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Original Research Article

Serum Albumin Levels in Edematous Severe Acute Malnutrition Children Aged 6 Months to 5 Years

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Abstract

Background: Severe acute malnutrition (SAM) is one of the major health problems of children in our country. Edematous severe acute malnutrition (E-SAM) is associated high mortality and morbidity. In SAM edema is of multifactorial in origin.
Objective: To evaluate the serum albumin levels in E-SAM children aged 6months to 5 years.
Methods: An observational hospital based prospective study was conducted at Malnutrition Treatment Center (MTC), Balchikitsalya, RNT Medical College, Udaipur (Rajasthan) India from July 2015 to Dec 2015. We enrolled total 50 children aged 6 Months to 5 Years having nutritional edema with medical complications. Acute complications were treated and nutritional rehabilitation was done as per WHO protocols.
Results: A total of 50 children were studied. Mean age of children was 16.54±11.05 months, 26(52.0%) were males and 24(48.0%) were females. Majority of children had moderate edema 26(52.0%) followed by 17(34.0%) of severe edema whereas only 7(14.0%) of SAM children had mild edema. Mean serum albumin levels were 2.75± 0.74 gm/dl. Serum albumin levels were, in mild grade edema (1+), 3.27±0.60 gm/dl, in moderate grade edema (+2) 2.85 ± 0.74gm/dl and in severe grade edema (3+) 2.38 ±0.63 gm/dl. Most of edematous SAM children were having hypoalbuminaemia which was statistically significant with grade of edema (p value=0.01).
Conclusion: We conclude that edematous severe acute malnutrition children had hypoalbuminaemia and this hypoalbuminaemia statistically significant with grade of edema.
Keywords: Edematous Severe Acute Malnutrition, Malnutrition Treatment Center, Nutritional Status, Serum Albumin.

1. Introduction

Malnutrition in children is widely prevalent in developing countries including India. Acute malnutrition is classified into severe acute malnutrition (SAM) and moderate acute malnutrition (MAM) according to severity of malnutrition. According to National Family Health Survey-3, in India, 43% children under 5 years of age are underweight (low weight for age), 48% children under 5 years of age are stunted (low height for age) and 20% children under 5 years of age are wasted (low weight for height); 6.4% of these children are severely wasted (<-3SD).Since wasting denotes acute malnutrition, these children are said to have severe acute malnutrition or SAM. The median case fatality rate in children under 5 years is approximately 23.5% in SAM, which may reach 50% in edematous malnutrition.[1] Malnutrition is one of the major cause of morbidity in under 5 years of children in Rajasthan. According to NFHS -3, 20% of children less than 3 years of age in Rajasthan are wasted, 34% stunted and 44% are underweight. [2]

The severe acute malnutrition (SAM) is defined as per WHO criteria as Weight for height/length (WFH/L), and/or mid upper arm circumference of <11.5cm, and/or bipedal edema of nutritional origin in less than 5 years of age [3].

Edema formation in edematous malnutrition is multifactorial. It has been proposed that giving excess carbohydrate to a child with non edematous malnutrition reverses the adaptive responses to low protein intake, resulting in mobilization of body protein stores. Eventually, albumin synthesis decreases, resulting in hypoalbuminaemia with edema. Fatty liver also develops secondary, perhaps, to lipogenesis from the excess carbohydrate intake and reduced apolipoprotein synthesis. Other causes of edematous malnutrition are aflatoxin poisoning, as well as diarrhea, impaired renal function and decreased Na^+/K^+ATPase activity [4].

No such studies that evaluate serum albumin levels in E-SAM children in our area are available. The aim of this study was to assess serum albumin levels in E-SAM children and its relationship with grade of edema.

2. Material and Methods

This observational hospital based prospective study was conducted at Malnutrition Treatment Center (MTC), Balchikitsalya, RNT Medical College, Udaipur (Raj.) India from July 2015 to Dec 2015. After calculating the sample size by using Epi Info 6 software total 50 edematous malnourished children were enrolled.

The inclusion criteria were of : 6 months to 5 years of age who were having edema of nutritional origin, WFH z-score <-3SD and/or mid upper arm circumference <11.5 cm. Children with aged below 6 months and above 5 years, refusal for consent, critical sick children like septicemia shock, acute respiratory distress syndrome (ARDS), patient on ventilator, HIV, Acquired immunodeficiency syndrome(AIDS), children with secondary malnutrition cerebral palsy(CP), mental retardation(MR), congenital heart disease(CHD), tubercular meningo encephalitis(TBME) were **excluded** from the study.

A written informed consent was taken from parents of all malnourished children who fulfilled the inclusion criteria. By using structured Performa questionnaire include questions about child's personal (including dietary history), clinical and laboratory data were filled. Proper ethical clearance was taken from the Ethical Committee of the institution before starting the study. Institutional ethical committee clearance no. is RNT/STAT/IEC/2015/1487. All the ethical issues were taken care during the study.

Study population was divided according to grade of edema into mild (+1) grade (edema of feet and hand), moderate (+2) grade (edema edema up to knees and elbow) and severe (+3) grade (generalized edema) [5]

Five ml of peripheral venous blood sample was taken in plain vial for total serum protein, serum albumin, serum electrolytes, calcium, phosphorus, urea and creatinine, serum glutamate oxaloacetate transferase (SGOT), serum glutamate pyruvate transferase (SGPT), serum alkaline phosphates. Urine routine and culture, chest X-rays, mantoux test (MT- tests) for tuberculosis and stool examination were done in all the children. During hospital stay, children were involved in playful activities and mothers were counseled on feeding and hygiene practices.

2.1 Statistics

Data were entered and analyzed using Statistical Package for Social Sciences (SPSS) version 21. P value <0.05 was considered significant.

3. Results

A total of 50 E-SAM children were analyzed. In this study the mean age of children was 16.54±11.05 months and majority of them 41 (82%) were in critical period of malnutrition 6 months to 2 years. 26(52.0%) were males and 24(48.0%) were females. Basic anthropometric variables of study population were as shown in **Table 1**.

Majority of study population was having moderate grade of nutritional edema 26 (52.0%) followed by severe grade of edema 17(34.0%) where as only7 (14.0%) of SAM children were having mild grade of edema as shown in **Fig**. 1. As per WHO SD z score, 24 (48.0%) children were in <-3SD and <-4SD z score. followed by16 (32%) children were in <-1SD and <-2SD z-score. Extremes of SD z score i.e. <-5SD and <-8SD children were also noted as shown in **Table 2.**

In 6 months - 2years age group, out of 41 children, 34 were on breast feeding and 20 children were receiving complementary feeding when they developed edema. In 2y-5y age group out of 9 children, 2 were on breastfeeding and all 9 children were receiving complementary feeding**.**

In this study as far anemia is concerned most of children had anemia except 2(4%) who were having normal hemoglobin. Twenty eight (56.0%) children had severe anemia but 22(44%) were required blood transfusion at the time of admission. When this anemia was correlated with edema it was not significant (p value = 0.35) as shown in **Table 3.**

Majority of E-SAM children 40(80%) had hypoalbuminaemia. Ten (20%) of children had normal serum albumin but they had edema as shown in **Table 4.**

Mean serum albumin concentration in E-SAM was 2.75 ± 0.74 gm/dl. Serum albumin concentration was decrease with severity of edema (Shown in **Table 5**). There was statistically significant correlation between serum albumin levels and grade of edema. (P value=0.01) serum sodium levels in edematous SAM children were 133.02±6.02 meq/l; serum potassium, serum calcium, serum phosphorus levels were 3.38 ± 0.74 meq/l; 8.53±0.93mg/dl; and 3.49±0.66 mg/dl respectively. The study shows that serum electrolyte levels were definitively lower side in edematous severe acute malnourished children but there was no statistically significant correlation between serum electrolyte level and grade of edema (p-value >0.05)

Table 1: Basic anthropometric variables of study population

Variables		No. of children
Age (in months)	6 - <12	21(42%)
	12 - <24	20(40%)
	24 – 60	9(18%)
	Mean ± SD	16.54±11.05 months
Sex	Male	26(52%)
	Female	24(48%)
Anthropometry	Mean	SD
Weight(kg)	6.77	1.42
Height/length(cm)	71.25	7.24
MUAC(cm)*	11.57	1.11

*MUAC: Mid upper arm circumference

Table 2: Distribution of study population according grade of edema and WFH/L*

SD z-score	Grade (+1) edema	Grade (+2) edema	Grade (+3) edema	Total no. of children	Percentage
2SD	0	1	0	1	2.0%
Median	1	1	1	3	6.0%
<-1SD	2	5	1	8	16.0%
<-2SD	1	4	3	8	16.0%
<-3SD	0	8	6	14	28.0%
<-4SD	2	4	4	10	20.0%
<-5SD	1	2	2	5	10.0%
<-8SD	0	1	0	1	2.0%
Total	7	26	17	50	100.0%

*WFH/L – weight for height/length

Table 3: Showing Hemoglobin levels and grading of edema

Hemoglobin levels	Mild edema (+1)	Moderate edema (+2)	Severe edema (+3)	Total
No anemia (>11gm %)	1	0	1	2
Mild anemia (10-10.9gm %)	0	2	1	3
Moderate anemia (7- 9.9gm %)	3	11	3	17
Severe anemia (< 7gm %)	3	13	12	28
Total	7	26	17	50

(P value =0.35).

Table 4: Grading of hypoalbuminaemia and severity of edema

Grade of hypoalbuminaemia	(+1) edema	(+2) edema	(+3) edema	Total no. of SAM children	%
Normal albumin level (≥3.5gm/dl)	3	6	1	10	20%
Mild hypoalbuminaemia (2.8-3.4gm/dl)	2	8	2	12	24%
Moderate hypoalbuminaemia (2.1-2.7gm/dl)	2	8	8	18	36%
Severe hypoalbuminaemia (<2.1gm/dl)	0	4	6	10	20%
Total	7	26	17	50	100.0%

Table 5: Relation between level of serum albumin and severity of Nutritional edema

Variables	Mild grade edema (1+)	Moderate grade edema (2+)	Severe grade edema (3+)	Total	P value
Serum albumin (gm/dl)	3.27± 0.60	2.85± 0.74	2.38±0.63	2.75±0.74	0.01
Serum total protein (gm/dl)	5.67±0.62	5.27±0.89	4.96±0.96	5.22±0.90	0.19

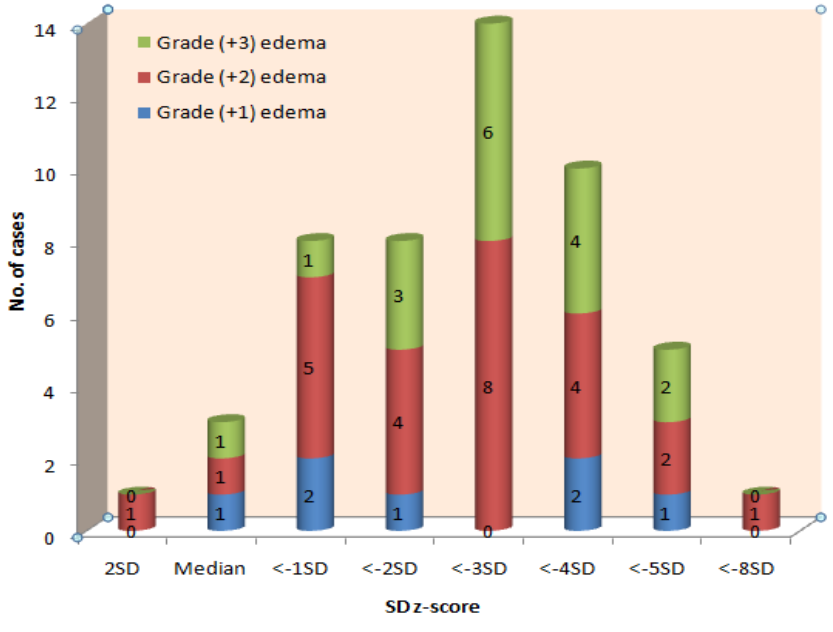

Fig-1: Shows distribution of study population according grade of edema and WFH/L*

4. Discussion

It is evident from the current results that serum albumin concentration was lower in edematous severe acute malnourished children. This had statistically significant relation between serum albumin levels and grade of edema (p value=0.01) in E-SAM children. But few patients had edema in spite of normal serum albumin.

Hypoalbuminaemia have been put forward as possible causes of the edema. Nevertheless, some children with significantly low albumin are still not suffering from edema and some with normal serum albumin were still edematous. These paradoxical results display the possible variations in the pathophysiological response to food deprivation in those suffering from malnutrition [6].

Though there are so many etiological causes like edema in SAM is multifactorial in origin i.e. increased hydrostatic pressure, decreased entotic pressure, dyselectrolytemia and abnormal ADH. In our study ADH levels were not done but electrolyte levels were little bit towards lower side. And there was no correlation between dyselectrolytemia and edema.

Capillary filtration rate across the capillaries is proportional to difference between hydrostatic and colloidal osmotic pressure. Low plasma albumin associated with malnutrition is expected to decrease plasma colloidal osmotic pressure and induce generalized edema. However most cases of hypoalbuminaemia are caused by acute and chronic inflammatory responses.[7].

In 2015, study done by Marwa A. Hanafi *et al*, to evaluate Serum sodium, potassium and Proteins Levels in Protein Energy Malnutrition disorder in Sudan. They concluded that significant decrease in serum sodium, total protein, albumin and globulin (P. values 0.00) when compared with normal [8].

In 2014, a study was conducted by Deepika Nagle *et al*, to Study serum electrolytes and proteins level in SAM children at Bhopal, India. They concluded that the mean values of electrolytes i.e. Serum sodium was 132.97±4.11mEq/L; Serum potassium was 3.01±0.07 meq/L; Serum total Protein was 5.93±0.46 and mean value of Serum albumin was 3.01±0.42 g/dl in kwashiorkor [9].

Limitation of our study is that we have not compared the serum albumin levels of edematous v/s non-edematous SAM which would have given the better understanding about the cause of edema in E-SAM.

We conclude from this study that edematous severe acute malnourished children had significantly reduced serum albumin levels and this was associated with severity of edema. So we recommend that further studies are to be conducted to access the serum albumin levels of both edematous and non-edematous SAM to correlate with nutritional and inflammatory status.

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