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ORIGINAL ARTICLE

Variation of Serum Sodium and Potassium in Acute Watery Diarrhea

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ABSTRACT

Background: Diarrhea is one of the leading causes of mortality and morbidity in children less than 5 years of age in developing countries. Electrolyte abnormalities are common in children with diarrhea that may remain unrecognized and result in mortality and morbidity.

Objective: To determine the frequency of serum sodium and potassium disturbances in acute watery diarrhea.

Methodology: This cross sectional study was conducted at Paediatric Ward, Lahore General Hospital, Lahore from 1st July 2016 to 31st December 2016 and 280 patients of acute diarrhea were enrolled. Venous blood samples for serum sodium and potassium were done at the time of admission and sent to the hospital lab and followed. All the cases were rehydrated according to WHO guidelines.

Results: 61.8% patients had electrolyte abnormalities. Most significant electrolyte abnormality was hypokalemia 33.6%, followed by hyponatremia 22.5% and hypernatremia 5.7%.

Conclusion: The electrolyte abnormalities were more common in infants and the electrolyte abnormalities increased as the duration of diarrhea prolonged.

Keywords: Acute diarrhea, Hyponatremia, Hypokalemia, Hypernatremia

INTRODUCTION

It is estimated that diarrhea kills more young children worldwide than malaria[1], acquired immunodeficiency syndrome (AIDS), and tuberculosis combined.[2] The World Health Organization estimates that more than 700 million episodes of diarrhea occur annually in children under the age of five. Diarrhea is characterized by an increase in the frequency and fluidity of stools[3]. In Pakistan, diarrhea is responsible for 200, 000 deaths per year (600 deaths per day) and up to 5-6 episodes in each child annually.[4] On average, diarrhea is responsible for 18% of child deaths, with an estimated 1.8 million deaths per year. Bacterial pathogens like Vibrio cholera, Escherichia coli, Shigella, and Salmonella account for 20% of cases, while viruses like the rotavirus, adenovirus, and entetoparasites account for 30% and 5% of cases, respectively. These organisms have their own interaction with gut mucosa and as a result produce different spectrum of body changes.[5]

Electrolyte homeostasis is necessary for the body to function normally, and even minor disruptions can sometimes result in serious complications. During diarrhea, there is an increase in the amount of water and electrolytes that are lost in the stools.[6] When these losses are not adequately replaced, a deficiency of water and electrolytes develops. The absorption of sodium and potassium through the gastrointestinal tract is what determines their regulation. Electrolyte disorders can manifest as lethargy, seizures, vomiting, and cardiac arrhythmias—in severe cases, they can even result in death—when there is an imbalance between the two ions.[7]Commonly observed electrolyte disturbances are hyponatremia, hypokalemia and hypernatremia.[8] Striking variations in serum sodium and potassium levels have been observed in children with diarrhea.[9] In one study, electrolyte disturbance was found in 55.5% cases of acute watery diarrhea, hypokalemia (28.5%) was found to be more frequent electrolyte abnormality followed by hyponatremia (24.5%) and hypernatremia (7.5%).[10] In another study, electrolyte disturbance was found in 90.5% cases ,and in this study hyponatremia (61.4%) was found to be more frequent followed by hypokalemia (15.8%) and hypernatremia (5.3%).[11] Whereas in Nepal, hyponatremia was even more higher and was found in 56% of the patients and hypernatremia in 3.8%, hypokalemia was found in 46% of the patients.[12] In another study hypokalemia was documented in 56.36% patients while hypernatremia was seen in 5.45% and 47.87% had hyponatremia.[13]

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METHODOLOGY

This cross-sectional study was conducted at Department of Pediatric Medicine, Lahore General Hospital Lahore from 1st July 2016 to 31st December 2016. The sample size was 280 calculated with 95% confidence level, 3.5% margin of error using expected percentage for hypernatremia at 7.5% from study done by Naeem et al.10 All patients of diarrhea between 2 months to 5 years of age, duration of diarrhea less than 14 days and both genders were included. In the absence of co-morbid conditions like cardiac, renal, or respiratory disease, as determined by history and physical examination, cases of diarrhea with severe acute malnutrition (weight for length 70% or 3S.D. and or edema) were excluded. At the time of admission, venous blood samples were taken to check serum sodium and potassium levels. These samples were sent to the hospital lab, where they were analyzed. According to the operational definition, disturbances in sodium and potassium were labelled. All the cases were rehydrated according to WHO guidelines. SPSS-16 was used to enter and analyze all of the data.

RESULTS

There were 98 (35%) males and 182 (65%) females, 72 (25.7%) patients between 2-12 months, 67 (23.9%) between 13 months to 24 months, 58 (20.7%) between 25 months to 36 months, 49 (17.5%) between 37 months to 48 months of age and 34 (12.1%) between 49 months to 60 months of age. One hundred seventy three (61.8%) had electrolyte abnormalities and 107 (38.2%) patients were normal. Sixty three (22.5%) had hyponatremia, 16 (5.7%) had hypernatremia and 94 (33.6%) had hypokalemia (Table 1).

The mean age was 26.16±15.83 months at the time of admission, mean sodium level was 139.13±4.53 mEq/L and mean potassium level was 3.74±0.41 mEq/L (Table 2).

Table 1: Demographic information of the patients (n=280)

Variable	No.	%
Gender		
Male	98	35.0
Female	182	65.0

Age (months)		
2-12	72	25.7
13-24	67	23.9
25-36	58	20.7
37-48	49	17.5
49-60	34	12.1
Electrolyte Abnormality		
Hyponatremia	63	22.5
Hypernatremia	16	5.7
Hypokalemia	94	33.6

Table 2: Descriptive statistics of the patients (n=280)

Variable	Mean±SD
Age (months) (Table 1)	26.16±15.83
Sodium level (mEq/L)	139.13±4.53
Potassium (mEq/L)	3.74 ± 0.41

DISCUSSION

In this study, 173(61.8%) patients had electrolyte abnormalities and 107(38.2%) were normal. Hypokalemia accounted for 33.6% of all electrolyte abnormalities, followed by hyponatremia (22.5%) and hypernatremia (5.7%). In our nation, poverty and a lack of awareness are the primary contributors to the prevalence of electrolyte abnormalities. Many parents do not start ORS when the child is having diarrhea or it is started quite late. Electrolyte abnormalities increase as a result of this practice. This demonstrated that the incidence of hypokalemia was slightly higher than the 28.5% that Naeem and Mahmood[10] reported, whereas Naz and Virk[13] reported an even higher incidence of hypokalemia with 56.36 percent. These studies' with high incidence of hypokalemia suggested that it is prevalent in children with acute diarrhea. Diarrhea is a leading cause of hypokalemia due to the high potassium loss in the stool. Up to 100mEq/L of potassium can be lost in the stool during diarrhea, which is significantly more than the 9 meq/day that is normally excreted in the feces. In addition, the dehydration resulting from diarrhea stimulates aldosterone release, which further potentiates hypokalemia, thereby compounding the potassium loss due to diarrhea.

The incidence of hyponatremia (22.5%) and hypernatremia (5.7%) is nearly identical to that of Naeem and Mahmood[14], who reported incidences of 24.5% and 7.5%, respectively. Naz and Virk[13] found a 47.87 percent higher rate of hyponatremia, while my study found a 5.45 percent rate of hypernatremia. The pathogenesis of hyponatremia in diarrhea is caused by a combination of sodium and water loss, as well as water retention to compensate for volume depletion. In contrast, in Nepal, hyponatremia was found in 56% of patients and hypernatremia in 3.8%.[15] Antidiuretic hormone is released as a result of hypovolemia, reducing water excretion by the kidney. In the process, water retention leads to hyponatremia, thus, resulting in higher frequency of hyponatremia, as found in this study. Although hyponatremia often goes unnoticed, it can result in severe neurological damage and even death. Additionally, the higher prevalence of cholera in our region may be to blame for the rise in hyponatremia. This is because different pathogens cause diarrhea to lose different amounts of sodium. Secretary diarrhea is caused by cholera and E. coli, and cholera patients' stools contain a high sodium concentration of 120-150 mEq/L. Whereas osmotic diarrhea causes less loss of sodium i.e. <70 mEq/L.

The first group had the highest incidence of all electrolyte abnormalities (hyponatremia 29.16 percent, hypokalemia and hypernatremia 8.33 percent, and so on). Therefore, the abnormalities in electrolytes were more prevalent in infants. In study done by Naeem and Mahmood[10], electrolyte abnormalities were commom in less than 2 years age. In a similar vein, Kosek and Bern15 demonstrated that infants experience the highest prevalence of diarrhea. Younger children have a higher risk of developing fluid and electrolyte abnormalities because they have higher basal fluid and electrolyte requirements per kg of body weight and are more dependent on others for their needs. The frequency of electrolyte abnormalities increased with the duration of the diarrhea. 19.7% of the first group had hyponatremia, while 27.1% of the second group did. This difference is also significant for hypokalemia which was found in 31.6% in the first group as compared to 36.8% in the second group. In study done by Naeem and Mahmood[10], electrolyte abnormalities also increased as the duration of diarrhea increased. Electrolyte abnormalities are more common when electrolytes are not properly rehydrated and replaced. Significant association was found between age of patients and electrolyte imbalance (p=0.013). None of the patients in this study passed away, nor did they experience any neurological symptoms like seizures or other clinical signs of electrolyte imbalance.

CONCLUSION

Serum electrolytes are disturbed significantly during acute watery diarrhea and there is high incidence of hypokalemia and hyponatremia and the infants are most affected. So all children especially infants must be properly rehydrated and evaluated for their electrolyte disturbances. It is necessary to keep watch over signs and symptoms of electrolyte disorders among patients with diarrhea. If such clinical manifestations are present, electrolyte levels should be checked and managed according to the electrolyte disturbance.

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