correlates of Electrolyte Disturbances in Children Hospitalized with Acute Gastroenteritis. Acta Med Int. 2026;13(2):781-785.

utilization.

Therefore, the current study was undertaken with primary objective to determine the prevalence of electrolyte abnormalities among children aged 6 months to 12 years admitted with acute gastroenteritis. Secondary objectives were to identify the most common electrolyte abnormality, to assess the association between electrolyte abnormalities and dehydration status and to quantify the risk of electrolyte abnormalities among dehydrated children compared with non-dehydrated children using relative risk and odds ratio estimates.

Materials and Methods

Study design and setting: A retrospective cross-sectional study was conducted in the Department of Paediatrics of a tertiary care teaching hospital. The study involved review of hospital records of children admitted with acute gastroenteritis over a two-year period from March 2024 to February 2026.

Study population: The study population comprised children aged 6 months to 12 years who were admitted with acute gastroenteritis. Acute gastroenteritis was defined as the passage of three or more loose or watery stools per day, with or without vomiting, of less than 14 days duration.

Sample size and sampling technique: The sample size was calculated using the formula: n={Z^2pq}/{d^2}, where Z = 1.96 at 95% confidence level, p = 20% (expected prevalence of electrolyte abnormalities among children with acute gastroenteritis based on previous literature), q = 80%, and d = 11% absolute precision. The minimum calculated sample size was 50 children. Medical records of all eligible children admitted during the study period were screened, and records meeting the inclusion criteria with complete clinical and laboratory data were included using consecutive sampling.

Inclusion criteria: Children aged 6 months to 12 years admitted with acute gastroenteritis during the study period and having complete clinical and laboratory records were included.

Exclusion criteria: Children with chronic kidney disease, congenital renal disorders, endocrine disorders affecting electrolyte balance, severe malnutrition requiring intensive care management, chronic diarrheal disorders, or incomplete laboratory or medical records were excluded.

Data collection: Clinical and laboratory information was extracted from medical records using a structured case record form. The following variables were recorded – age, sex, duration of diarrhea, presence of vomiting, presence of fever, nutritional status, degree of dehydration, serum sodium, serum potassium, clinical outcome, dehydration status was assessed according to World Health Organization guidelines (categorized as no dehydration, some dehydration and severe dehydration). For analytical purposes, children were subsequently categorized as having dehydration or no dehydration.

Laboratory data: Laboratory values recorded at admission prior to initiation of intravenous fluid therapy were extracted from hospital records. Serum sodium and potassium levels had been measured using standard automated biochemical analyzers in the institutional central laboratory.

Electrolyte abnormalities were defined as follows: hyponatremia: serum sodium <135 mEq/L; hypernatremia: serum sodium >145 mEq/L; hypokalaemia: serum potassium <3.5 mEq/L and hyperkalaemia: serum potassium >5.5 mEq/L.

Derived Variables: A composite variable termed Electrolyte Disturbance Status was created. Children were classified as having electrolyte disturbance if any of the following were present – hyponatremia, hypernatremia, hypokalaemia and / or hyperkalaemia. Children with normal sodium and potassium values were classified as having no electrolyte disturbance.

Relative Risk of electrolyte abnormality: To quantify the clinical impact of dehydration on electrolyte imbalance, the relative risk (RR) of electrolyte disturbance among dehydrated children compared with non-dehydrated children was calculated.

Odds Ratio for electrolyte disturbance: The odds ratio (OR) for electrolyte abnormalities associated with dehydration was also estimated to assess the strength of association between dehydration and electrolyte imbalance.

Statistical analysis: Data were entered into Microsoft Excel and analyzed using JASP version 0.19.3 (University of Amsterdam, Netherlands). Continuous variables were expressed as mean ± standard deviation or median with interquartile range depending on data distribution. Categorical variables were expressed as frequencies and percentages.

The prevalence of electrolyte abnormalities was calculated as proportions with corresponding percentages. Associations between electrolyte abnormalities and dehydration status were assessed using the Chi-square test or Fisher's exact test, as appropriate. The RR, OR, and corresponding 95% confidence intervals were calculated to quantify the strength of association between dehydration and electrolyte abnormalities. A p-value less than 0.05 was considered statistically significant.

Ethical considerations: Institutional Ethics Committee approval was obtained prior to commencement of the study. Confidentiality of participant information was maintained throughout the study. Data were anonymized prior to analysis, and the study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and the Indian Council of Medical Research guidelines for biomedical research involving human participants.

Results

Baseline characteristics: A total of 50 children aged 6 months to 12 years admitted with acute gastroenteritis were included in the study. The mean age of the study population was 6.64 ± 3.15 years. There were 28 females (56%) and 22 males (44%).

Fever was present in 25 children (50%). Most children had no clinically significant dehydration (42/50, 84%), while 8 children (16%) had dehydration. The majority of children were nutritionally normal (44/50, 88%), whereas 6 children (12%) had varying degrees of malnutrition.

No child developed seizures, shock, or altered sensorium during hospitalization. Forty-nine children (98%) recovered and were discharged, while one child (2%) had an adverse outcome.

Prevalence of Electrolyte Abnormalities: Serum sodium

abnormalities were observed in 7 children (14%). Hyponatremia was the most common sodium abnormality, occurring in 6 children (12%), while hypernatremia was observed in 1 child (2%). Normal serum sodium levels were present in 43 children (86%) [Figure 1]. Serum potassium abnormalities were less frequent and were observed in 2 children (4%). All potassium abnormalities were due to hypokalemia. No cases of hyperkalemia were identified. Overall, electrolyte abnormalities (either sodium or potassium abnormality) were present in 9 children (18%), whereas 41 children (82%) had normal electrolyte values.

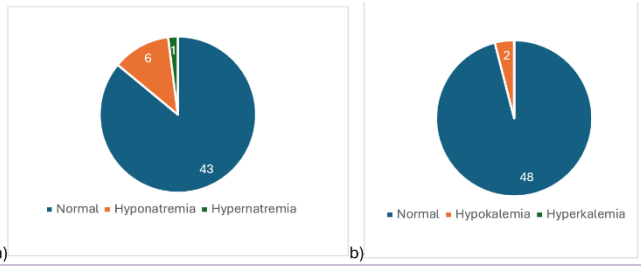

Figure 1: Distribution of electrolyte abnormalities among children with acute gastroenteritis a) serum sodium levels, b) serum potassium levels.

Most Common Electrolyte Abnormality: Hyponatremia was the most frequently encountered electrolyte disturbance, accounting for 6 of the 9 electrolyte abnormalities (66.7%) and affecting 12% of the total study population [Figure 2]. Hypokalemia was observed in 2 children (4%), while hypernatremia was identified in only one child (2%).

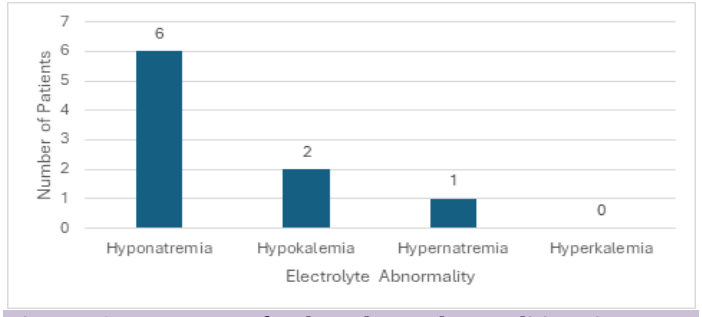

Figure 2: Pattern of electrolyte abnormalities in acute gastroenteritis

Association Between Electrolyte Abnormalities and Dehydration Status: A significant association was observed between electrolyte abnormalities and dehydration status. Among children without dehydration, electrolyte abnormalities were present in only 3 of 42 children (7.1%). In contrast, electrolyte abnormalities were detected in 6 of 8 children (75.0%) with dehydration.

Table 1: Association Between Dehydration Status and Electrolyte Abnormalities in Children with Acute Gastroenteritis

Dehydration Status	Normal Electrolytes	Electrolyte Abnormality
No dehydration (n=42)	39 (92.9%)	3 (7.1%)
Dehydration (n=8)	2 (25.0%)	6 (75.0%)

Chi-square analysis demonstrated a statistically significant association between dehydration and electrolyte abnormalities (χ^2 = 16.62, p < 0.001).

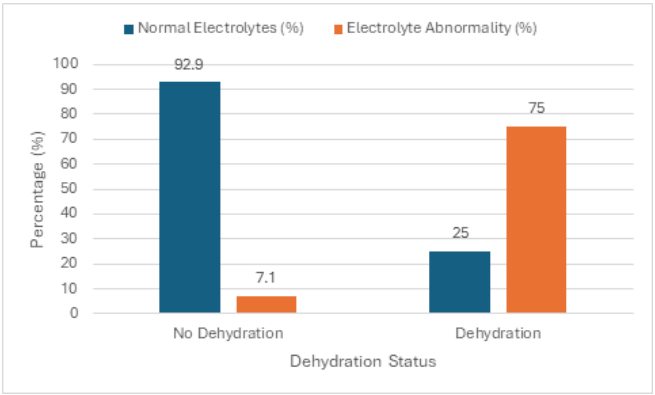

Figure 3: Prevalence of electrolyte abnormalities according to dehydration status

Electrolyte Risk Ratio: The risk of electrolyte abnormalities was substantially higher among children with dehydration. The prevalence of electrolyte abnormalities was 75.0% in dehydrated children compared with 7.1% among children without dehydration, corresponding to a relative risk of 10.5 and an odds ratio of 39.

Discussion

This retrospective cross-sectional study determined the prevalence of clinical correlates of serum electrolyte disturbances among children aged between six months to 12 years admitted with acute gastroenteritis. In the court included 18% of children had electrolyte abnormality. The study established a profound statistical significant association between presence of clinical dehydration and risk of developing biochemical imbalances.

There are many biochemical abnormal prevalence reporting in the past. Kinasha et al. reported an overall abnormality rate of 37% in Botswana,[1] Chary and Shalini observed abnormalities in 53.8% of PICU-admitted children,[12] and Ali et al. noted exceptionally high rates of hypokalemia (60%) and hyponatremia (45%) in a specifically dehydrated cohort.[13] Comparatively lower prevalence noted in present study is likely attributed to clinical profile of the sample population as most patients presented with no clinical dehydration.

Consistent with the previous studies hypernatremia was most frequently encountered electrolyte disturbance. This aligns closely with findings by Sahai et al., who identified hyponatremia (33%) as the primary imbalance,[14] and Noreen et al., who also found hyponatremia (35%) to be the most prevalent.[15] The predominance of hyponatremia in AGE typically reflects excessive sodium losses in diarrheal stools or the inappropriate pre-admission administration of hypotonic

fluids.[16]

Conversely, hypokalemia and hypernatremia were relatively rare in our cohort, occurring in only 4% and 2% of the children, respectively, with no cases of hyperkalemia. Hypokalemia is known to be particularly prevalent in settings with higher rates of underlying malnutrition, as malnourished children often suffer from chronic whole-body potassium depletion even prior to an AGE episode.[17–19]

The association of electrolyte abnormalities with dehydration was highly statistically significant (with RR of 10.5 and OR of 39). These results strongly reinforce the findings of Ali et al. and Noreen et al., who both emphasized that severe dehydration is highly linked with various electrolyte abnormalities.[15,17] Sahai et al., while evaluating correlation between serum sodium categories and the degree of dehydration failed to reach statistical significance.[14] Our data definitively demonstrates that as fluid volume is lost, the likelihood of biochemical derangement surges.

Limitations of the study: Relatively small sample size and retrospective cross sectional study design restricts the ability to establish definitive causal pathway or recommendations for long term dynamic fluid resuscitation protocols. Being a single institute study the outcomes are cohort centric. Future multi-centre prospective studies with larger cohorts could build upon these findings to establish refined, severity-based electrolyte screening protocols for paediatric acute gastroenteritis.

Conclusion

Electrolyte abnormalities were present in 18% of children admitted with acute gastroenteritis. Hyponatremia was the most common electrolyte disturbance, followed by hypokalaemia. Children with dehydration were significantly more likely to exhibit electrolyte abnormalities than those without dehydration, highlighting the importance of electrolyte monitoring in dehydrated children with acute gastroenteritis.

Acknowledgements: Authors acknowledge the faculty of medical record section for providing data required to undertake this study. Authors also thank Dean and management of college for facilitating the study.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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