International Journal of Contemporary Pediatrics
Dogra S et al. Int J Contemp Pediatr. 2026 Jul;13(7):1133-1138
https://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291
DOI: https://dx.doi.org/10.18203/2349-3291.ijcp20261903

Original Research Article

Electrolyte disturbances in infants with enterostomy: a prospective analysis

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Received: 28 April 2026
Accepted: 08 June 2026

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ABSTRACT

Background: Aim was to prospectively evaluate the incidence, pattern, and longitudinal trends of electrolyte disturbances, including serum electrolytes and urinary sodium levels, in infants with enterostomies compared to controls.
Methods: This prospective case-control study was conducted at a tertiary care center between May 2023 and December 2024. Fifty infants aged 0-3 months undergoing ileostomy were compared with 50 age-and sex-matched controls without malabsorption. Serum electrolytes (sodium, potassium, calcium, phosphate, magnesium) and urinary sodium were assessed at discharge and at 1, 3, and 6 months. Electrolyte abnormalities were defined using standard pediatric reference ranges, and urinary sodium <10 mmol/L indicated sodium depletion.
Results: Infants with ileostomy demonstrated a significantly higher prevalence of sodium depletion compared to controls. Urinary sodium <10 mmol/L was observed in 50%, 50%, and 54.2% at 1, 3, and 6 months, respectively. Hyponatremia occurred in 62.5%, 60.4%, and 52.1% of infants at corresponding time points. Other electrolyte disturbances were less frequent but clinically relevant, with hypocalcemia and hypokalemia observed in 10.4% of infants at 6 months.
Conclusions: Hyponatremia, along with low urinary sodium levels, is commonly observed in infants with enterostomies and indicates underlying total body sodium depletion secondary to ongoing gastrointestinal losses. Although other electrolyte abnormalities are less common, periodic surveillance remains important. Early recognition and targeted management are essential to optimize growth and clinical outcomes.

Keywords: Ileostomy, Infant, Electrolyte imbalance, Hyponatremia, Sodium, Urinary sodium excretion

INTRODUCTION

Neonatal ileostomy is a lifesaving surgical intervention commonly performed for conditions such as necrotizing enterocolitis, intestinal perforation, and small bowel atresia. Despite its critical role in survival, ileostomy is associated with substantial fluid and electrolyte losses due to diversion of intestinal contents at the level of the distal ileum.[1] Loss of colonic continuity eliminates a major site of water and sodium reabsorption, resulting in increased fecal output that is rich in sodium and bicarbonate. Neonates are particularly susceptible to these losses because of immature renal tubular function, which limits their ability to conserve sodium and maintain acid-base balance. Consequently, infants with ileostomies are at heightened risk of dehydration, electrolyte disturbances, metabolic acidosis, and impaired growth during a crucial period of development.[2-3]

Total body sodium depletion is a key contributor to failure to thrive in infants with ileostomies.[4,5] Importantly, serum sodium concentrations may remain

within the normal range despite significant depletion of total body sodium, thereby delaying clinical recognition and intervention. In this context, urinary sodium excretion has emerged as a sensitive and practical marker of sodium status. Low urinary sodium reflects renal conservation in response to excessive gastrointestinal losses and precedes the development of overt hyponatremia. Spot urine sodium measurements correlate well with overall sodium balance and provide an early warning of impending depletion, allowing clinicians to initiate or escalate sodium supplementation before clinical deterioration occurs.[6] Previous studies have demonstrated that timely sodium replacement guided by urinary sodium levels is associated with improved weight gain and growth outcomes in infants with ileostomies.[7]

Current evidence on hyponatremia in infants with ileostomies remains limited, as no prospective studies have been conducted, and most available data originate from small case series and retrospective observational studies.[8,9]

Moreover, there is a limited data on disturbances of other electrolytes, including potassium, calcium, phosphorus, and magnesium. Prolonged intestinal diversion, reduced absorptive surface area, and malabsorption may adversely affect these electrolytes, with potential implications for neuromuscular function, bone mineralization, and long-term growth.

In view of these gaps in existing literature, the present study was designed to prospectively evaluate the incidence and pattern of electrolyte disturbances in infants with enterostomies, including sodium, potassium, calcium, phosphorus, and magnesium.

We aimed to compare serum electrolyte profiles and urinary sodium levels with those of age-matched controls, and to assess the utility of urinary sodium as an early marker of total body sodium depletion. By systematically evaluating these parameters, this study seeks to improve early recognition and guide targeted management of electrolyte imbalances in this high-risk population.

METHODS

Study design and setting

This prospective case-control study was conducted in the Department of Pediatric Surgery at a tertiary care center of North India between May 2023 and December 2024. The study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the institutional ethics committee, and written informed consent was obtained from parents or legal guardians prior to enrollment. The study protocol was approved by the institutional ethics committee (EC-INT/2023/MCh-1463) and registered with the Clinical Trials Registry of India (CTRI/2024/03/063496).

Study population

Infants aged 0-3 months undergoing ileostomy for conditions such as necrotizing enterocolitis, intestinal atresia, or meconium ileus were included. Infants with complex congenital cardiac anomalies, suspected syndromic or chromosomal disorders, or those whose parents did not provide consent were excluded. Written informed parental consent was obtained prior to enrollment. The control group comprised 50 age- and sex-matched infants discharged from Neonatal surgical intensive care unit with conditions unrelated to malabsorption or nutritional impairment.

Assessments and definitions

Baseline characteristics, including birth weight, gestational age, and relevant clinical details, were recorded. The primary parameters evaluated were serum electrolyte levels-sodium, potassium, total calcium, phosphate, and magnesium-as well as urinary sodium concentration. In infants with ileostomy, these measurements were obtained at the time of hospital discharge and subsequently at follow-up visits at approximately 1, 3, and 6 months of age. Control infants underwent electrolyte assessment at corresponding age intervals. Serum electrolyte levels were measured from venous blood samples using standard automated analyzers. Urinary sodium was assessed using a spot urine sample and reported in mmol/L.

Electrolyte abnormalities were defined according to established pediatric reference ranges. Hyponatremia was defined as serum sodium <135 mmol/L, hypokalemia as serum potassium <3.5 mmol/L, hypocalcemia as total calcium <8.8 mg/dL, hypophosphatemia as phosphate <2.7 mg/dL, and hypomagnesemia as magnesium <1.58 mg/dL. A urinary sodium concentration <10 mmol/L was considered indicative of significant sodium depletion. The infants who had severe electrolyte abnormalities in followup were managed as per the unit protocol.

Statistical analysis and sample size calculation

Electrolyte profiles of infants with ileostomy were compared with those of control infants at each time point. Continuous variables were expressed as mean±SD and analyzed using Student's t test or the Mann-Whitney U test, as appropriate. Categorical variables, including the prevalence of electrolyte disturbances, were compared using the chi-square test or Fisher's exact test. A $p<0.05$ was considered statistically significant. Based on an expected prevalence of hyponatremia of 64% in infants with ileostomy (previous study) and 0% in controls, the minimum required sample size was small.[10] However, to increase the precision of estimates, enable evaluation of multiple electrolyte disturbances, and account for potential attrition, 50 infants were enrolled in each group. This sample size was also considered feasible based on

the expected patient load within the stipulated study period at our center.

RESULTS

A total of 50 neonates who underwent ileostomy were included in the study. Table 1 describes the baseline demographic and clinical characteristics. The mean birth weight was 2.4±0.51 kg, and the mean gestational age was 37.22±2.18 weeks. Females constituted 42% of the study population. Mean discharge weight was 2.31±0.4 kg. Nearly half of the neonates required total parenteral nutrition during their hospital stay. The most common indication for ileostomy was ileal atresia (28%), followed by necrotizing enterocolitis with perforation (14%).

Hyponatremia and urine sodium levels

Significant sodium depletion was noted among infants with ileostomy (Table 2 and Figure 1). Urine sodium levels <10 mmol/L were recorded in 24 infants (50%) at 1 month, 24 (50%) at 3 months, and 26 (54.2%) at 6 months, compared with 5 (10%), 0%, and 2 (4%) in the control group at respective time points (all p=0.001). Hyponatremia was also markedly more prevalent in the ileostomy group, affecting 30 infants (62.5%) at 1 month, 29 (60.4%) at 3 months, and 25 (52.1%) at 6 months, whereas it occurred in only 2 infants (4%) at 1 and 6 months and none at 3 months in the control group (all p=0.001).

Other electrolyte abnormalities

Infants with ileostomy had a significantly higher frequency of electrolyte abnormalities compared to the control group throughout the follow-up period (Table 3). At 6 months, hypocalcemia was observed in 5 infants (10.4%) in the ileostomy group, whereas no cases were noted among controls, and this difference was highly significant (p=0.001). Hypophosphatemia was detected in 4.2% of infants with ileostomies, and a similar proportion (4.2%) also developed hypomagnesemia.

Hypokalemia was not present in either group at the time of discharge. However, by 6 months of follow-up, hypokalemia was documented in 5 infants (10.4%) in the study group, with no cases in control group, showing a statistically significant difference (p=0.01). Overall, electrolyte disturbances were markedly more common in infants with ileostomies than in controls, particularly at 6 months of follow-up, with hypocalcemia and hypokalemia emerging as most frequent abnormalities.

Table 1: Baseline demography.

Variables	N (%)
Birth weight (kg)	2.4±0.51
Gender (Female)	21 (42%)
Gestation age (weeks)	37.22±2.18
Discharge weight (kg)	2.31±0.4
Received TPN	24 (48%)
Indication for ileostomy	
Ileal atresia	14 (28%)
NEC perforation	7 (14%)
Cloaca/UGS with pouch colon	5 (10%)
Umbilical cord hernia with complications	5 (10%)
Colonic perforation peritonitis	5 (10%)
Ileal perforation peritonitis	4 (8%)
Band obstruction	2 (4%)
Malrotation with volvulus	2 (4%)
Total colonic aganglionosis	2 (4%)
Meconium pseudocyst	2 (4%)
Rectal atresia	1 (4%)
Obstructed inguinal hernia	1 (4%)

*TPN: total parenteral nutrition; NEC: necrotizing enterocolitis; UGS: urogenital sinus.

Table 2: Hyponatremia and urine sodium levels.

Parameters	Time point	Ileostomy	Control	P value
Hyponatremia	1 month	30 (62.5%)	2 (4%)	0.001
	3 months	29 (60.4%)	0	0.001
	6 months	25 (52.1%)	2 (4%)	0.001
Urine sodium <10 mmol/L	1 month	24 (50%)	5 (10%)	0.001
	3 months	24 (50%)	0	0.001
	6 months	26 (54.2%)	2 (4%)	0.001

Table 3: Electrolyte disturbances.

Variables	Ileostomy (n=50)	Control (n=50)	P value
Hypocalcemia			
At discharge	4 (8.3%)	0%	0.006
At 6 months	5 (10.4%)	0%	0.001
Hypophosphatemia			
At discharge	1 (2.1%)	0%	0.001
At 6 months	2 (4.2%)	0%	0.001
Hypomagnesemia			
At discharge	0	0	1
At 6 months	2 (4.2%)	0	0.001
Hypokalemia			
At discharge	0%	0 %	1
At 6 months	5 (10.4%)	0 %	0.01

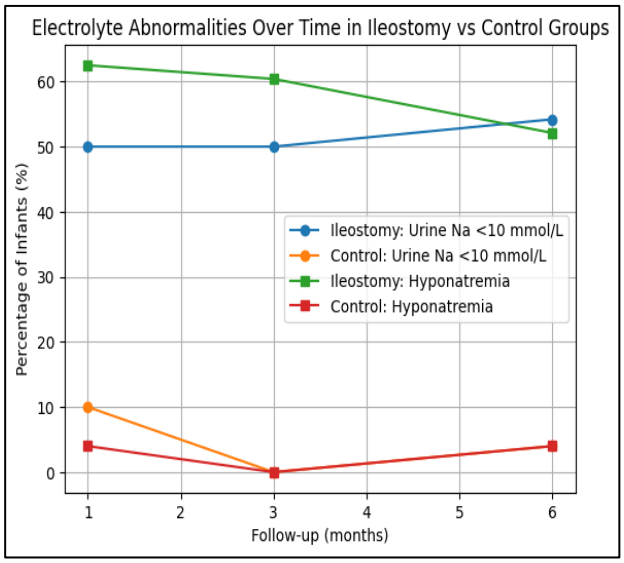

Figure 1: Electrolyte abnormalities over time in ileostomy versus control groups.

DISCUSSION

This prospective study demonstrates that neonates with ileostomies experience significant and persistent electrolyte imbalances, most notably sodium depletion. This was evidenced by persistently lower serum sodium levels and extremely low urinary sodium excretion, in contrast to the stable and normal sodium balance observed in the control group. These observations emphasize the indispensable role of the distal intestine in maintaining fluid and electrolyte homeostasis, as the colon and distal ileum are major sites for sodium and water reabsorption. When these segments are bypassed, as in an ileostomy, substantial sodium-rich fluid losses occur, which can rapidly exceed the infant's limited compensatory capacity.[11,12]

It is well documented that infants with ileostomies may lose two to three times the normal amount of sodium and water, predisposing them to dehydration, metabolic acidosis, and poor weight gain.[13] High-output stomas are therefore recognized as a major physiological and clinical challenge in infancy, particularly because of their association with significant electrolyte imbalance. Previous studies have shown that sodium depletion in infants with ileostomies often manifests as hyponatremia, low urinary sodium excretion, and failure to thrive, unless active sodium supplementation is provided.[14,15]

Our findings confirm that, despite standard postoperative care, a substantial proportion of neonates with an ileostomy develop biochemical hyponatremia and evidence of total body sodium depletion in the weeks following surgery, reinforcing the need for vigilant monitoring and proactive sodium replacement strategies.[16]

Beyond sodium, disturbances in other electrolytes were observed, although they occurred far less frequently. Potassium homeostasis was largely preserved in our cohort, with only occasional episodes of mild and transient hypokalemia in the ileostomy group. These episodes were confined mainly to the early postoperative period, when stoma outputs are typically highest and enteral intake is still limited. Importantly, no infant demonstrated persistent hypokalemia by 6 months of follow-up. Current clinical practice and published reviews recommend potassium supplementation in neonates with an ileostomy only when there is a documented biochemical deficit.[17] Our findings support this approach, indicating that routine potassium supplementation is unnecessary in most infants provided that overall intake is adequate and serum levels are regularly monitored.

Calcium, phosphorus, and magnesium abnormalities were infrequent and generally mild. A small proportion of infants with ileostomy (approximately 10%) developed low serum calcium levels by 6 months of age. This may be attributable to vitamin D deficiency, which can occur due to malabsorption of fat-soluble vitamins following intestinal diversion or resection.[18,19] Calcium and

phosphate metabolism are closely interrelated, and inadequate vitamin D status or prolonged dependence on parenteral nutrition could plausibly explain lower values in some surgical neonates.[20]

The available literature addressing calcium, phosphate, and magnesium balance in infants with enterostomies is limited. However, long-term ileostomy patients, particularly those with significant bowel resection, have been reported to be at increased risk of hypomagnesemia, likely due to chronic intestinal losses and malabsorption.[21] In our study, only 4% of infants had low magnesium levels at 6 months, but this prevalence may rise with longer follow-up or in infants with more extensive intestinal loss. Hypomagnesemia is clinically important because it can aggravate both hypocalcemia and hypokalemia and may manifest with neuromuscular irritability, tremors, or seizures.[22]

Taken together, our results suggest that although major disturbances in potassium, calcium, phosphorus, and magnesium are uncommon, they are clinically relevant. We therefore recommend periodic monitoring of calcium, phosphate, and magnesium as part of routine follow-up in infants with an ileostomy. Early detection allows timely and targeted supplementation, such as calcium and vitamin D therapy for hypocalcemia or magnesium replacement when required, thereby preventing secondary complications and supporting optimal growth and neurodevelopment.

Our findings indicate that the ileostomy itself is the primary driver of electrolyte disturbances, as age- and nutrition-matched healthy infants maintained normal electrolyte homeostasis. Despite careful clinical management, infants with ileostomies experience ongoing gastrointestinal losses that necessitate heightened surveillance. While definitive management ultimately involves timely stoma closure, careful interim medical management-including routine urinary sodium assessment, growth monitoring, and nutritional support—is essential to optimize outcomes in this vulnerable population.

CONCLUSION

Neonates with ileostomies are at high risk of significant sodium depletion due to ongoing intestinal losses, with urinary sodium serving as a sensitive early marker of total body deficiency. Our findings reinforce that vigilant monitoring and proactive sodium supplementation are essential, even with standard postoperative care. Although other electrolyte disturbances are less common, periodic assessment of potassium, calcium, phosphate, and magnesium remains clinically important. A holistic management approach-integrating electrolyte surveillance, nutritional support, and timely stoma closure-is crucial to optimize growth and outcomes in this vulnerable population.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Crealey M, Walsh M, Awadalla S, Murphy JF. Managing newborn ileostomies. Ir Med J. 2014;107(5):146-8.
2. Bower TR, Pringle KC, Soper RT. Sodium deficit causing decreased weight gain and metabolic acidosis in infants with ileostomy. J Pediatr Surg. 1988;23(6):567-72.
3. Moschino L, Duci M, Fascetti Leon F, Bonadies L, Priante E, Baraldi E, Verlato G. Optimizing Nutritional Strategies to Prevent Necrotizing Enterocolitis and Growth Failure after Bowel Resection. Nutrients. 2021;13(2):340.
4. Mansour F, Petersen D, De Coppi P, Eaton S. Effect of sodium deficiency on growth of surgical infants: a retrospective observational study. Pediatr Surg Int. 2014;30(12):1279-84.
5. Trautmann T, Bang C, Franke A, Vincent D, Reinshagen K, Boettcher M. The Impact of Oral Sodium Chloride Supplementation on Thrive and the Intestinal Microbiome in Neonates with Small Bowel Ostomies: A Prospective Cohort Study. Front Immunol. 2020;11:1421.
6. Bines JE, Francis DE, Hill DJ. Reducing sodium deficiency in infants with ileostomy. J Paediatr Child Health. 1996;32(1):61-4.
7. Schwarz KB, Ternberg JL, Bell MJ, Keating JP. Sodium needs of infants and children with ileostomy. J Pediatr. 1983;102(4):509-13.
8. O'Neil M, Butterworth S, O'Dwyer B. Total body sodium depletion and poor weight gain in children and adults with high-output small bowel stomas. Nutr Clin Pract. 2014;29(3):333-40.
9. Zarraga CM, Borowitz SM. Growth failure and metabolic acidosis due to total body sodium depletion in an infant with an ileostomy. BMJ Case Rep. 2021;14(3):e241570.
10. Butterworth SA, Lalari V, Dheensaw K. Evaluation of sodium deficit in infants undergoing intestinal surgery. J Pediatr Surg. 2014;49(5):736-40.
11. Gallagher ND, Harrison DD, Skyring AP. Fluid and electrolyte disturbances in patients with long-established ileostomies. Gut. 1962;3:219-23.
12. Kocoshis SA. Short bowel syndrome and intestinal failure. In: Kliegman RM, St. Geme JW, eds. Nelson Textbook of Pediatrics. 21st ed. Philadelphia: Elsevier, 2020.
13. Amin SC, Pappas C, Iyengar H, Maheshwari A. Short bowel syndrome in the NICU. Clin Perinatol. 2013;40(1):53-68.
14. Goulet O, Ruemmele F. Causes and management of intestinal failure in children. Gastroenterology. 2006;130(2-1):S16-28.

15. Wales PW, Allen N, Worthington P, George D, Compher C; ASPEN Board of Directors. ASPEN clinical guidelines: support of pediatric patients with intestinal failure. JPEN J Parenter Enteral Nutr. 2014;38(5):538-57.
16. Sacher P, Hirsig J, Gresser J, Spitz L. The importance of oral sodium replacement in ileostomy patients. Prog Pediatr Surg. 1989;24:226-31.
17. Wouters M, Vanuytsel T, Huysentruyt K, De Bruyne P, Van Hoeve K, Hoffman I. Nutritional management of high-output ileostomies in paediatric patients is vital and more evidence-based guidelines are needed. Acta Paediatr. 2024;113(5):861-870.
18. Ubesie AC, Heubi JE, Kocoshis SA, Henderson CJ, Mezoff AG, Rao MB, Cole CR. Vitamin D deficiency and low bone mineral density in pediatric and young adult intestinal failure. J Pediatr Gastroenterol Nutr. 2013;57(3):372-6.
19. Wozniak LJ, Bechtold HM, Reyen LE, Hall TR, Vargas JH. Vitamin D deficiency in children with intestinal failure receiving home parenteral nutrition. JPEN J Parenter Enteral Nutr. 2015;39(4):471-5.
20. Koo WW. Calcium, phosphorus, and vitamin D requirements of infants receiving parenteral nutrition. J Perinatol. 1988;8(3):263-8.
21. Miranda SC, Ribeiro ML, Ferriolli E, Marchini JS. Hypomagnesemia in short bowel syndrome patients. Sao Paulo Med J. 2000;118(6):169-72.
22. Whang R. Magnesium deficiency. Causes and clinical implications. Drugs. 1984;28(1):143-50.

Cite this article as: Dogra S, Udwani K, Peters NJ, Malik MA, Mahajan JK. Electrolyte disturbances in infants with enterostomy: a prospective analysis. Int J Contemp Pediatr 2026;13:1133-8.