

## A Prospective Hospital-Based Assessment of the Clinical Features of Hyponatremic Dehydration in Acute Gastroenteritis

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### Abstract

**Aim:** To estimate the incidence of hyponatraemic dehydration in infants and children aged till 12 years and to evaluate clinical features associated with acute gastroenteritis associated dehydration.

**Methodology:** A prospective observational study was conducted in Department of Paediatrics, Darbhanga Medical College & Hospital, Darbhanga, Bihar for 11 months (December 2021 – October 2022). Study population consisted from Infants to children aged till 12 years attending the pediatric Department both OPD and IPD care for acute gastroenteritis are enroll in the study who is satisfying the criteria for Moderate to severe dehydration. A total of 100 Children including neonates are enrolled in the study. After obtaining informed consent from the parents of cases, they are subjected to detailed history and clinical examination and the findings were entered. Blood samples were collected and serum electrolytes & serum Calcium were measured and compared with that of the clinical aspects of the patient i.e diarrhea, vomiting, thirst, fever, abdominal distention and convulsions followed by urine analysis.

**Results:** Out of 56% males, 22 were hyponatremic (39.4%) and out of 44% females, 17 were hyponatremic (38.6%). Hyponatremia was found in 31 subjects with high incidence in lower age group in both the genders. Males (39.4%) were more affected than females (38.6%). Lowest sodium level was 127mmol. Among 100 individuals, 36% had severe dehydration and rest of them had some dehydration (64%). The number of episodes of loose stools were correlating with the extent of dehydration. Higher the episodes, the severe was the dehydration. Vomiting were associated with diarrhea in 61% subjects whereas 39% subjects only complained of diarrhea. Only 11 individuals showed hypokalemia without hyponatremia. About 3 subjects showed hypokalemia with hyponatremia.

**Conclusion:** This study, like others before, found electrolyte imbalance in more than half of the gastroenteritis children. It can be said that electrolyte disturbances are very common in children with acute diarrhea. The degree of dehydration and the age of less than 12 months seem to be good prognostic factors for electrolyte imbalance. Early diagnosis and treatment are very important to prevent complications.

**Keywords:** Diarrhoea, Gastroenteritis, Dehydration, Hyponatremia, Hypokalaemia.

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## Introduction

Worldwide, most cases of gastroenteritis are caused by viral infections, with rotaviruses being the most common. Viral infections damage the enterocytes of the small intestine and cause mild fever and watery diarrhea. Rotavirus infection is seasonal in temperate climates and peaks in late winter, but occurs throughout the year in the tropics. Rotavirus strains vary depending on the season and geographically within the countries [1]. Bacterial pathogens such as *Campylobacter jejuni* and *Salmonella* spp. penetrate the lining of the small and large intestine and cause inflammation. Children with bacterial gastroenteritis are more likely to have a high fever and may have blood and white blood cells in their stools. Bacterial pathogens sometimes spread systemically, especially in young children. Infection with *Escherichia coli* or *Shigella dysenteriae*, which produce Shiga toxin, can cause hemorrhagic colitis (with severe bloody diarrhea), which can be complicated by hemolytic uremic syndrome [2].

Dehydration, complicating acute gastroenteritis (AGE), continues to be a leading cause of morbidity and mortality around the globe [3]. Numerous studies have confirmed the safety and efficacy of oral rehydration therapy (ORT), thus it is considered the preferred method of rehydration in children with AGE [4]. Nevertheless, intravenous rehydration (IVR) continues to be frequently employed in settings where ORT is clinically inappropriate (i.e., obtunded child, intractable vomiting, and severe dehydration), and at times when it may not be necessary but it is deemed the preferable therapy by families or physicians [5, 6].

The occurrence of hyponatremia has been exhibited to be an autonomous hazard factor for expanded mortality in medical

clinic inpatients. As hyponatremia is the most well-known electrolyte unsettling influence experienced in clinical drug, it is fundamental that specialists and medical attendants realize how to properly deal with this condition. Extreme hyponatremia has for quite some time been perceived to be related with antagonistic results [7]. Babies and children with gentle lack of hydration regularly have negligible or no clinical changes other than a lessening in pee yield. Alongside diminished pee yield in kids with moderate drying out regularly have dried mucous layers, diminished skin turgor, crabbiness, tachycardia with diminished hairlike refill, and profound breath. A methodical audit of the exactness of clinically foreseeing at any rate 5% lack of hydration in kids found abnormal skin surface, and decreased respiratory example to be the best indicators [8]. The aim of the present study was to estimate the incidence of hyponatraemic dehydration in neonates and children aged till 12 years and to evaluate clinical features associated with acute gastroenteritis associated dehydration.

## Methodology

A prospective observational study was conducted in Department of Paediatrics, Darbhanga Medical College & Hospital, Darbhanga, Bihar for 11 months (December 2021 – October 2022). Study population consisted from Infants to children aged till 12 years attending the pediatric Department both OPD and IPD care for acute gastroenteritis are enroll in the study who is satisfying the criteria for Moderate to severe dehydration. A total of 100 Children including infants are enrolled in the study.

### Inclusion criteria:

1. Watery diarrhoea of 4 or more episodes per day.
2. Age group of 6months to 12 years.

- Signs and symptoms suggestive of some dehydration.
- Without any other severe complications.

#### Exclusion criteria:

- Diarrhoea of 12 or more episodes per day.
- Haematological disorders, chronic illness.
- Signs suggestive of no dehydration

After obtaining informed consent from the parents of cases, they are subjected to detailed history and clinical examination and the findings were. Blood samples are collected and serum electrolytes & serum Calcium are measured and compared with that of the clinical aspects of the patient i.e diarrhea, vomiting, thirst, fever, abdominal

distention and convulsions followed by urine analysis. Statistical analysis was done with EpiInfo, SPSS and Microsoft Excel.

#### Results

100 cases were studied and analyzed to detect Gastroenteritis associated dehydration and its clinical features as a possible risk factor for hyponatremia. It was found that 56% of the males were having acute gastroenteritis while it was 44% in female subjects. The data also reveals that higher incidence of acute gastroenteritis was noted between 6 to 24 months of age while the lower incidence was found in the subjects above 36 months of age.

**Table 1: Age and Gender Distribution of the Subjects in Study**

Age distribution	Male	Female	Total
6m – 24m	47	37	84
25m-36m	6	3	9
Above 36m	3	4	7
<b>Total</b>	<b>56</b>	<b>44</b>	<b>100</b>

**Table 2: Incidence of Hyponatremia with respect to age and Gender**

Age	Male				Females			
	Hyponatremic	Normal	Total	%affected	Hyponatremic	Normal	Total	% affected
6m – 24m	17	28	45	30.4	14	23	37	31.8
25m-36m	3	3	6	5.4	2	0	2	4.5
Above 36m	2	3	5	3.6	1	4	5	2.3
<b>Total</b>	<b>22</b>	<b>34</b>	<b>56</b>	<b>39.4%</b>	<b>17</b>	<b>27</b>	<b>44</b>	<b>38.6%</b>

Out of 56% males, 22 were hyponatremic (39.4%) and out of 44% females, 17 were hyponatremic (38.6%). Hyponatremia was occurred in 31 subjects with high incidence in lower age group in both the genders. Males (39.4%) were more effected than females (38.6%). Lowest sodium level was 127mmol.

**Table 3: Incidence of severity of dehydration with Respect to age and gender:**

Age	Male				Females			
	Severe	Moderate	Total	%	Severe	Moderate	Total	%
6m – 24m	17	30	47	83.9	17	21	38	86.4
25m-36m	0	5	5	8.9	2	0	2	4.5
Above 36m	0	4	4	7.2	0	4	4	9.1
<b>Total</b>	<b>17</b>	<b>39</b>	<b>56</b>	<b>100</b>	<b>19</b>	<b>25</b>	<b>44</b>	<b>100</b>

Among 100 individuals, 36% were severely dehydrated and rest of them were moderately dehydrated (64%). The number of episodes of loose stools were correlating with the extent of dehydration. Higher the episodes, the severe was the dehydration. Vomiting

were associated with diarrhea in 61% subjects whereas 39% subjects only complained of diarrhea. Only 11 individuals showed hypokalemia without hyponatremia. About 7 subjects showed hypokalemia with hyponatremia.

**Table 4: Symptoms**

Symptoms	Number
Diarrhea with vomiting	61
Diarrhea without vomiting	39
Hypokalemia with hyponatremia	7
Hypokalemia without hyponatremia	11

## Discussion

Disorder of sodium in dehydration associated with diarrhea can be a medical emergency that requires quick and appropriate diagnosis and treatment [9]. Different studies have shown a different prevalence of hyponatremia and hypernatremia in children with dehydration. A study by Samadi et al. including the children admitted for diarrhea, it was found that hyponatraemia and hypernatraemia were present in 20.8% and 6.4% of cases, respectively [10]. The study by Shah et al. showed that 56% of the cases with diarrhea and dehydration had hyponatremia, whereas hypernatremia only occurred in 10% of the cases [11]. So, his result was similar to our study. Out of 56% males, 22 were hyponatremic (39.4%) and out of 44% females, 17 were hyponatremic (38.6%).

In the present study, only 11 individuals showed hypokalemia without hyponatremia. About 7 subjects showed hypokalemia with hyponatremia. In the Ritika study, isonatremia was the most common dehydration (71.5%), followed by hyponatremic dehydration (22%) and hypernatremic dehydration (6.5%). 170 children (85%) had normokalaemia and 30 cases (15%) had hypokalaemia and none of the cases had hyperkalaemia. Six cases of hyponatraemia were associated with hypokalaemia. Of the 21 children who received appropriate ORS rehydration therapy before admission, only 5 had hyponatremia and none of them had hypernatremia. Therefore, the concentration of ORS made at home has played an important role in the electrolyte imbalances that occur with gastroenteritis. Using diluted ORS often leads to hyponatremia [12].

In a study by SV Prasad et al found that 29.8% of the sick children is suffering from hyponatremia who require emergency care and must hospitalize while compared to the reported data in adult population, it also states that frequency of hyponatremia is much higher in hospitalized sick children [13]. Diarrhoea is the most concerning cause of dehydration in children as most of the fluids during gastroenteritis are lost. Our study reveals that prolong patient stay in the hospital is due to increase in the frequency of diarrhoea and so the risk of hyponatremia. Furthermore, emesis is also an important factor contributing to the fluid loss from the body resulting in electrolyte imbalance. As shown in our study, emesis and diarrhea leads to hypokalemia as well in few subjects [14].

Clinical management of hyponatremia depends on treating the fundamental causes however precise assurance of etiology of hyponatremia is not known, additionally, a clinical history might be hard to get because of pediatric population. Hence proper history from the parents and pediatrician clinical judgment is the most broadly acknowledged methods for acquiring precise conclusion of hyponatremia and its treatment in pediatric population [15].

The “maintenance fluids” paradigm, coined by Holliday and Segar in the 1950s, was based on the emulation of physiologic daily requirements for water and electrolytes that need to be administered intravenously, to replace oral intake when it is not possible [16]. This approach led to the conception of formulas for calculation of electrolyte quantities and water volumes, that need to be added to calculated deficits and ongoing losses, and are to be administered over 24 h, aiming at meeting requirements, without risk for water or sodium overload. In most cases, such calculations demonstrate that the volume of fluid and quantity of electrolytes needed are approximated best

by hypotonic saline solutions containing 0.3–0.45% saline [17]. However, despite its sensibility, this approach does not take into consideration non-osmotically induced and occasionally inappropriate excretion of ADH triggered by stress, hypovolemia, and other factors directly related to the AGE itself [18,19].

### Conclusion

This study, like others before, found electrolyte imbalance in more than half of the gastroenteritis children. It can be said that electrolyte disturbances are very common in children with acute diarrhea. The degree of dehydration and the age of less than 12 months seem to be good prognostic factors for electrolyte imbalance. Early diagnosis and treatment are very important to prevent complications.

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