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Original Research Article

Frequency of Hyponatremic Dehydration in Children (02–60 Months) With Acute Watery Diarrhea in a Tertiary Care Hospital

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Abstract: *Acute watery diarrhea remains a major cause of fluid and electrolyte imbalance in young children, particularly in low-resource settings. Hyponatremic dehydration is a clinically important complication that may worsen outcomes if not identified early. Determining its frequency may help improve timely diagnosis and management.* ***Objective:*** *To find out the frequency of hyponatremic dehydration in children with acute watery diarrhea.* ***Methods:*** *This cross-sectional study was conducted in the Department of Pediatrics at Saidu Group of Teaching Hospital, Swat, from 06-January-2025 to 06-April-2025. A total of 194 children aged 2 to 60 months were selected for this study who presented with acute watery diarrhea, defined as three or more loose or watery stools within 24 hours lasting <14 days. Children with pneumonia and severe comorbidities were excluded. All the children were assessed for hyponatremic dehydration, which was diagnosed if the sodium concentration was < 135 mEq/L. Data was analyzed with SPSS 27.* ***Results:*** *The mean age of 194 children with acute watery diarrhea was 30.45±17.37 months, with a sodium concentration of 137.46±5.47 mEq/L. The majority of the patients were male, 121 (62.4%). Mostly were from a lower socioeconomic background, 92 (47.4%). The frequency of hyponatremic dehydration was 61 (31.4%) among these children.* ***Conclusion:*** *The present study observed that the frequency of hyponatremic dehydration in children with acute watery diarrhea was 61 (31.4%).*

Keywords: Sodium concentration, Hyponatremia, Dehydration, Acute diarrhea, Paediatrics

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Introduction

Acute gastroenteritis is a leading cause of paediatric hospital admissions worldwide. Especially in low-income countries, it continues to be the primary contributor to childhood morbidity and mortality. Fluid reduction following the diarrhoea, irrespective of its aetiology, may give rise to serious complications requiring inpatient care and, in serious circumstances, may prove fatal if not rapidly and suitably managed. The spectrum of infectious agents, including bacterial and viral pathogens, is associated with the progression of diarrhoeal illness and the subsequent risk of dehydration (1-3). The pathophysiology of diarrhoea is mainly described by two mechanisms, i.e., damage to the intestinal villous brush border and toxin-mediated secretory processes. Such mechanisms lead to substantial intestinal fluid secretion that surpasses the gastrointestinal tract's absorptive capacity. However, diarrhoeal disease remains common as there has been a visible reduction in children with paediatric clinics with diarrhoea and associated complications in recent years (4,5).

Oral rehydration solution (ORS) has considerably reduced mortality from diarrhoeal illnesses. The sodium-glucose co-transport system within the intestinal mucosa remains intact in cases of profuse diarrhoea, thus permitting effective electrolyte absorption when ORS is administered. Uncomplicated diarrhoea among children is characterised by increased stool frequency and altered stool consistency, along with nausea and abdominal discomfort (6). In the absence of suitable management, progressive dehydration may occur, resulting in hypovolaemic shock. Neurological features may also improve in severe cases. Adverse outcomes for untreated diarrhoea, such as dehydration and electrolyte disturbance, are marked in children under five years of age.

Hyperkalaemia and hypernatraemia are comparatively not frequent in this setting (6,7). Prompt recognition of electrolyte disturbances is vital, as is the needful replacement of sodium and potassium deficits to re-establish physiological balance. Hospitalised patients managed with intravenous fluids may be at increased risk of hypernatraemic dehydration, underscoring the importance of careful fluid selection and monitoring (8-10).

Hyponatremic dehydration in children with acute watery diarrhea poses substantial clinical challenges and is a critical concern in pediatric healthcare. Due to the paucity of local literature on this subject, the goal of this study is to determine the frequency of hyponatremic dehydration in children with acute watery diarrhea in our hospital setting. This study seeks to develop targeted interventions to improve early detection and treatment, with the ultimate goal of reducing morbidity and mortality linked to acute watery diarrhoea in children.

Methodology

This cross-sectional study was conducted in the Department of Pediatrics at Saidu Group of Teaching Hospital, Swat, from 06-January-2025 to 06-April-2025, after obtaining ethical approval from the hospital's IRB. The study enrolled 194 patients. The sample size was calculated using the WHO sample size calculator, keeping the following parameters: frequency of hyponatremic dehydration (30.77%) in children with acute watery diarrhea, (10) absolute precision 6.5%, and confidence level 95%. Consecutive non-probability sampling was used to select patients.

Patients aged 2 to 60 months, of either gender, who were presenting with acute watery diarrhea, which was defined on the basis of clinical assessment observing three or more loose or watery stools within 24 hours, lasting < 14 days, accompanied by all of the following symptoms such as abdominal pain (VAS>3), nausea, vomiting, and fever (Body temperature > 38.5 oC).

Children with pneumonia, already on treatment, and those with serious comorbid conditions were excluded from the study.

Children who met the selection criteria for this research were included, following a thorough explanation of the study's objective and advantages to parents/attendants. They were assured that their participation in this research initiative posed no associated risks. Baseline demographics,

including age, weight, gender, maternal literacy status, maternal employment status, socioeconomic status, and residential area, were recorded. Children diagnosed with acute watery diarrhea were examined for hyponatremic dehydration, for which 3mL of blood was taken from the arm of the children using a needle and collected in a sterile container for laboratory assessment. Children were labelled positive for hyponatremic dehydration if the sodium concentration was < 135 mEq/L. The comprehensive evaluation was carried out under the supervision of a consultant with at least 5 years of experience following the completion of a fellowship. A predetermined, structured proforma was utilised to record each patient's information.

The analysis and entry of data were conducted utilising IBM SPSS 27 software. Mean and SD were calculated for numerical variables such as age, weight, and sodium concentration. Frequencies and percentages were used for categorical variables, including gender, hyponatremic dehydration, maternal literacy status, maternal employment status, socioeconomic status, and residence area. Hyponatremic dehydration was stratified by age, gender, weight, maternal literacy status, maternal employment status, socioeconomic status, and residence area to assess effect modifiers. Post-stratification chi-square or Fisher's exact test was performed by using a p-value < 0.05 as significant. All results were shown in the form of tables.

Results

194 children presenting with acute watery diarrhea were enrolled in this study. Their mean age was 30.45±17.37 months. Their mean weight was 12.34±4.68 kilograms. The mean serum sodium concentration of these children was 137.46±5.47 mEq/L. (Table 1)

Gender distribution showed that 121 (62.4%) were male and 73 (37.6%) were female. Regarding socioeconomic status, the majority of the children, 92 (47.4%), belonged to the lower class, and 71 (36.6%) belonged to the middle class. Maternal literacy status showed that 86 (44.3%) mothers were literate, while 108 (55.7%) were not literate. The majority of children belonged to rural areas, 109 (56.2%) (Table I). Hyponatremic dehydration was observed in 61 (31.4%) children (Table 2). Stratification of hyponatremic dehydration by various demographic parameters is presented in Table 3.

Table 1: Demographic profile of the patients

		(n)	%
Gender	Male	121	62.4%
	Female	73	37.6%
Socioeconomic status	Lower class	92	47.4%
	Middle class	71	36.6%
	Upper class	31	16.0%
Maternal literacy status	Literate	86	44.3%
	Illiterate	108	55.7%
Maternal employment status	Employed	78	40.2%
	Unemployed	116	59.8%
Residence area	Rural	109	56.2%
	Urban	85	43.8%

Table 2: Frequency of hyponatremic dehydration

		(n)	%
Hyponatremic dehydration	Yes	61	31.4%
	No	133	68.6%

Table 3: Stratification of hyponatremic dehydration with demographic parameters

Parameters		Hyponatremic dehydration				P value
		Yes		No		
		(n)	%	(n)	%	
Age distribution (Years)	2 to 12	16	26.2%	23	17.3%	0.35
	13 to 36	22	36.1%	53	39.8%	
	> 36	23	37.7%	57	42.9%	
Weight (kg)	5 to 15	40	65.6%	98	73.7%	0.24
	> 15	21	34.4%	35	26.3%	
Gender	Male	39	63.9%	82	61.7%	0.76
	Female	22	36.1%	51	38.3%	
Socioeconomic status	Lower class	28	45.9%	64	48.1%	0.35
	Middle class	26	42.6%	45	33.8%	
	Upper class	7	11.5%	24	18.0%	
Maternal literacy status	Literate	23	37.7%	63	47.4%	0.20
	Illiterate	38	62.3%	70	52.6%	
Maternal employment status	Employed	28	45.9%	50	37.6%	0.27
	Unemployed	33	54.1%	83	62.4%	
Residence area	Rural	33	54.1%	76	57.1%	0.69
	Urban	28	45.9%	57	42.9%	

Discussion

The occurrence of sodium disturbances in children presenting with acute diarrhea has been reported in several studies in different regions and healthcare settings. A study conducted in Pakistan by Khan et al. reported a relatively low frequency of hyponatraemia, 4.18%(11). In contrast, a study from Bangladesh by Ara et al. reported sodium disturbances in 41.3% of children, with hyponatraemia in 14.9% and hypernatraemia in 26.4%. (12) These differences in prevalence rates may be attributed to differences in patient selection criteria, severity of dehydration at presentation, nutritional status of the study populations, and the composition of fluids administered at home before seeking healthcare. Rashid et al. from Lahore, Pakistan, observed that among children presenting with acute watery diarrhea and dehydration, 30.86% had hyponatraemic dehydration, 61.30% had isonatraemic dehydration, and 7.82% had hypernatraemic dehydration. (13)

The frequency of hyponatraemic dehydration observed in the present study was 31.4%, which is consistent with the findings of Mishra et al. in India. They conducted a prospective study and found that hyponatraemia occurred in 37% of children presenting with acute gastroenteritis and moderate to severe dehydration, with a higher incidence noted in the younger age groups and among male children. (14) Verma et al. reported that hyponatraemic dehydration was present in 32% of children admitted with acute gastroenteritis, with males being more affected than females, and the highest incidence observed between six and twenty-four months of age. (15) Ahmad and associates reported that among children with severe dehydration, hyponatraemia was present in 10.6% of patients, while hypernatraemia affected 17.3% of their study population. (16)

The mean age of the patients in the present study was 30.45 months. Ara et al. documented that the majority of their patients were aged twelve months or younger. (12) Usman et al. reported a mean age of 35.62 months in children presenting with acute diarrhea, with 69.7% of participants aged more than two and a half years. (17) Majority of the patients in the present study were male; this aligns with the findings from Khan et al., who reported that 69.25% of their patients were male, while Ara et al. reported male predominance in 62% of cases. (11,12) Usman et al. also observed that 61.1% of their study subjects were male. (17)

In the present, that 47.4% children belonged to the lower socioeconomic class, and 55.7% had illiterate mothers. These findings are in alignment with the study by Khan and colleagues, who reported that 73.13% of children with acute diarrhea belonged to lower socioeconomic status. (11) Usman reported that 41.1% of mothers of the patients were illiterate, 46.9% of children resided in rural areas, and hand pumps served as the source of drinking water for 46.3% of families. (17)

The mean serum sodium concentration of 137.46 mEq/L observed in the present study is consistent with that of Usman et al., who documented a mean serum sodium level of 138.24 mEq/L in children with acute diarrhea. (17) These findings underscore the potentially serious consequences of electrolyte disturbances and emphasise the importance of early recognition and appropriate management.

Conclusion

In conclusion, the present study found that the frequency of hyponatremic dehydration in children with acute watery diarrhea was 61 (31.4%). In contrast, the majority of the children belonged to the lower socioeconomic spectrum. Early recognition of hyponatraemic dehydration through prompt serum electrolyte assessment and appropriate rehydration therapy should be emphasised in all children presenting with acute watery diarrhea.

Declarations

Data Availability statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (227-ERB/024)

Consent for publication

Approved

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Not applicable

Conflict of interest

The authors declared no conflict of interest.

Author Contribution

FK (Postgraduate Resident)
Manuscript drafting, Data Collection, Study Design,
SMK (Associate professor)
Review of Literature, Data entry, Data analysis, and Conception.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the study's integrity.

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