

Status of Serum Electrolytes among Malnourished Children Presenting with Acute Diarrhea to the Emergency Department of a Teaching Hospital

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ABSTRACT

Objective: To determine the frequency of hypokalemia and hyponatremia among malnourished children presenting with acute diarrhea to the emergency department of a tertiary care hospital of Lahore.

Methodology: It was a cross-sectional study including 144 malnourished children presenting in the pediatrics emergency of Akhtar Saeed Hospital from February to August 2019. Using aseptic techniques, 5 ml of blood sample of each patient was taken and sent to the pathology laboratory for determination of serum potassium and sodium levels. The presence of hypokalemia and hyponatremia was noted in the proforma. Confidentiality of the data was ensured. Serum potassium concentration of <3.5 mmol/L was taken as hypokalemia. Serum sodium concentration of <135 mmol/L was taken as hyponatremia.

Results: The mean age of all cases was 35.84 ± 14.36 months with minimum and maximum age between 6 to 60 months. There were 84 (58.3%) male and 60 (41.7%) female cases. The mean serum sodium level was 134.82 ± 8.63 mmol/L and the mean serum potassium level was 3.20 ± 1.33 mmol/L. According to operational definition, the frequency & percentage of hyponatremia and hypokalemia was 47 (32.6%) and 86 (59.7%), respectively.

Conclusion: The current study concludes that serum electrolyte imbalances in malnourished children are significantly enhanced by an acute episode of diarrhea.

Keywords: Acute diarrhea. Hypokalemia. Hyponatremia. Malnourishment.

INTRODUCTION

Malnutrition is a major contributing factor in high childhood mortality and morbidity worldwide.¹ Malnourished children are more susceptible to other diseases like measles, chickenpox, diarrhea.² The National Nutrition Survey conducted by the United Nations Children's Emergency Fund and Government of Pakistan, showed a significant proportion of children suffering from stunting and wasting in all age groups.³ Malnutrition interacts with diarrhea in a bidirectional way.⁴ Severe prolonged episodes of diarrhea cause malnutrition in patients and on the other hand, malnourished children are more likely to develop complications with diarrhea. Many studies showed a detrimental effect of diarrhea in malnourished children. Children suffering from malnutrition already suffer from electrolyte abnormalities which worsen during an acute episode of diarrhea leading to life-threatening complications. However, literature regarding electrolyte imbalance has shown considerable variation in the frequency of hyponatremia and hypokalemia.⁵ Studies have revealed

that hyponatremia can be present in as low as 10.4% to as high as 32.5% of the children with malnutrition while hypokalemia can be present from 26.9% to 62.5% of the malnourished children suffering from an acute episode of diarrhea.^{5,6} However, the majority of these children remain unscreened for electrolyte imbalance during routine emergency practices and they are treated using a similar regimen as that of normal children which prone them to further worsening of the condition. Moreover, the variations in the frequency of electrolyte imbalance reported in the existing literature warrant further exploration according to our local population.⁶

Hyponatremia is defined as a serum sodium level less than 135 mmol/L. A serum sodium level less than 125 mmol/L is considered as severe hyponatremia. Malnourished children excrete more sodium during diarrhea and they have significantly low gut net sodium balance and diminished total body sodium balance causing hyponatremia.⁷

Severe and rapidly evolving hyponatremia may cause generalized tonic-clonic seizures when sodium concentration decreases to 115 mmol/L.² Age and gender of the patient as well as other several factors influence the clinical outcome of neurological complications of hyponatremia. Many studies have documented potassium deficiency in severely malnourished children which rises to normal levels after therapy.^{4,5}

The aim of this study was to determine the frequency of hyponatremia and hypokalemia in malnourished

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children presenting with an episode of acute diarrhea in an emergency of a teaching hospital. Educating the clinicians regarding the electrolyte status of these malnourished children suffering from diarrhea would help in timely screening and management of the child accordingly to decrease morbidity and mortality.

METHODOLOGY

It was a cross-sectional study including 144 malnourished children presented to the pediatrics emergency of Akhtar Saeed Hospital from February to August 2019. After approval by the institutional ethical committee (Letter No. ASTH/10401099, 15-01-2019), a total of 144 malnourished children presenting to the Paediatrics Emergency of Akhtar Saeed Hospital, Lahore were included in this study. A sample size of 144 cases was calculated with a 95% confidence level, 5% margin of error, and taking an expected percentage of hyponatremia as 10.4%.² Malnourished children aged between 6 months to 5 years of either gender who presented with an episode of acute diarrhea were included in this study. Children having weight less than 10th centile for age according to the Centers for Disease Control and Prevention (CDC) growth chart for both boys and girls were considered malnourished. Children with congenital anomalies, known congenital cardiac diseases, chronic diarrhea (diarrhea for more than two weeks), and receiving diuretics treatment were excluded from the study. An informed consent was taken from their parents before enrolling in the study. Information regarding their demographic data was noted in the proforma. Using aseptic techniques, 5 ml blood was drawn and sent to the pathology laboratory for determination of serum sodium and potassium levels. The presence of hypokalemia and hyponatremia was noted in the proforma. Confidentiality of the data was ensured. Serum potassium concentration of <3.5 mmol/L was taken as hypokalemia. Serum sodium concentration of <135 mmol/L was taken as hyponatremia.

STATISTICAL ANALYSIS

Data was analyzed using Statistical Package for the Social Sciences (SPSS) version 22. Numerical variables i.e. age, serum sodium, and serum potassium were summarized as mean and standard deviation. Qualitative variables like gender, presence of hyponatremia, and hypokalemia were presented as frequency and percentages. Data was stratified for age and gender and a Chi-square test was applied for stratification. A p-value ≤0.05 was taken as statistically significant.

RESULTS

The mean age of all cases was 35.84±14.36 months with minimum and maximum age between 6 to 60 months. The frequency of males and females is shown in Figure 1. The mean serum sodium levels were 134.82±8.63 mmol/L and the mean serum potassium level was 3.20±1.33 mmol/L. According to operational definition, the frequency of hyponatremia and hypokalemia was 47(32.6%) and 86(59.7%), respectively (Figure 2 & 3).

The frequency of hyponatremia was 22(46.8%) in the age group of <3 years and 25(53.2%) in cases who were ≥3 years old. The frequency of hyponatremia was statistically the same in both age groups, p-value >0.05. The frequency of hyponatremia was 27(57.4%) in male cases and 20(42.6%) in female cases. The frequency of hyponatremia was statistically the same in both genders, p-value >0.05 (Table 1).

The frequency of hypokalemia was 29(33.7%) in the age group of <3 years and 57(66.3%) in cases who were ≥3 years old. The frequency of hypokalemia was statistically higher in cases aged ≥3 years of age, p-value ≤0.05. The frequency of hypokalemia was 51(59.3%) in male cases and 35(40.7%) in female cases. The frequency of hypokalemia was statistically the same in both genders, p-value >0.05 (Table 2).

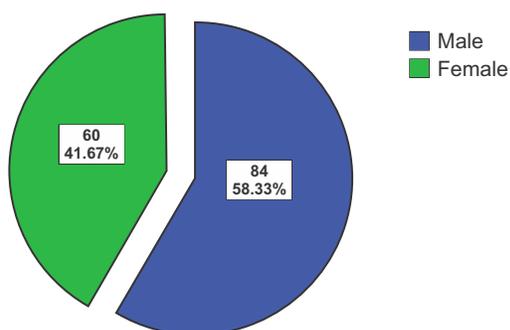


Figure 1: Gender Distribution of the Cases

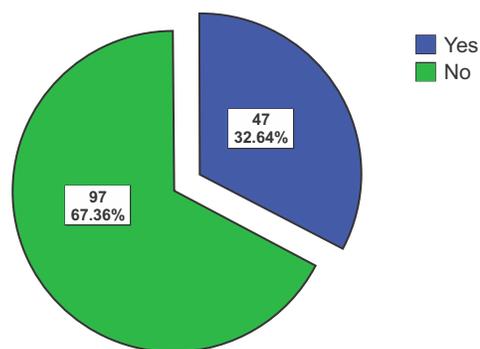


Figure 2: Frequency Distribution of Hyponatremia

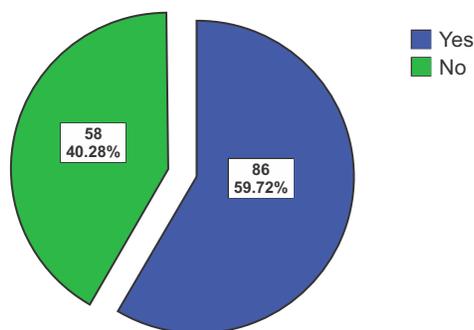


Figure 3: Frequency Distribution of Hypokalemia

Table 1: Comparison of Hyponatremia According to Age Groups & Gender

Demographic Variables		Hyponatremia		Total	p-value
		Yes	No		
Age Groups	<3 years	22(46.8%)	41(42.3%)	63(43.8%)	0.607
	≥3 years	25(53.2%)	56(57.7%)	81(56.2%)	
Gender	Male	27(57.4%)	57(58.8%)	84(58.3%)	0.881
	Female	20(42.6%)	40(41.2%)	60(41.7%)	

Table 2: Comparison of Hypokalemia According to Age Groups & Gender

Demographic Variables		Hypokalemia		Total	p-value
		Yes	No		
Age Groups	<3 years	29(33.7%)	34(58.6%)	63(43.8%)	0.003*
	≥3 years	57(66.3%)	24(41.4%)	81(56.2%)	
Gender	Male	51(59.3%)	33(56.9%)	84(58.3%)	0.774
	Female	35(40.7%)	25(43.1%)	60(41.7%)	

*Significant p-value

DISCUSSION

Diarrheal disease worldwide has a great impact on mortality and morbidity in children of age less than 5 years.⁷ Diarrhea and malnutrition interact with each other in a vicious cycle. By aggravating each other they can cause serious clinical consequences.⁸ Malnutrition contributes to 35% of the deaths in under-five age group children. Serum electrolyte disturbances are commonly found in malnourished children.⁹ While diarrhea among severely malnourished children further worsens the clinical condition by affecting serum electrolytes thus causing hyponatremia (serum sodium <130 mmol/L) and hypokalemia (serum potassium <3.5 mmol/L). Moreover, these are associated with other symptoms including

encephalopathy and seizures. If electrolyte imbalance was not identified and properly managed, children may develop neurological disorders.¹⁰

In this study, the mean age of all cases was 35.84±14.36 months with minimum and maximum age between 5 to 60 months. There were 84(58.3%) male and 60(41.7%) female cases. Similarly, another study showed males (61.3%) are more predominantly affected by diarrhea more than females (38.7%).¹⁰

According to operational definition, hyponatremia was observed in 47(32.6%) patients and hypokalemia in 86(59.7%). Raza et al. also revealed hypokalemia as most frequently reported (79.9%) in malnourished children with diarrhea while hyponatremia was found in 48.9%.⁹ Hoque et al. explored whether malnourished

children with diarrhea are more prone to electrolyte disturbance as compared to children without diarrhea. The results showed that both hyponatremia and hypokalemia were more common in malnourished children with diarrhea.¹¹

In this study mean serum potassium levels are 3.20(5.5-1.20) mmol/L and mean sodium levels 134.8(110-144) mmol/L. These serum electrolytes levels are comparable with the findings illustrated by Mosav et al. According to their results, in malnourished children with diarrhea mean sodium level was 136.61±8.85 mmol/L and its range was 116-156 mmol/L. Serum potassium was 4.2±0.64 mmol/L and it ranged from 3 to 6 mmol/L.⁸

Another cross-sectional study conducted at Military Hospital, Rawalpindi, Pakistan, included 80 patients presented with acute diarrhea. The age of the patients was 6 months to 5 years. They found hyponatremia in 26(32.5%) patients and hypokalemia was observed in 44(55%) patients.¹⁰

Moreover, the comparison of hyponatremia with age and gender showed no significant association in our study. Dastidar et al. explored electrolyte disturbances with diarrhea and also found out that there is no significant association of electrolytes abnormality with age and gender.¹² Contrarily, the frequency of hypokalemia was more in >3 year age group in our study but no gender differences were observed.

Another study concluded that in malnourished children of age less than 5 years, early management of hypokalemia is essential to reduce complications of the disease.¹³

Thus, the study has shown that hypokalemia is a common electrolyte imbalance in malnourished children with diarrhea. So, the use of interventions like oral rehydration solution is required in these patients to reduce morbidity and mortality from the acid-base and electrolyte disturbances commonly seen with acute diarrhea.^{14,15}

CONCLUSION

The current study concludes that electrolyte imbalances in malnourished children are significantly enhanced by an acute episode of diarrhea. So, the children under treatment must be screened for electrolytes abnormality and promptly managed to avoid serious clinical consequences.

LIMITATIONS

The sample size was small and the study was conducted in a single institution so results cannot reflect findings in a generalized population.

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