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Original Article

Hypokalemia among Children Having Acute Malnutrition with Diarrhea

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ABSTRACT

Diarrhea is one the most common symptoms encountered in emergency department in children specially and needs prompt management. There are many disastrous complications and hypokalemia is one and most important of them. Hypokalemia warrants urgent diagnosis and expert management. **Objective:** To determine the frequency of hypokalemia among children having acute malnutrition with diarrhea. **Methods:** This cross-sectional study was done in Department of Pediatrics, Khairpur Medical College from 1st November 2021 to 30th April 2022. A total of 134 patients fulfilling the inclusion criteria were included. Informed consent was taken from attendants. The data were collected on prepared proforma. **Results:** There were 134 patients in this study with The mean age of the cases was 2.4 ± 3.13 years. Male children 84 (62.6%) and were in majority while females comprising of 50(37.3%). Frequency of hypokalemia was 57 (42.5%). **Conclusions:** Our results showed that children with acute diarrhea and dehydration have an increased risk of developing hypernatremia and hypokalemia. Significant correlations were found between electrolyte imbalance and mortality.

INTRODUCTION

Diarrhea is one of the leading risk factors that is regarded as major factor for mortality and morbidity of childhood age especially under 5 years. Four million deaths occur each year in under-five children. An average of 3.3 episodes each year per child occur worldwide, but in certain areas this average exceeds nine episodes each year. Acute watery diarrhea is defined as abrupt onset of 3 or more stools per day and last up to 14 days and is due to imbalance of physiology of small intestine and large intestine and process involved in the absorption of ions, organic substrate and water [1]. There are different underlying causes usually in acute and chronic. Diarrhea leads to malabsorption and results into malnutrition if persist for longer time. Dehydration is important cause of mortality, depressed consciousness and depressed sunken fontanel [2, 3]. The clinical presentation of diarrhea depends upon its cause and host response. The common cause is infection mostly because of *salmonella*, *shigella*, *campylobacter* or rotavirus. Chronic diarrhea if not treated may result in severe malnutrition or failure to thrive despite of taking normal diet and has severe implication [4, 5]. Workup usually targets the presentation essentially labs

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that include blood test for leukocytes. Cultures for organisms and immunoassay for viruses. Other labs may include ultrasound abdomen, endoscopy and biopsy if required. In a study in US which enrolled 604 children of age between 3-36 months in community settings before introduction of rotavirus virus vaccine found highest incidence of acute watery diarrhea [6, 7]. One of the important and disastrous impact of diarrhea is electrolyte imbalance among that hypokalemia is the most important is hypokalemia and needs immediate attention for diagnosis and management [8]. Presentation of hypokalemia ranges from weakness and fatigue to muscle cramps and heart block. Psychological manifestation includes psychosis, delirium, hallucination and depression. Muscle weakness from hypokalemia may manifest as dyspnea, abdominal distension and frank paralysis. Replacing electrolytes is early and needs expert attention in emergency department or ICU care. Replacement may be oral or intravenous according to level and severity of patient. Ongoing potassium losses should be taken in consideration while replacing the deficit oral potassium chloride is replenished initially and larger doses can be given safely while intravenous replacement is second step and during that ECG monitoring and close follow up required as there are chances for development of cardiac arrhythmias. Serial monitoring for potassium for every hourly and then three hourly for inpatient is required. Due to paucity of local data that were needed for local guidelines. So, we had designed the study to determine the frequency of hypokalemia among children having acute malnutrition with diarrhea [9].

METHODS

This cross-sectional study was done at Khairpur Medical College, at Khairpur Mir in the duration from 1st November 2021 to 30th April 2022. The sample size was determined using WHO calculator with 7% error margin having 90% confidence interval and the frequency of hypokalemia in acute malnutrition accompanied with diarrhea (40%), calculated as 134. So, we included 138 children aged six months to 59 with malnutrition having acute diarrhea fulfilling the inclusion criteria using Non-Probability, Consecutive Sampling. Malnutrition as defined as edema [bilateral pitting of the foot], a low W/H ratio, and a MUAC are diagnostic markers [mid-upper arm circumference] and acute diarrhea where symptoms lasting less than 15 days. While hypokalemia is defined as potassium level less than 3.5mEq/L. Chronic, bloody diarrhea, necrotizing enterocolitis, congenital illnesses such as Cystic Fibrosis, or acute renal failure or any child who is currently receiving immunosuppressive or steroid medication in children, were not included in this study. After getting permission from ethical committee and informed consent from parents was taken by explaining benefits of the study children's comprehensive demographic information was gathered. By using sterile syringe 5ml of blood is taken and sent for analysis. SPSS version 22 was used for all analyses. The average and standard deviation of the serum K concentration were determined using descriptive statistics. Categorical variables such as gender, age range, and weight and serum potassium concentration were analyzed using frequency and percentage distributions. Statistical significance was assumed when the p-value was less than 0.05.

RESULTS

There were 134 patients enrolled in this study. Majority were males, 84(62.6%) as compare to females, 50(37.3%). The mean age of the cases was 2.4 ± 3.13 years. Mean weight was 5.7 ± 6.4 kg. Majority of children 82(61.1%) belonged to urban areas while 52(38.8%) cases had rural residency as shown in table 1.

Variable	Frequency (%)
Gender	
Male	84(62.6)
Female	50(37.3)
Residence	
Urban	82(61.1)
Rural	52(38.8)
Age Mean (years)	2.4 ± 3.13
Weight Mean (kg)	5.7 ± 6.4

Table 1: Distribution of demographic and clinical characteristics of the study sample

Hypokalemia was observed in 57(42.5%) children as shown in figure 1.

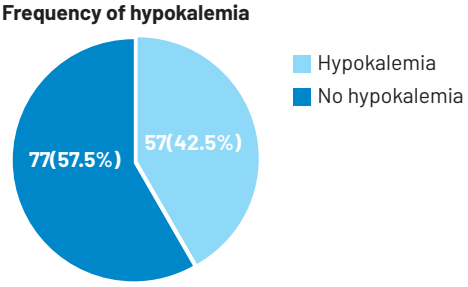

Figure 1: Frequency of hypokalemia

DISCUSSION

Electrolyte imbalance is always devastating especially in children having malnutrition which goes hand by hand with poverty because of poor hygiene and water and sanitary problems. Electrolyte imbalance is almost always lethal presentation during diarrhea. Acute diarrhea is extremely common and usually due to fecal-oral transmission of bacteria, their toxins, viruses or parasites. Infective diarrhea is usually short lived and patients who present

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with a history of diarrhea lasting more than 10 days rarely have an infective cause [10, 11]. A variety of drugs, including antibiotics, cytotoxic drugs, Proton Pump Inhibitors (PPIs) and Non-Steroidal Anti-Inflammatory Drugs (NSAIDs), may be responsible for acute diarrhea. The most common chronic diarrhea cause is irritable bowel syndrome which can present with increased frequency of defecation and loose, watery or pellet stools. Other causes may include chronic pancreatitis, cancer of pancreas, cystic fibrosis and coeliac disease [12, 13]. Children underlying malnutrition needs to evaluate children nutritional status and identification of underlying etiology of malnutrition. In mild to moderate cases of malnutrition initial assessment and intervention may be done as outpatient. Micronutrient deficiencies must be corrected for child to attain appropriate growth and development. Children commonly have protein energy malnutrition and present with poor weight gain, slow growth and behavioral changes like irritability, apathy and decrease social responsiveness. Deficiency of different substances like iron that leads anemia, headache and glossitis, while iodine causes goiter and developmental delay. Zinc deficiency may cause decrease immune response, anemia and delayed wound healing [14]. Our study included 134 patients where majority were males 84(62.6%) and female comprising of 50(37.3%). Similarly, male-dominant pattern was observed in several other studies like 57% (57/100) males in a study by Memon *et al.*, [15] and 64.4% (58/90) in a study by Zulqarnain *et al.*, [6], although possible explanation for male predominance is not known. The Mean age of the cases was 2.4 ± 3.13 years. Mean weight was 5.7 ± 6.4 kg. Majority of the children 82(61.1%) belongs to urban areas while 52(38.8%) cases had rural residency. Hypokalemia was observed in 57(42.5%) with insignificant p-value. Out of 57 cases of hypokalemia, majority was observed in male children 38 (66.66%), this may be due to more male children were in study. Whereas hypokalemia was more seen patients from rural areas 36(63.15%), these findings may be because of lower literacy rate in rural areas that possibly result in to unaware of the composition of balance needed for serum electrolyte imbalance. our finding of hypokalemia is little lower than the study by Memon *et al.*, who found hypokalemia 62.5% children with malnutrition with diarrhea and the frequency was lower around 22.2% in group of children who was having diarrhea with no malnutrition [15]. Study by Gangaraj *et al.*, [11] observed hypokalemia in 61.22% (30/49) of malnourished children with diarrhea. In another study they found little lower frequency around 40%, it may be because of lower sample size and lower number of children with rural background. Another study by Ahmed *et al.*, observed the frequency of 25% while in a study hypokalemia reported among 47.5% of children [16]. In a study of extremely malnourished patients, diarrhea was shown to be the most prevalent illness (50.8%), while hypernatremia was found to be the most common electrolyte imbalance [17]. Hypokalemia has very devastating complication as it gets low because it prolongs repolarization phase cells results in delayed or impaired depolarization phase which is responsible for initiating contraction of a muscle that results into various effects like myalgia, fatigability and muscle weakness to paralysis. Study by Andériz *et al.*, has observed paraplegia in children with acute diarrhea because of severe hypokalemia while another study reported paralysis after acute gastroenteritis with low level of serum potassium [18, 19]. In one study comprising of 35 cases quadriparesis was observed in children after diarrhea. Other studies also found hypokalemia as major risk for morbidity and mortality after diarrhea [20].

CONCLUSIONS

Our study suggests that electrolyte imbalance is a common and devastating complication of diarrhea that needs prompt diagnosis and treatment. We suggest that more research with better study designs in terms of the nature of the study, sample size, targeted regions, and varied age groups should be conducted to explore all factors contributing to malnutrition in Pakistan. In the meantime, we recommend adopting national guidelines for the management of acute malnutrition to reduce morbidity and mortality.

Conflicts of Interest

The authors declare no conflict of interest.

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