Original Article

Electrolyte Changes in Malnourished under-5 Children with or without Diarrhoea

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Abstract

Background: *Malnutrition is widely recognized as a major health problem in children in developing country. Malnutrition is a serious public health problem that has been linked to increase risk of morbidity and mortality .Many factors can cause malnutrition, most of which relate to poor diet, family size, family income, repeated ARI and diarrhea that may or may not causes electrolytes changes, particularly in underprivileged populations.*

Objective: *To determine the serum electrolyte disturbances in malnourished under 5 children with or without diarrhea.*

Methodology: *This is a descriptive study and conducted among 100 under 5 malnourished children of randomly selected in admitted patient of Dhaka Shishu Hospital. It was carried out during January-2015 to December-2017. They were suffering from different grades of malnutrition with or without diarrhea. On the basis of history, physical examination and anthropometrics measurement they were divided into Group A patients (n=56) who were malnourished but had diarrhoea and Group B patients (n=44) who were also malnourished and had no diarrhoea. Serum electrolytes were done in patients of both groups and the results were analyzed statistically by using SPSS windows programs 21.*

Results: *Analysis of serum electrolytes in both groups that hyponatremia and hypokalemia were seen more frequently in patients of group A as compared to group B. In group A hyponatremia was seen in 41 patients (71.92%) while it was observed in 16 patients (28.07%) in group B ($p<0.00$), hypokalemia was seen in 27 patients (69.23%) in group A and in 12 patients (30.76%) in group B ($p<0.03$).*

Conclusions: *Electrolyte changes were commonly seen in moderate and severe malnourished children particularly who presented with diarrhoeal episode of variable duration. If these changes are diagnosed in time the morbidity and mortality decreased.*

Key Words:
Malnutrition, Diarrhoea, Electrolyte changes.

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Introduction

Human health disease, productivity, socio-economic development and quality of life index are directly related to nutrition.[1] Malnutrition is a serious public health problem that has been linked to increase risk of morbidity and mortality. Many factors can cause malnutrition, most of which relate to poor diet or severe and repeated ARI, diarrhea, particularly in underprivileged populations. Overpopulation undermines food production, which leads to inadequate food intake and/or the consumption of non-nutritious food, and thus to malnutrition. On the other hand, malnutrition itself can have far-reaching impacts on the environment, and can induce a cycle leading to additional health problems and deprivation.[2] Malnutrition interacts with diarrhoea in a vicious circle leading to high morbidity and mortality in children, and is a complicating factor for other illness in developing countries. Malnourished children have more severe diarrhoea, which lasts for longer period. The prevalence of diarrhoea is 5-7 times more in malnourished as compared to normal children and its severity is 3 to 4 times greater in malnourished children as compared to normal children.[3] Sodium is one of the

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most important electrolytes in the body and is responsible for a number of important functions, mostly related to fluid and water regulation. The normal accepted range for sodium is 135 to 145 mEq/L. Hyponatremia is considered to serum sodium below 135 mEq/L. A common cause of hyponatremia is water retention due to cardiac or renal or hepatic failure. Other causes of hyponatremia include some medicines, psychogenic polydipsia and syndrome of inappropriate ADH (antidiuretic hormone) secretion, and chronic or severe vomiting and diarrhoea. Common symptoms of hyponatremia include confusion, agitation, nausea and vomiting, muscle weakness, spasms or cramps. Potassium is responsible for the functioning of excitable tissues such as skeletal and cardiac muscle and nerves. The normal range for potassium is 3.5 to 5.4 mmol/L. Hypokalemia is defined as a serum potassium less than 3.5 mmol/L. A low serum potassium may be caused by decreased oral intake, increased renal or gastrointestinal loss of potassium, or a shift of potassium within the body's fluid compartments (from outside the cell where it should be, to inside the cell). Common clinical features of hypokalemia are muscle weakness, cardiac arrhythmias such as ventricular tachycardias.[4] Various abnormalities in body electrolytes in malnutrition were found. Most common electrolyte abnormalities are those that involve sodium, potassium, and water.[5] Malnutrition with edematous state body water content is increased accompanied by sodium retention that is primarily extra cellular but serum sodium level is reduced in most children with malnutrition making the sodium overload. These levels may be low due to associated diarrhea.[6] Total body potassium is decreased in all malnourished as much as 25% in overt malnutrition, due to decreased intake and poor muscle mass. Potassium is predominantly intracellular ion needed for maintaining homeostasis integral to normal cellular function but only 2% of body content is in extra cellular fluid so plasma potassium is a poor indicator of total amount in the body. However plasma potassium concentration has importance in immediate therapy in case of life threatening hypokalemia.[7] In malnutrition sub clinical deficiency of potassium may be present without any clinical feature but these children are at risk of hypokalemia during diarrhoeal disease, which makes the clinical picture of deficiency obvious and patient presents with muscle weakness, hypotonia, apathy, abdominal distention, paralytic illness and serious cardiac arrhythmias.[8] Both malnutrition and electrolyte disturbances are considered to be risk factors for death among children with diarrhea.[9] The purpose of this study was to determine the serum electrolyte status in malnourished children with and without diarrhoea, so that serum electrolyte disturbances could be managed to reduce the risk of death or disability.

Methodology

This is a descriptive study. It was carried out during January-2015 to December-2017. This study of 100 cases of protein energy malnutrition was conducted in the admitted patient in Dhaka Shishu Hospital, Dhaka. Each child was assessed by taking detailed history from mother, performing physical examination. Anthropometric measurements:- Determination of nutritional status: following parameters were studied: (1) Height: 06 months to 2 years of age by infantometer in lying position and after 2 years up to 5 years in standing position by stadiometer. Height was recorded in standing position without footwear, foot together, knees straight and heels, buttocks and shoulder in contact with the vertical wall. The children were held firmly with eyes looking straight up and the body held as straight as possible with the knees pressed straight. Height was measured to the nearest millimeter. (2) Weight: Weight was taken by electronic weighing machine. The children were asked to stand on the weighing machine with minimum clothing and without shoes and any weight in hands or touching or catching other things. Weight was recorded to the nearest grams. (3) Age: Asking with parents or birth certificate/ hospital records. The nutritional status of these children was assessed by WHO classification of malnutrition using (Z score) weight for height (wasting), height for age (stunting) and weight for age (under weight). According to Z score mild malnutrition (>-2SD), moderate malnutrition (-2SD to-3SD) and severe malnutrition (<-3SD).[10] Inclusion Criteria*:* Malnourished children between 6 months to 5 year of age, with or without diarrhea of variable duration. Exclusion criteria*:* Malnourished children under 6 months and above 5 year of ages. Malnourished children who investigations were not completed.

Results

Out of hundred children 56 were male and 44 female. Among them 18 children were mild malnutrition, 32 children were moderate malnutrition and 50 children were severe malnutrition (Fig-1).

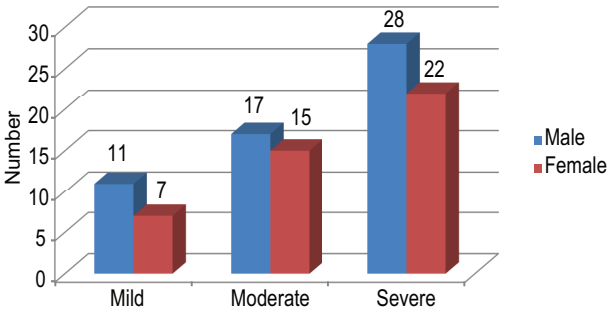

Fig-1: Protein energy malnutrition status according sex

Table-1

Electrolyte changes in group-A and group-B

Electrolyte changes	Group-A	Group-B	p value	Total
Hyponatremia	41	16	<0.00	57
Hypokalemia	27	12	<0.03	39

The patients were divided into two groups (Table-I). Group A includes fifty six malnourished children who had diarrhoea of variable duration and Group B, which includes forty four malnourished children who had no diarrhoea. According to table-1, hyponatremia (serum sodium <135 meq/l) was seen in 57 children, out of them 41 had group-A and 16 had group-B (p<0.00). Hypokalemia (serum potassium <3.5 meq/l) were 39 malnourished children, 27 had group-A and 12 had group-B (p<0.03) children.

According to figure-II isonatremic malnourished children were 43, out of them 08 had mild, 14 had moderate and 21 had severe malnourished. Hyponatremia were 57, out of them 10 had mild,18 had moderate and 29 had severe malnourished children. Normokalemic children were 61, out of them 11 had mild, 19 had moderate and 31 had severe malnourished children. Hypokalemia were 39 malnourished children, out of them 07 had mild, 13 had moderate and 19 had severe malnourished.

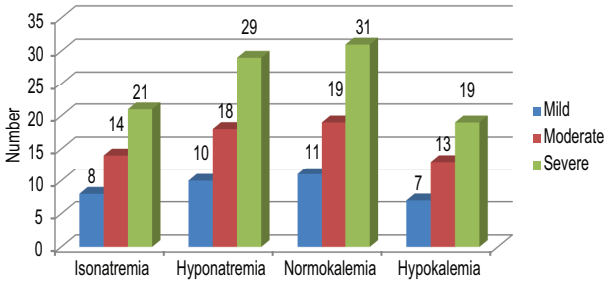

Fig-2: *Electrolyte changes according to grading of malnutrition*

Discussion

Children are considered as the leader of tomorrow. But they are the most victimized group of the society and regretably**.** Diarrhoea continues to be a serious problem in our children and may be fatal when superimposed upon malnutrition. It results in large losses of water and electrolyte especially sodium and potassium.[11] Sodium chloride are the major ions contributing to osmolality of extracellular fluid while potassium is in low concentration but never the less is essential for normal cell function. In malnutrition serum electrolytes do not reflect the body content but only the circulating concentration, thus high serum potassium make intracellular potassium deficiency while low serum sodium make sodium overload but they have importance in immediate therapy in cases of life threatening situation.[12] In different studies show that malnutrition is associated with increased incidence and duration of acute diarrhoea and is a risk factor for diarrhoeal mortality.[13] In severe malnutrition significant risk factor for fatal diarrhoea includes hyponatremia, hypokalemia and metabolic acidosis.[14] In our study electrolyte disturbance were mostly seen in moderate and severe malnutrition. This study also shows that hypokalemia and hyponatremia were seen more frequently in those who had diarrhea as compared to those who had no diarrhea. A study from Bangladesh reported that incidence of hyponatremia was directly related to the degree of malnutrition and a serious complication of diarrhoea with case fatality rate of 10.1% as compared to isonatremia or hypernatremia.[15] Malnourished children have poorer sodium balance during acute diarrhea and they lose more sodium in their stool and urine during diarrhoea so that their total body sodium balance is diminished.[16] Hypokalemia alters function of several organs and prominently affects the cardiovascular system, neurological system, muscle and kidney. In profound potassium deficiency muscle paralysis can occur.[17] Ortuno et al. reported hypokalemic induced paralysis secondary to acute diarrhoea in their case series.[18] Hypokalemia may be sub clinical in malnourished children but during diarrhoeal illness it becomes obvious clinically and manifests as hypotonia, abdominal distension, paralytic ileus, cardiac arrhythmia and respiratory distress. Our study also confirms that hypokalemia is more marked when there is associated diarrhoea. In a study by Rehana 37% children with acute diarrhea were found to be hypokalemic.[19]

Conclusion

Electrolyte changes in malnourished children may be sub clinical but features become obvious during diarrhoeal episode and estimation of serum electrolytes is helpful for immediate therapy to avoid serious life threatening condition.

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