

Electrolytes and Blood Sugar Changes in Severely Acute malnourished Children and Its Association With Diarrhoea and Vomiting.

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ABSTRACT:-

Objectives: To study the serum electrolytes and blood sugar changes in a severely acute malnutrition in children and its association with diarrhea and vomiting.

Methods: The study was done among severely malnourished children (weight for height < -3SD) under five years of age with or without edema. The WHO growth standard was used as reference. Severely malnourished children (n=76) under 5 years of age whose weight for length or height of < -3SD with or without bilateral pedal edema symmetrically of nutritional origin were enrolled. Group A (n=49) were admitted with history of diarrhea or vomiting with other complaints and Group B (n=27) with other complaints other than diarrhea and vomiting were enrolled. Serum electrolytes Na⁺, K⁺, Ca⁺⁺ and blood sugar done immediately on admission and compared after taking appropriate consents from guardian. Again cases were divided group C (n=58) without edema and group D (n=18) and compared their electrolytes and sugar level with appropriate statistical analysis.

Results: In our study the severely malnourished children were more in age group of (6-12) and (13-24) months of age. 51 % of our case had hypokalemia, 31.57% and 15.7% of cases had hyponatremia and hypernatremia respectively. The ionized calcium level was within normal limit in cases. Only 3.9% of our cases had hypoglycaemia. There was significant hypokalemia (61.22%) in group A as compared to group B (33%) (p=0.018), hyponatremia group A (n=40.8 %), group B (n=14.8 %) (p=0.019) was also significant. 14.25% of group A and 18.5% of group B had hypernatremia (p=0.62). The serum ionized calcium level was within normal level. There was no significant mean serum electrolytes changes among non-oedematous group C and oedematous group D but the blood sugar of edematous malnourished group D (65±12.65)mg/dl was statistically significant lower than in non-edematous malnourished children group D (79.28±14.74)mg/dl (p=0.005).

Conclusion: Most of the severely acute malnourished children usually present with diarrhea or vomiting. The serum sodium and potassium changes are commonly presents in such children or may presents sub clinically which becomes obvious due to diarrhea or vomiting. The blood sugar may be low in oedematous malnutrition with depleted energy source with loss of appetite. The ionized calcium level remains within normal limit.

Keywords: serum sodium, potassium, calcium, blood sugar, severe acute malnutrition.

I. INTRODUCTION

Malnutrition is a major global problem especially in developing country like India where majority of people lives below poverty line. Those are the children who need extra care because they are our supreme assets as children of today human resource of tomorrow. As per NFHS (2005-2006) reports 43% of India's under five children are underweight, 20 % wasted and 48 % stunted (1). It has been known that diarrhea is more common and severe in malnourished children than normal (2). Deficiency of energy intake is major risk factor in malnutrition and impaired glycogenolysis in kwashiorkor (3). 52.5% of all deaths in young children were attributable to under nutrition, 60.7% in case of diarrhea (4). In edematous malnutrition one would expect the increase of the serum sodium level but the content may be low due to water resorption that masks the serum sodium. The serum potassium may be low due to associated diarrhea and vomiting in malnutrition. Decrease potassium content is associated decreased muscle mass, poor intake and digestive losses while decreased sodium level is attributed to increased in ECF in plasma and a poor prognostic factor in protein energy malnutrition (5). Since linear growth creates an increased demand for calcium. It is speculated that the children who are severely malnourished and experiencing marked growth retardation will have a reduced calcium demand (6). Therefore in the present study we set out to find out the serum sodium, potassium and calcium changes in

severely acute malnourished children presented with and without diarrhea and vomiting.2).To compare if any significant serum electrolytes and blood sugar changes among oedematous and non- oedematous malnutrition.

II. MATERIAL AND METHODS

Seventy six under five who were severely acute malnourished children (< -3 SD) weight for length/ height with or without edema and with or without diarrhea and vomiting were studied from 2008-2009 in kamlia Raja Hospital, under G.R. Medical college, Gwalior, India. Children with congenital heart disease, chronic renal/ hepatic failure, cerebral palsy, disseminated tuberculosis, malignancies and haemolytic anemia were excluded from study. The study was approved by institutional review board of G.R. Medical College. Written informed consents were taken from parents or guardian of children prior to study. Then the blood sample was taken for serum sodium, potassium, calcium and blood sugar measurement. Immediate serum electrolytes were measured using automated electrolytes analyser and blood sugar using glucometer. The enrolled subjects were divided into group A those presented with diarrhea or vomiting or both of considerable durations and group B those without diarrhea, vomiting. Again the malnourished children were grouped into group C who were non-edematous and group D edematous malnutrition. Appropriate statistical analysis test was applied where p value < 0.05 considered as significant.

III. RESULTS

Seventy six children with severe acute malnutrition completed the study. Group A contents 49 children with diarrhea, vomiting and group B contents 24 children with no diarrhea, vomiting. Again Group C had 58 children who were non edematous and group D had 18 children with edematous type of malnutrition. 57 % of cases were male and 43% female with majority of the cases were in age group of 13-24 months of age (32.8%) and 6-12 months of age (30.26%).

Table 1. Distribution of study subjects according to age and sex (n=76)

Age	Male	Female	Total	Total %
<6 months	03	03	06	08
6-12 months	12	11	23	30.26
13-24 months	16	09	25	30.8
25-36 months	09	04	13	17
37 months-<5 years	03	06	09	11.8
Total	43 (57%)	33 (43%)	76	100

Table 2. Electrolytes and blood sugar changes in severely acute malnutrition (overall view)

Electrolytes and blood sugar	No of subjects (n=76)
Hypokalemia (Sr. Potassium < 3.5 mEq/dl)	39 (51.53%)
Hyponatremia (sr. Sodium < 135 mEq/dl)	24 (31.57%)
Hypernatremia (sr. Sodium > 145 mEq/dl)	12 (15.7 %)
Hypo/hypercalcemia (ionized Ca^{++})	0
Hypoglycaemia (Bl.sugar < 54 mg/dl)	03 (3.9 %)

Majority of the cases 51.53% were having hypokalemia, 31.57% cases had hyponatremia, 15.7% had hypernatremia, 3.9 % had hypoglycaemia and all cases had normal calcium level. 61.22% of group A and 33% of group B had hypokalemia ($p=0.018 < 0.05$), 40.8% of group A and 14.8% of group B had hyponatremia ($p=0.09 < 0.05$) and 4.25% of group A and 18.5% of group B had hypernatremia ($p=0.62$) as shown in table.3

Table3. Effect of diarrhea or vomiting on serum electrolytes severe acute malnutrition

Group A: cases presented with diarrhea and vomiting
Group B: cases presented without diarrhea and vomiting

Serum electrolytes	Group A (n=49)	Group B (n=27)	P value
Hypokalemia	30 (61.22%)	09 (33%)	0.018456
Hyponatremia	20 (40.28%)	04 (14.8%)	0.019593
Hypernatremia	07 (14.25%)	05 (18.5%)	0.626499

Again on comparing the mean electrolytes in non-edematous malnourished children group C (n=58) and edematous malnourished children group D (n=18), there was no statistically significant correlation has been found. However, the mean blood sugar (79.28 ± 19.74)mg/dl of group C and (65 ± 12.68)mg/dl of group D was significant $p=0.00515$.df=74, student's t test: 2.88 as shown in table 4.

Table 4: Serum electrolytes and blood sugar in non oedematous and oedematous malnourished children

Sr.electrolytes/ blood sugar	Non-edematous malnutrition n=58		Edematous n=18	malnutrition	P value
	Mean \pm SD	Range	Mean \pm SD	Range	
Sr.sodium (mEq/dl)	137.58 \pm 9.23	(112-164)	135.3 \pm 8.1	(115-149)	0.34993
Sr.potassium (mEq/dl)	3.562 \pm 0.818	(2.5-6)	3.5 \pm 0.79	(2.43-5.3)	0.7778
Sr.calcium ionized (mmol/L)	1.184 \pm 0.12	(1.05-1.5)	1.2 \pm 0.13	(1.08-1.5)	0.629
Blood sugar (mg/dl)	79.28 \pm 19.74	(39-120)	65 \pm 12.68	(49-98)	0.00515

IV. DISCUSSION

Our study was carried out to find out the serum electrolytes and blood sugar changes in children < 5 years of age who are severely malnourished as they are more prone for malnutrition as well the caregiver may not know when and how to initiate the complementary feeding (7,8). Usually and universally, researchers around the globe now prefer and uses WHO classification of malnutrition that will be helpful in comparing our findings as well this classification accounts undernutrition, stunting and edematous types which helped us in comparing our data between edematous and non-edematous malnourished children. In previous studies it has been found that complementary feeding was less ideal although breastfeeding rate were high (9,10). In our study the severely malnourished children were more in age group of (6-12) and (13-24) months of age which explains that probably wrong time and methods of feeding, similar like previous studies. 51 % of our case had hypokalemia who were severely malnourished as compared to 48 % in all grades of malnutrition on Gomez classification where 59.64 % of 34 cases were in grade III malnutrition in their study which explain as severity of malnutrition increased the chances of hypokalemia increases (11). The hypernatremic cases was 15.7% had hypernatremia taking sr. Na⁺ > 145 mEq/dl but only 3% had hypernatremia on study by *yasmeen et al* (11) considering Na⁺ level > 150 mEq/dl. The ionized calcium level was within normal limit in cases, which was similar to other studies (12,13)). Only 3.9% of our cases had hypoglycaemia as compared to 10 % cases by *Anuj seth and S aneja*, New Delhi, in grade III and grade IV malnutrition of IAP classification. (14). Again, there was significant hypokalemia and hyponatremia in malnourished children who were having diarrhea or vomiting but there were also considerable numbers of cases with such dys-electrolytemia who did not had diarrhea or vomiting which may leads to such dyselectrolytemia as explained by others (11,12,,13). This explains that the electrolytes changes commonly presents in a malnourished children or may presents subclinically which becomes obvious during diarrhea/vomiting. This may manifests along with various neurological symptoms.(12,14,15). On comparisons between edematous and non edematous malnutritions there was no stastically significant mean electrolytes changes as shown in other studies (16) although dyselectrolytemia was common in both groups. In our study the mean blood sugar was significantly lower in edematous malnutrition as compared to non edematous which may fall any time during sickness (17).

V. CONCLUSION

The electrolytes changes are commonly presents in malnourished children which may be sub clinically which becomes obvious during diarrhea /vomiting. Although the frequency of hypoglycaemia was low but the mean blood sugar which was low may fall any time. So these electrolytes and blood sugar changes may lead to morbidity and mortality which is well known. Therefore, the measurement of blood sugar and electrolytes are helpful to avoid life threatening situation.

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