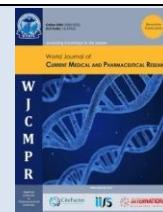




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SERUM ELECTROLYTE ALTERATIONS AND CLINICAL OUTCOMES IN INFANTS ADMITTED WITH COMMUNITY-ACQUIRED INFECTIONS: A PROSPECTIVE OBSERVATIONAL STUDY AT A TERTIARY CARE HOSPITAL

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ARTICLE HISTORY	ABSTRACT
Received on: 27-07-2026 Revised on: 11-08-2026 Accepted on: 19-09-2026	Background: Acute community-acquired infections such as acute gastroenteritis (AGE), acute bronchiolitis, and urinary tract infection are common reasons for infant hospitalization. While hyponatremia was mainly noticed in gastroenteritis, electrolyte imbalances like hyponatremia are increasingly recognized across various acute pediatric infections. This study evaluated the prevalence of hyponatremia in infants admitted to Koppal Medical College and its correlation with clinical outcomes, including Pediatric Intensive Care Unit (PICU) admission, need for positive pressure ventilation (PPV), and total duration of stay.
Keywords: Hyponatremia; Acute Gastroenteritis; Acute Bronchiolitis; Urinary Tract Infection; Infants; Pediatric Intensive Care Unit.	Methods: A prospective observational study was conducted involving 120 consecutive infants aged 1 to 24 months admitted with community-acquired infections (AGE n=50, acute bronchiolitis n=45, uti n=25). Venous blood samples were collected at admission to analyze serum electrolytes {Na ⁺ , K ⁺ }, renal parameters, and blood gas values. Clinical outcomes were compared between normonatremic (Na ⁺ 135 mmol/L) and hyponatremic (Na ⁺ < 135 mmol/L) infants, further stratifying hyponatremia severity (mild: 130-134mmol/L}, moderate: 125-129mmol/L}, severe: <125 mmol/L}).
Corresponding Author Annapoorani S. Dr. Pramod Padasalimani Senior resident, Department of Pediatrics, Koppal Institute of Medical Sciences (KIMS), Koppal, Karnataka, India West Bengal, India.	Results: Hyponatremia was present in 58 out of 120 infants (48.3%) at admission, most commonly in acute bronchiolitis (55.5%) and uti (52.0%), compared to AGE (40.0%). Infants with severe hyponatremia (n=12) experienced significantly poorer outcomes, demonstrating higher rates of PICU transfer (66.7% vs 11.3%, p < 0.001), increased requirement for positive pressure ventilation (50.0% vs 6.5%, p < 0.001), and prolonged length of PICU stay (6.2 pm 1.8 days vs 2.1 pm 0.8 days, p < 0.001) compared to normonatremic or near-normal sodium controls.
	Conclusion: Dysnatremia, particularly hyponatremia, is highly prevalent among infants admitted with common community-acquired infections in a tertiary setup in northern Karnataka. Severe hyponatremia serves as a marker of disease severity and is directly associated with higher PICU utilization, mechanical respiratory support, and prolonged hospitalization.

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INTRODUCTION

Acute community-acquired infections-primarily acute gastroenteritis, bronchiolitis, and uti account for significant pediatric morbidity and hospital admissions in regional tertiary care centers across India. Traditionally, dehydration secondary to acute gastroenteritis was strongly associated with hypernatremic state. However, clinical evidence demonstrates a shifting paradigm wherein hyponatremia has become the predominant electrolyte distortion in hospitalized infants. Non-osmotic stimulation of arginine vasopressin (AVP) secretion, triggered by intravascular

volume depletion, inflammatory cytokines (such as IL-6 and TNF-alpha), fever, pain, and lower respiratory tract stress, plays a key role in the development of hospital-associated hyponatremia. While mild hyponatremia is often asymptomatic, significant serum sodium depression can impair cellular membrane potential, exacerbate cerebral edema, and compromise respiratory and circulatory mechanics.

This study was designed to investigate the prevalence of hyponatremia upon hospital admission among infants at Koppal Institute of Medical Sciences (KIMS), Koppal, and

evaluate its direct impact on clinical outcomes, including PICU requirement, positive pressure ventilation (PPV), and length of stay.

MATERIALS AND METHODS

Study Design & Setting: This prospective observational study was conducted in the Department of Pediatrics at Koppal Institute of Medical Sciences (KIMS), Koppal, Karnataka, over a 6-month period jan 2026 to june 2026. informed written consent was obtained from the parents or legal guardians of all enrolled infants.

Inclusion & Exclusion Criteria

Inclusion Criteria: Consecutive infants aged 4 weeks to 24 months admitted with a clinical diagnosis of acute gastroenteritis with dehydration, moderate-to-severe acute bronchiolitis, or uti.

Exclusion Criteria: Preterm infants (<34 weeks gestational age), known cases of congenital heart disease, chronic renal insufficiency, metabolic bone disorders, prior electrolyte-altering therapy before transfer, or severe systemic shock requiring immediate volume resuscitation prior to blood sampling.

Clinical Assessment & Laboratory Measurements: At admission, detailed demographic and clinical histories were documented. Dehydration severity in AGE was assessed using standard clinical scoring. Bronchiolitis severity was graded based on respiratory rate, chest retractions, nasal flaring, and oxygen saturation. uti was established via clinical presentation, elevated systemic inflammatory markers (WBC, CRP), pyuria, and urine culture confirmation.

Venous blood samples were drawn under minimal stasis prior to intravenous fluid initiation. Serum electrolytes (Na⁺, K⁺), blood urea, serum creatinine, blood glucose, and venous blood gas (pH, pCO₂, HCO₃⁻) were evaluated.

Definitions:

- **Normonatremia:** Serum sodium 135-145mmol/L
- **Hyponatremia:** Serum sodium <135mmol/L (Mild: 130-134mmol/L; Moderate: 125-129mmol/L; Severe: <125mmol/L)
- **Hypernatremia:** Serum sodium >145mmol/L

Outcome Measures: Primary outcomes included admission or transfer to the Pediatric Intensive Care Unit (PICU), requirement for positive pressure ventilation (non-invasive CPAP/BiPAP or invasive mechanical ventilation), and overall duration of PICU and hospital stay.

Statistical Analysis: Continuous variables are expressed as median [interquartile range] or mean standard deviation. Categorical variables are presented as frequencies and percentages. Group comparisons were performed using the Kruskal-Wallis test, Fisher's exact test, and Chi-square test as appropriate. A p-value <0.05 was considered statistically significant.

RESULTS

A total of N=120 infants meeting the inclusion criteria were enrolled in the study (AGE n=50, Bronchiolitis n=45, uti n=25). The overall prevalence of hyponatremia at admission was 48.3% (n=58). Hypernatremia was rare, observed in only 2 infants (1.7%), both presenting with acute

gastroenteritis.

Table 01: Clinical and Laboratory Data of Enrolled Infants on Admission (N=120)

Parameter	Acute Gastroenteritis (n=50)	Acute Bronchiolitis (n=45)	uti (n=25)	P-value
Age (months), median [IQR]	7.5 [3.5–12.0]	4.2 [2.0–8.5]	6.8 [3.0–11.2]	<0.01
Gender (Male/Female)	28 / 22	26 / 19	13 / 12	0.82
Serum Sodium (mmol/L), mean $\pm$ SD	134.2 $\pm$ 4.1	132.8 $\pm$ 3.6	133.1 $\pm$ 3.9	0.14
Hyponatremia	20 (40.0%)	25 (55.5%)	13 (52.0%)	0.28
Hypernatremia	2 (4.0%)	0 (0.0%)	0 (0.0%)	0.21
Serum Potassium (mmol/L)	4.1 $\pm$ 0.6	4.4 $\pm$ 0.5	4.8 $\pm$ 0.6	<0.001
Blood Urea (mg/dL)	34 [22–48]	21 [15–29]	28 [18–38]	<0.001
Serum Creatinine (mg/dL)	0.52 [0.4–0.7]	0.38 [0.3–0.5]	0.45 [0.3–0.6]	<0.01
Venous pH,	7.31 $\pm$ 0.08	7.35 $\pm$ 0.05	7.34 $\pm$ 0.06	0.04
Bicarbonate (mmol/L)	16.4 $\pm$ 3.2	21.5 $\pm$ 2.8	19.2 $\pm$ 3.1	<0.001

Impact of Hyponatremia Severity on Clinical Outcomes

Stratification by sodium levels revealed a clear inverse relationship between serum sodium concentration and disease severity. Infants with severe hyponatremia (<125 mmol/L) demonstrated significantly worse clinical trajectories compared to those with normonatremia or near-normal sodium levels (130-134mmol/L).

Table 02: Primary Clinical Outcomes Stratified by Serum Sodium Status

Outcome Parameter	Normonatremia / Near-Normal (n=108)	Severe Hyponatremia [Na ⁺ < 125mmol/L] (n=12)	Statistical Significance (p-value)
PICU Admission Rate, n (%)	12 (11.1%)	8 (66.7%)	<0.001

Requirement for Positive Pressure Ventilation (PPV), n\ (%)	7 (6.5%)	6 (50.0%)	<0.001
Length of PICU Stay (Days), mean \pm SD	2.1 \pm 0.8	6.2 \pm 1.8	<0.001
Total Hospital Length of Stay (Days), mean \pm SD	4.3 \pm 1.2	9.5 \pm 2.4	<0.001

DISCUSSION

In this study conducted at Koppal Medical College, nearly half (48.3%) of all infants presenting with common community-acquired infections exhibited hyponatremia on hospital admission. These findings closely parallel the primary observations of Mazzoni et al. (2019), who reported a 54% overall prevalence of hyponatremia in a similar infant cohort, reinforcing that dysnatremia is a frequent finding across diverse clinical presentations.

The underlying pathophysiological mechanism in non-diarrheal conditions like acute bronchiolitis and uti predominantly involves inappropriate antidiuresis driven by inflammatory mediators, fever, respiratory distress, and intravascular volume depletion. Elevated levels of interleukin-1 and TNF-alpha directly stimulate hypothalamic production of antidiuretic hormone (ADH).

Crucially, our study highlights the prognostic significance of severe hyponatremia. Infants with serum sodium <125mmol/L required significantly more intensive care monitoring (66.7%), higher rates of positive pressure ventilation (50.0%), and longer PICU stays (6.2 days) compared to those with normal or near-normal sodium levels. Hyponatremia exacerbates underlying pulmonary fatigue in bronchiolitis and compromises cellular perfusion, leading to clinical decompensation.

CLINICAL IMPLICATIONS

- Fluid Management:** The high prevalence of hyponatremia cautions against the uncritical administration of hypotonic intravenous fluids in hospitalized infants with acute infections, supporting the use of isotonic maintenance fluids to prevent hospital-acquired hyponatremia.
- Risk Stratification:** Baseline serum sodium measurement at admission serves as a valuable biomarker for identifying infants at risk for severe clinical decline requiring PICU-level intervention.

LIMITATIONS

This study was conducted at a single tertiary center in Koppal with a modest sample size (N=120). Direct measurement of serum ADH levels and urinary osmolality was not performed due to operational resource constraints.

CONCLUSION

Hyponatremia is a common electrolyte alteration in infants presenting with community-acquired infections to Koppal Medical College. Severe hyponatremia strongly correlates with adverse outcomes, marked by increased PICU transfer rates, greater necessity for positive pressure ventilation, and prolonged PICU stays. Early identification of serum sodium imbalance is essential for risk stratification and tailored fluid resuscitation.

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