

Vol 45 (3) September , 2021

Print: ISSN 0304 4904  
Online: ISSN 2305-820X



# PAKISTAN PEDIATRIC JOURNAL



**A JOURNAL OF PAKISTAN PEDIATRIC ASSOCIATION**

Indexed in EMBASE/Excerpta Medica, Index Medicus WHO

IMEMR & Global Health/CAB Abstracts and UDL-EDGE Products and Services

[www.pakpedsjournal.org.pk](http://www.pakpedsjournal.org.pk)

<http://www.pakmedinet.com/PPJ>

## ORIGINAL ARTICLE

# Spectrum of Clinical Presentation of Children with Hyponatremia Associated With Acute Diarrhea

NABEELA ZIA, SANA JAMIL, MISBAH NOOR, Sadia Shabir, Shaffaq Aziz

Pak Pediatr J 2021; 45(3): 317-20

### ABSTRACT

**Objective:** To determine the spectrum of clinical presentation in children with hyponatremia associated with acute diarrhea.

**Study Design:** Cross-sectional study

**Place and Duration of the Study:** This study was conducted at The Children's Hospital & ICH, Lahore from November 2018 to May 2019.

**Material and Methods:** Patients aged 1 month to 15 years, of either gender with acute diarrhoea fulfilling the inclusion criteria, were enrolled in study. After informed consent from parents, demographic data, clinical features were recorded on predesigned proforma. Serum sodium level was determined. Data was analysed using SPSS 20. Numerical variables were presented as mean  $\pm$ SD and categorical variable were presented as frequencies and percentages.

**Results:** Total 155 patients with acute diarrhoea, 79 (51.0%) male and 76 (49.0%) female were included in this study. Duration of diarrhoea was from 1 to 6 days (mean  $3.5 \pm 1.7$  days). Serum sodium level ranged from 132 mmol/L to 188 mmol/L with a mean of  $142.1 \pm 10.3$  mmol/L. Hyponatremic dehydration was found in 26 (16.8%) children. The mean serum sodium level was significantly high in children with hyponatremic dehydration ( $161.3 \pm 10.9$  vs.  $138.3 \pm 3.8$  mmol/L; p-value  $<0.001$ ) and frequency of vomiting, oliguria, seizures and coma was 34.6% (09), 53.5% (14), 38.5% (10) and 26.9% (07) respectively.

**Conclusion:** Significant proportion of children with acute watery diarrhoea had hyponatremic dehydration (n=26/155, 16.8%) with frequent clinical features of vomiting, oliguria, seizures and coma.

**Key Words:** Acute Diarrhoea, Hyponatremia, Dehydration, oliguria, seizures, coma.

### Correspondence to:

#### Misbah Noor

Department of Pediatric Medicine,  
King Edward Medical University,  
Lahore - Pakistan

#### E-mail:

misbahparhyar@gmail.com

Received 16<sup>th</sup> Nov 2020;  
Accepted for publication  
7<sup>th</sup> July 2021

## INTRODUCTION

Acute diarrhea is defined as passage of 3 or more loose or liquid stools per day or more frequent passage than is normal for the individual lasting for less than 14 days. Approximately 1.7 billion cases of diarrhea are reported worldwide every year and it is the second leading cause of death in children under five years of age. Around 0.52

million children die of diarrheal disease every year.<sup>1</sup> Africa and Southeast Asia contribute 78% share to worldwide diarrhea associated mortality.<sup>2,3</sup>

The most severe threat posed by diarrhoea is dehydration. Water and electrolytes are lost through liquid stools, vomit, sweat, urine and breathing. Dehydration occurs when these losses

are not replaced. Child with severe dehydration has at least two of the following signs: lethargy/unconsciousness, sunken eyes, unable to drink or drinks poorly and skin pinch going back very slowly ( $\geq 2$  seconds). Some dehydration is characterized by two or more of the following signs: restlessness, irritability, sunken eyes, child is thirsty and eager to drink. There is no dehydration if there are not enough signs to be labelled as some or severe dehydration.

Hypernatremic dehydration is defined as serum sodium greater than 145 mEq/L (145 mmol/L) and is caused by water loss in excess of sodium.<sup>4,5</sup> Because the intravascular contents are hypertonic, fluid shifts from the cells into the intravascular space. Thus, the children may be hemodynamically less compromised and clinically underestimated for the degree of dehydration. Hypernatremic dehydration may have some deleterious neurological sequelae like shrinkage of brain matter, tearing of cerebral blood vessels leading to cerebral hemorrhage, seizures, paralysis, and encephalopathy.<sup>6</sup> Other presenting features include irritability, fever, dehydration, vomiting and oliguria<sup>7</sup>. Mortality (12%)<sup>7</sup> and morbidity from hypernatremic dehydration is very high and this is often an overlooked aspect of diarrhea management, this study was conducted to document the incidence and clinical spectrum of presentation of hypernatremic dehydration among children presenting with acute watery diarrhea.

## MATERIAL AND METHODS

This cross-sectional study was conducted at Pediatric Medical Wards and Emergency Department of the Children's Hospital and Institute of Child Health, Lahore from November 2018 to May 2019. Ethical approval was taken from institutional review board (IRB), Ref no. 2020-135-CHICH dated 27-08-2020. A sample size of 155 cases was calculated with 95% confidence level and 6% margin of error while taking expected percentage of hypernatremia to be 17.3% in children with diarrhea.<sup>8</sup>

Patients with age range of 1 month to 15 years, with either gender presenting with acute diarrhea were enrolled in this study. Children with congenital disorders, not accompanied by parents

and having previous history of seizures were not included in this study.

After taking informed consent from parents, demographic data including name, age, gender and duration of diarrhea was recorded. Patients were assessed for hydration status (some/severe dehydration as per operational definition), vomiting, oliguria (urine output  $< 0.5$  ml/kg/hr.), seizures and altered sensorium and all this information was recorded on predesigned proforma. Blood sample for serum sodium level was obtained using 3cc syringe under aseptic measures and was sent to hospital laboratory.

All the collected data was entered and analyzed through SPSS 20. Numerical variables; age, duration of diarrhea and serum sodium level were presented by mean  $\pm$ SD. Categorical variable i.e. gender, hypernatremic dehydration (some/severe dehydration) and clinical features (seizures, coma, oliguria and vomiting) were presented by frequencies and percentages.

## RESULTS

The age of the children ranged from 1 year to 15 years with a mean of  $8.3 \pm 4.4$  years. There were 79 (51.0%) male and 76 (49.0%) female patients. The duration of diarrhea ranged from 1 to 6 days with a mean of  $3.5 \pm 1.7$  days. Serum sodium level ranged from 132 mmol/L to 188 mmol/L with a mean of  $142.1 \pm 10.3$  mmol/L. Various characteristics of patients are shown in table 1.

**TABLE 1: Characteristics of study subjects (n=155)**

Characteristics	Study Sample (%)
<b>Age (years)</b>	8.3 $\pm$ 4.4
• upto 5 years	48 (31.0)
• >5-10 years	46 (29.7)
• >10 years	61 (39.4)
<b>Gender</b>	
• Male	79 (51.0)
• Female	76 (49.0)
<b>Duration of Diarrhea (days)</b>	3.5 $\pm$ 1.7
• 1-3 days	83 (53.5)
• 4-6 days	72 (46.5)

Hypernatremic dehydration was documented in 26 (16.8%) children in the study group. The mean serum sodium level was significantly high in children suffering hypernatremic dehydration as compared to those having normal serum sodium ( $161.3 \pm 10.9$  vs.  $138.3 \pm 3.8$  mmol/L; p-value

<0.001). Among the 26 hyponatremic children, 10 (38.5%) children had some dehydration while 16 (61.5%) children had severe dehydration. The mean serum sodium level was significantly higher in children with severe dehydration as compared to some dehydration ( $165.3 \pm 10.6$  vs.  $154.9 \pm 8.6$  mmol/L; p-value 0.016). Among the clinical features, oliguria was the most frequent finding and was recorded in 14 (53.8%) children followed by seizures in 10 (38.5%), vomiting in 9 (34.6%) and coma in 7 (26.9%), as shown in fig 1.

Frequencies of these clinical features were stratified according to age, gender and duration of diarrhea as presented in table 2.

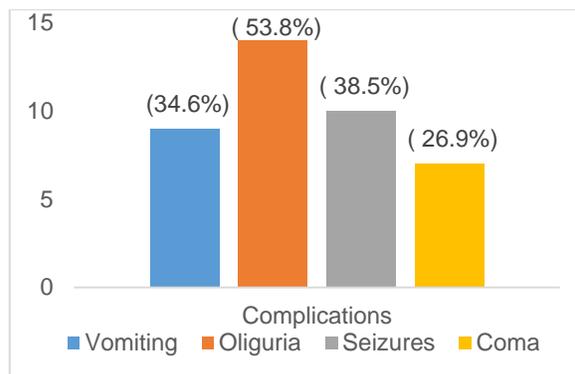


Fig 1: clinical features of patients

TABLE 2: Clinical features associated with hyponatremic dehydration among various demographic groups

Clinical Features	Age Group (Years)			Gender		Duration of diarrhea	
	≤5 (n=8) n (%)	>5-10 (n=8) n (%)	>10 (n=10) n (%)	Male (n=13) n (%)	Female (n=13) n (%)	1-3 (n=14) n (%)	4-6 (n=12) n (%)
Vomiting	3 (37.5)	3 (37.5)	3 (30.0)	5 (38.5)	4 (30.8)	5 (35.7)	4 (33.4)
Oliguria	4 (50.0)	4 (50.0)	6 (60.0)	6 (46.2)	8 (61.6)	7 (50.0)	7 (58.4)
Seizures	3 (37.5)	3 (37.5)	4 (40.0)	5 (38.5)	5 (38.5)	6 (42.9)	4 (33.4)
Coma	1 (12.5)	3 (37.5)	3 (30.0)	3 (23.0)	4 (30.8)	3 (21.4)	4 (33.4)

## DISCUSSION

Hyponatremic dehydration is a potentially lethal condition which adversely affects central nervous system, leading to devastating consequences like intracranial hemorrhage, thrombosis, and even death<sup>9</sup>. In our study, hyponatremic dehydration was diagnosed in 26 (16.8%) children with acute diarrhea. Among the 26 hyponatremic children, 10 (38.5%) children had mild dehydration while 16 (61.5%) children had severe dehydration which are in accordance with another local study where Ahmad et al. in 2016 reported the frequency of hyponatremic dehydration to be 17.3% in children presenting with acute diarrhea.<sup>8</sup> Similar frequency of hyponatremic dehydration as 12.3% has been reported by Hariram et al. among children with gastroenteritis<sup>10</sup> while Shahrin et al. reported it to be 19.5% in Bangladesh.<sup>11</sup> Another study in Bangladesh<sup>2</sup> showed frequency of hyponatremic dehydration in acute diarrhea as 11.2% while a relatively lower frequency of hyponatremic dehydration (5.7%) has been reported by Soleimani et. al. in Iran<sup>12</sup> and a much higher frequency of 31.8% by Bhat et al. in India.<sup>13</sup>

Oliguria was the most frequent clinical feature and was recorded in 14 (53.8%) children followed by seizures, vomiting and coma in 10 (38.5%), 9 (34.6%) and 7 (26.9%) children respectively. Results being in line with that of Sultana et al. who also reported similar frequency of oliguria (61.0%), seizures (46.0%), vomiting (40.0%) and coma (22.0%) among children suffering hyponatremic dehydration and acute diarrhea.<sup>3</sup> Similarly, present results are also in line with those of Shahrin et al. who reported similar frequency of seizures (39.0%) among children.<sup>11</sup> Dastidar et al documented 12.5% incidence of seizures in children with hyponatremic dehydration, which is lower than our findings, possible reason for this may be the major chunk of studied population comprised of isonatremic (143/166, 71.5%) and hyponatremic (44/166, 22%) dehydration.<sup>14</sup> Clinical features of isonatremic and hyponatremic dehydrated patients could not be evaluated in this study and may be a way forward for upcoming studies. Furthermore mortality and final outcome has not been addressed in this study.

## CONCLUSION

Significant proportion of children with acute watery diarrhea had hypernatremic dehydration (n=26/155, 16.8%) and the frequent clinical features among these children were vomiting, oliguria, seizures and coma. It warrants routine electrolyte monitoring of children presenting with acute diarrhea particularly those presenting with oliguria, seizures and vomiting so that early identification of hypernatremic dehydration and timely intervention can improve the case outcome.

**Limitation of Study:** Sample size was small. Additionally outcome and clinical spectrum of children with diarrhea having isonatremia and hyponatremia was not determined.

**Funding and conflict of interest:** This was not a funded study and authors declare no conflict of interest

### Authors' affiliation

**Nabeela Zia,**

Department of Pediatrics, Children's Hospital, Lahore

**Sana Jamil,**

Department of Pediatrics, Al-Aleem Medical College, Gulab Devi Teaching Hospital, Lahore

**Misbah Noor, Sadia Shabir, Shaffaq Aziz**

Department of Pediatric Medicine, King Edward Medical University/Mayo Hospital, Lahore

## REFERENCES

1. Diarrhoeal disease WHO 02 May 2017 <https://www.who.int/news-room/fact-sheets/detail/diarrhoeal-disease>
2. Farthing M, Salam M, Lindberg G, Dite P, Khalif I, Salazar-Lindo E, et al. Acute diarrhea in adults and children. *J Clin Gastroenterol.* 2013; 47(1):12- 20.
3. WHO Guidelines. Acute diarrhea in adults and children A global perspective. UK: Lippincott Williams & Wilkins; 2013 p. 12-20.
4. Greenbaum LA. Electrolyte and acid-base disorder. 20<sup>th</sup> Ed. In: Kliegman RM, Stanton BF, St Geme JW, Schor NF, editors. *Nelson Textbook of pediatrics.* Philadelphia: Saunders (2016).p:499-543
5. Mohammad Tinawi. Hyponatremia and Hypernatremia: A Practical Guide to Disorders of Water Balance. *Archives of Internal Medicine Research* 3 (2020): 074-095
6. Dehydration: Isonatremic, Hyponatremic, and Hypernatremic Recognition and Management. *Pediatrics in Review* Jul 2015, 36 (7) 274-285; DOI: 10.1542/pir.36-7-274
7. Shahrin L, Chisti MJ, Huq S, Nishath T, Christy MD, Hannan A, et al. Clinical manifestations of hyponatremia and hypernatremia in under-five diarrheal children in a diarrhea hospital. *J Trop Pediatr.* 2016; 62(3):206-12.
8. Ahmad MS, Wahid A, Ahmad M, Mahboob N, Mahmood R. Prevalence of electrolyte disorders among cases of diarrhea with severe dehydration and correlation of electrolyte levels with age of the patients. *J Coll Physicians Surg Pak* 2016; 26(5):394-8.
9. Bhat SR, Lewis P, David A, Liza SM. Dehydration and hypernatremia in breast-fed term healthy neonates. *Indian J Pediatr* 2006;73(1):39-41
10. Hariram T, Naidoo KL, Ramji S. Hypernatremic Dehydration in Infants with Acute Gastroenteritis at King Edward VIII Hospital, Durban, South Africa. *SAJCH* 2018; 12(1):10-14.
11. Shahrin L, Chisti MJ, Huq S, Nishath T, Christy MD, Hannan A, et al. Clinical manifestations of hyponatremia and hypernatremia in under-five diarrheal children in a diarrhea hospital. *J Trop Pediatr.* 2016; 62(3):206-12.
12. Soleimani A, Foroozanfard F Tamadon MR. Evaluation of water and electrolytes disorders in severe acute diarrhea patients treated by WHO protocol in eight large hospitals in Tehran; a nephrology viewpoint. *J Renal Inj Prev.* 2017; 6(2):109-12.
13. Bhat SR, Lewis P, David A, Liza SM. Dehydration and hypernatremia in breast-fed term healthy neonates. *Indian J Pediatr* 2006;73(1):39-41
14. Dastidar RG, Konar N. A Study of Electrolyte Disturbances in a Child Presenting with Acute Gastroenteritis, with Special Emphasis on Hyponatremic Dehydration-A Hospital based Cross-Sectional Study. *Pediatr Ther J.* 2017; 7: 322. doi:10.4172/2161-0665.1000322