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Original Research Article

A Study of Clinical Profile and Biochemical Changes in Children with Acute Diarrhoea

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Abstract

Background: Diarrhoea is a prevalent clinical condition seen in medical practice, contributing significantly to child mortality rates in India, with an estimated 1.5 million deaths annually. Prompt recognition of heightened clinical suspicion and a comprehensive understanding of dehydration types are vital in averting fatalities. This study aims to explore the biochemical alterations and electrolyte imbalances in pediatric acute diarrhoea cases.

Methods: A two-year prospective study, with ethical approval, was conducted at a tertiary care Medical college . Children exhibiting signs of moderate to severe dehydration were included. Clinical data and pertinent biochemical investigations, including serum electrolytes, were collected and analyzed.

Results: A total of 90 cases of pediatric diarrhoea were included in the study. Children under 5 years old constituted the most prevalent age group (33.33%), The common clinical symptoms were increased stool frequency (diarrhea) was universal (100%). Vomiting (71.11%), fever (47.78%), dehydration symptoms (increased thirst, dry tongue), and signs of circulatory compromise (tachycardia) were frequently observed. Over half the patients (58.89%) had normal nutritional status. Electrolyte imbalances were prevalent (80% of cases). Hyponatremia (low sodium), either alone or combined with hypokalemia (low potassium), was the most frequent disturbance.

Conclusions: This study highlights the diverse clinical presentations of pediatric diarrhoea. Beyond increased stool frequency, various symptoms, dehydration signs, and potential associations with malnutrition and electrolyte imbalances were identified. Among the electrolyte abnormalities commonly observed in diarrhoeal cases, hyponatremia, hypokalemia, and their combination are significant.

Keywords: Dehydration, Diarrhea, Hypokalemia, Hyponatremia.

Introduction

Diarrhoea stands as one of the most frequently encountered clinical conditions in medical practice, particularly impactful as a leading cause of mortality and morbidity among children in developing nations. In India alone, an estimated 1.5 million children succumb to acute diarrhoea annually, underscoring the gravity of this health concern [1]. According to WHO estimates, a child loses their life to diarrhea every six seconds. This condition is characterized by loose or watery stools occurring at least thrice daily, surpassing an individual's normal frequency [2]. Alarmingly, 80% of these fatalities affect children under the age of two. The National Institute of Cholera and Enteric Diseases, Kolkata, reports a crude death rate of 9.3 per 1000 population due to diarrhoea in rural India, with diarrheal deaths comprising 22% of all rural deaths among children aged 0 to 6 years [3]. The disproportionate burden of diarrheal fatalities in developing regions is linked to factors such as high rates of malnutrition, poor sanitation practices, limited education, heightened susceptibility to infections, and premature cessation of breastfeeding, often replaced by inappropriate substitutes [3]. A significant majority—more than 90%—of acute diarrhoea cases stem from infectious agents, bacterial or viral. The primary cause of death in acute diarrhea is the excessive loss of fluids and electrolytes, leading to dehydration and acidosis. However, the majority of

these deaths are preventable through timely and adequate replacement of fluids and electrolytes. Oral rehydration therapy, utilizing glucose-electrolyte solutions, has been instrumental in saving countless lives and remains the cornerstone of treatment for acute watery diarrhoea.

Therefore, it becomes imperative for healthcare practitioners to promptly recognize signs and symptoms of dehydration and electrolyte imbalances to avert fatalities associated with diarrhoea. Particularly in resource-limited settings prevalent in developing countries, where laboratory facilities for identifying electrolyte disturbances may be lacking or delayed, a keen clinical acumen, coupled with a high index of suspicion, is indispensable. Understanding the diverse clinical presentations of dehydration is paramount in effecting timely interventions to prevent fatalities [4].Given the absence of recent local studies on electrolyte disturbances, the present study aims to fill this gap by focusing on delineating the biochemical alterations and electrolyte imbalances in children presenting with acute diarrhoea at a tertiary care center.

Material and Methods

The prospective study was carried out in Medical College hospital and was in adherence to their guidelines was ensured. A total of 90 cases involving children presenting with acute gastroenteritis in the emergency department and outpatient department of Medical college were included in the study.

Inclusion criteria encompassed children aged between 1 month and 14 years. Detailed patient histories, including stool frequency, consistency, and urine output in the preceding 24 hours, were obtained from parents or caregivers. Clinical examinations, focusing on dehydration severity, altered consciousness, and malnutrition grade, were conducted by senior pediatricians, following WHO criteria for dehydration assessment. Cases meeting criteria such as moderate/severe dehydration, frequent large loose stools, vomiting, and altered consciousness were included. Exclusion criteria comprised cases with blood in stools, those requiring intravenous rehydration, or who had not received oral rehydration salts. Blood samples were collected before rehydration for clinical biochemistry analysis.

Informed consent was obtained from all participants or their legal guardians, and detailed explanations of the study were provided. Baseline hematological and biochemical investigations, including hemoglobin levels, erythrocyte sedimentation rate, total cell counts, platelet counts, blood sugar, urea, electrolytes (calcium, sodium, potassium), and serum creatinine, were conducted. Cases were managed according to WHO guidelines and discharged accordingly. Those who did not complete treatment or withdrew consent were excluded from the analysis. Hyponatremia was defined as <135mmol/l, hypernatremia as >145mmol/l, hypokalemia as <3.5mmol/l, hyperkalemia as >5.5mmol/l, and normal creatinine levels varied according to age groups.

Statistical analysis: Data were recorded on a predefined questionnaire and subsequently analyzed using Microsoft Excel. Statistical analysis involves tabulation of data and calculation of mean and median values for continuous variables. The categorical variables were determined by chi-square test and values of p (<0.05) were considered as significant.

Results

A total of 90 cases were included in the study. Table 1 describes the age breakdown of pediatric patients included in the study. Age Groups: The table categorizes patients into four age groups: 1 month to 5 years, greater than 5 years to less than 10 years, greater than 10 years to less than 15 years, and greater than 15 years. The majority of cases (33.33%) fall within the 1-month to 5-year age group. Children above 5 years old comprised roughly two-thirds of the study population (67.78%).There's a slight majority of males (57.78%) across all age groups. However, this difference is not substantial within any specific age range.

Table 1: Age distribution of 90 Pediatric cases of diarrhoea included in the study.

Age group	Male	%	Female	%	Total	%
1 month-5 years	17	32.69	13	34.21	30	33.33
>5 years - 10 years	15	28.84	14	36.84	29	32.22
>10 years-<13 years	10	19.23	07	18.42	17	19.89
>13 - 14 years	10	19.23	04	10.53	14	15.56
Total	52	57.78	38	42.22	90	100.00

Table 2 shows the frequency and percentage of various clinical symptoms observed amongst the 90 pediatric patients involved in the study on childhood diarrhoea. Universal Symptom: Increased stool frequency (diarrhea) was the only symptom reported in 100% of the cases, as expected for a study on this condition. Frequent Symptoms: Following diarrhea, the most commonly reported symptoms were vomiting (71.11%), fever (47.78%), dehydration symptoms

like increased thirst (33.33%) and dry tongue (66.67%), and signs of circulatory compromise like tachycardia (rapid heart rate) in 22.22% of cases. Less Frequent Symptoms: Slow skin retraction (a sign of dehydration) was observed in over half the cases (61.11%), while tachypnea (rapid breathing) was present in 47.78%. Sunken eyeballs (another dehydration indicator) were seen in 37.78% of patients. Rare Symptoms: Altered sensorium (altered mental state) was a rare finding, occurring in only 8.89% of cases. While increased stool frequency is the defining feature, additional symptoms like vomiting, fever, and dehydration indicators are frequently observed. The presence of altered sensorium in a small number of cases suggests the potential for severe complications in some patients.

Table 2: Clinical symptoms associated with 90 Cases of Pediatric diarrhoea in the study.

Symptoms	Frequency	Percentage %
Increased frequency of stool	90	100.00
Vomiting	64	71.11
Fever	43	47.78
Increased thirst	30	33.33
Tachycardia	20	22.22
Slow retraction of skin	55	61.11
Tachypnoea	43	47.78
Dry tongue	60	66.67
Altered sensorium	08	88.89
Sunken eyeball	31	37.78

Table 3 describes the nutritional status of the 90 children with diarrhea included in the study, categorized using Protein-Energy Malnutrition (PEM) grades.Normal:53 patients (58.89%) had normal nutritional status. Mild Malnutrition (Grade I): 16 patients (17.78%) fell under this category, indicating slight weight loss or stunting without significant edema or muscle wasting. Moderate Malnutrition (Grade II): 10 patients (11.11%) had more noticeable weight loss or stunting, with the potential for moderate edema or muscle wasting. They might exhibit some nutritional deficiencies but maintain relatively normal function. Severe Malnutrition (Grade III): 9 patients (10.00%) showed significant weight loss or severe stunting, along with pronounced edema and muscle wasting. These individuals might experience severe weakness, fatigue, and compromised immune function. Kwashiorkor (Grade IV): No cases (0%) were classified as Kwashiorkor, a severe form with edema and minimal weight loss, typically caused by protein deficiency. Marasmus (Grade V): No cases (0%) were identified with Marasmus, another severe form characterized by extreme wasting and minimal edema, often due to overall calorie deficiency.

Table 3: Grading of malnutrition of cases 90 cases of Pediatric diarrhoea included in the study.

Grade of PEM	Frequency	Percentage %
Normal	53	58.89
Grade-I (mild)	16	17.78
Grade II (moderate)	10	11.11
Grade III (severe)	09	10.00
Grade IV (very severe)	02	2.22

Table 4 depicts the prevalence of electrolyte imbalances amongst the 90 children with diarrhea involved in the study. A significant portion of the patients (20.0%) had normal electrolyte levels. Electrolyte Imbalances: The remaining cases (80%) exhibited various electrolyte abnormalities. Hyponatremia (low sodium) was the most frequent disturbance, either in isolation (33.33%) or combined with hypokalemia (low potassium) (33.33%). Hypokalemia by itself occurred in 27.78% of cases. Hypernatremia (high sodium) was less frequent, seen in isolation (8.89%) or combined with hypokalemia (6.67%).Notably, no cases were identified with isolated hyperkalemia (high potassium) or the combination of hypernatremia and hyperkalemia. Electrolyte imbalances were prevalent among these pediatric diarrhea patients. Hyponatremia, with or without hypokalemia, emerged as the most common abnormality. This highlights the potential for diarrhea to cause significant fluid and electrolyte imbalances, requiring careful monitoring and management.

Table 4: Biochemical alterations among the 90 cases of Pediatric diarrhoea cases in the study.

Type of Biochemical disturbance	Frequency	Percentage %
Isolated Hyponatremia	30	33.33
Isolated Hypokalemia	25	27.78
Isolated Hypernatremia	08	8.89
Isolated Hyperkalemia	00	00.00
Hyponatremia+ Hypokalemia	30	33.33
Hyponatremia+ Hyperkalemia	07	7.78
Hypernatremia+ Hypokalemia	06	6.67
Hypernatremia+ Hyperkalemia	00	00.00
Normal electrolytes	18	20.0

Discussion

The important findings of this study were Children under 5 years old constituted the most prevalent age group (33.33%), but all age groups (1 month to 14 years) were represented. The common clinical symptoms were increased stool frequency (diarrhea) was universal (100%). Vomiting (71.11%), fever (47.78%), dehydration symptoms (increased thirst, dry tongue), and signs of circulatory compromise (tachycardia) were frequently observed. Altered sensorium, a sign of potentially severe complications, was uncommon (8.89%). Over half the patients (58.89%) had normal nutritional status. The remaining cases exhibited varying degrees of malnutrition (41.11%), with a distribution across mild, moderate, and severe categories. This highlights the potential for a two-way relationship between diarrhea and malnutrition. Electrolyte imbalances were prevalent (80% of cases). Hyponatremia (low sodium), either alone or combined with hypokalemia (low potassium), was the most frequent disturbance. Acute diarrheal disease represents a significant public health challenge, particularly as a prominent cause of morbidity and mortality among pediatric populations. Annually, it accounts for a staggering 1.5 billion episodes worldwide, leading to 1.5-2.5 million deaths in children under the age of 5. In developing nations, children under 5 experience a median of 3.2 episodes of diarrhea per year, with a mortality rate of 4.9 per 1000 episodes, contributing to 21% of all deaths in this age group [2]. This study enrolled a total of 250 cases, with males comprising the majority at 57.6%. The predominant age group was between 1 month and 5 years, accounting for 84 cases (33.6%), aligning with the observations from various studies globally that also highlight a male predominance. For instance, Behera et al. [5] reported a higher incidence of 48%, indicating variability in the incidence of acute gastroenteritis across different regions of India, influenced by varying levels of hygiene and public awareness.

All cases presented with varying frequencies of loose motions, averaging 8.12 per day. This observation mirrors findings from Subbarao SD et al. [6] where vomiting occurred in 71% of cases, with 3-4 episodes per day. Malnutrition was noted in 42% of cases in our study, consistent with Deivanayagam et al.'s [7] report of a 52% incidence in their study. Electrolyte abnormalities were observed in 80.8% of cases in our study, akin to Shah GS et al.'s [7] findings of 84% in their study. The most common electrolyte abnormality in our study group was isolated hyponatremia and combined hyponatremia with hypokalemia (33.6%), aligning closely with Purohit KR et al.'s [8] report of 39% of cases with isolated hyponatremia in their study. Increased frequency of diarrhea, heightened thirst, more frequent vomiting episodes, and altered sensorium were associated with hyponatremia in our study, consistent with clinical findings reported across various studies. The incidence of hypokalemia was 27.2% in our study, akin to Ahmed I etal.'s[10] findings in their study. Hypernatremia was observed in 9.6% of cases in our study, similar to Samadi AR et al.'s [11] report of a 12% incidence in their study. However, some studies have reported higher incidences, ranging from 18% to 22% of hypernatremia. Notably, our study did not observe any cases of isolated hyperkalemia, while most studies reported incidences ranging from 4% to 8% in their findings.

Conclusion

This study highlights the diverse clinical presentations of pediatric diarrhoea. Beyond increased stool frequency, various symptoms, dehydration signs, and potential associations with malnutrition and electrolyte imbalances were identified. Among the electrolyte abnormalities commonly observed in diarrheal cases, hyponatremia, hypokalemia, and their combination are significant. These findings emphasize the importance of considering these factors for comprehensive diagnosis, treatment planning, and potentially preventing complications in children with diarrhoea.

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