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Research Article

Clinico-laboratory profile and outcome of edematous severe acute malnutrition in children aged 6 months to 5 years

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ABSTRACT

Background: Malnutrition is still rampant in India. There are so many cases of edematous malnutrition present in Rajasthan. So we planned to study the Clinico-Laboratory profile And Outcome of Edematous Severe Acute Malnutrition in children aged 6 months to 5 years.
Methods: An observational hospital based prospective study was conducted at Malnutrition Treatment Center (MTC), Bal Chikitsalya, RNT Medical College, Udaipur, Rajasthan, India from July 2015 to Dec 2015. We enrolled total 50 SAM children aged 6 Months to 5 years having nutritional edema with medical complications. All the enrolled cases were hospitalized, acute complications were treated and nutritional rehabilitation by WHO feeding protocol was done. Clinical, laboratory parameters and outcome of E-SAM were analyzed.
Results: A total of 50 children were studied. Mean age of children was 16.54±11.05 months, 52.0% were male and 48.0% were female children, Majority of them were under <-3SD and <-4SD z-score (48.0%) followed by <-2SD and in <-1SD z-score (32.0%). Onset of edema reduction occurs on 3.22±0.91day, complete disappearance of edema occurs in 10.02±2.80 days, mean weight fall was 0.91±0.31% per day, mean length of stay in hospital was 14.93 ±4.10 days. Mean weight gain was 14.18±5.42 gm/kg/day and case fatality rate was nil. All these outcomes except weight gain were significantly associated with grade of edema (p value <.05).
Conclusions: Majority of the patients they were in WHO z-score of <-3SD and <-4SD z-score but extremes are also occurring up to <-8SD z-score Pneumonia and tuberculosis are the affected co morbidities for outcome of E-SAM children. Disappearance of edema, and length of stay are little bit longer than usual WHO guideline recommendations and they had a significant association with grade of edema. Percentage of wt. fall also had association with grade of edema.

Keywords: Edematous severe acute malnutrition, Malnutrition treatment center, Nutritional rehabilitation, WHO feeding protocol

INTRODUCTION

Globally malnutrition is the underlying cause of about 5.6 million of 10 million child deaths per year, with severe malnutrition contributing to about 1.5 million of these deaths. The nutritional status of children is the best indicator of the wellbeing of children.[1]

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.[2] According to NFHS -3, 20% of children under 3 years of age in Rajasthan are wasted, 34% stunted and 44% are underweight.[3]

Edematous malnutrition can occur initially as vague manifestations that include lethargy, apathy, and/or irritability. The three essential features are edema, growth retardation and mental changes. When edematous SAM is advanced, there is lack of growth, lack of stamina, loss of muscle tissue, increased susceptibility to infection, vomiting, diarrhea, dermatitis, anorexia, flabby subcutaneous tissue, and edema. The face looks puffy (moon face) with psychological changes like apathy.[4]

World Health Organization (WHO) in 1999 published a set of guidelines for inpatient management of severe malnutrition in children under 5 years of age which divides management in three phases: initial stabilization followed by rehabilitation and follow-up care. The protocols contain treatment of complications and infections, micronutrients supplementation and especially-made milk based starter and catch-up formulae for nutritional rehabilitation by the name of F-75 (Contains 75 kcal and 0.9 g protein per 100ml) and F-100 (contains 100 kcal and 2.9 g protein per 100 ml).4 These diets contain proteins, carbohydrates and sodium according to the needs of malnourished children. It has been shown that case fatality rates have reduced dramatically in hospitals that have used this formulas.[5]

According to WHO protocols weight reduction should be started from 4th day and complete disappearance of edema should be by 10th day. But in our institute we observed that many children of edematous SAM have not started to lose their weight up to 4th.day and many children of edematous SAM. Inspite of starting reduction of edema on 4th Day, there was no complete disappearance of edema up to 10th day. Most of patient's were on breastfeeding so it's very difficult to control the intake of children and because of these problems they required longer hospitalization stay, that's why we planned to study the clinico laboratory profile and outcome of edematous severe acute malnutrition in children aged 6 months to 5 years.

METHODS

This observational hospital based prospective study was conducted at Malnutrition Treatment Center (MTC), Bal Chikitsalya, 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: 6 months to 5 years of age, edema of nutritional origin, WFH z-score <-3SD and/or mid arm circumference <11.5 cm,. Children with aged below 6 months and above 5 years, refusal for consent, critical sick children like septicemia shock, ARDS, patient on ventilator, HIV, AIDS, children with secondary malnutrition (CP,MR,CHD,TBME) were excluded from the study.

By using structured Performa questionnaire include questions about child's personal clinical and laboratory data were filled.

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

The nurses and doctors working in the MTC were already trained regarding to management protocols. Feeds were prepared fresh every time of feeding schedule. Monitoring of weighing, feeding and preparation of feeds were done by trained staff and nurses under direct supervision of doctor.

Monitoring done with daily basis children were weighed everyday by nurses in the morning at same time before starting their morning feed. The weight change was calculated daily in gm/kg /day.

Treatment was divided in two phases, in the initial stabilization phase, acute complications like hypoglycaemia, hypothermia, severe anemia, dehydration, electrolyte imbalances, heart failure and severe infections were treated and feeding was started with F- 75 feeding formula (75 Kcal/100 ml and 0.9 gm protein/100 ml). After stabilization, children were put on 2 days transition period which was then followed by rehabilitation phase. Rehabilitation comprised of feeding with F-100 (100 Kcal/100 ml and 2.9 gm protein/100 ml) every 4 hourly interval. Caloric consumption was increased from 150 Kcal/kg to 220 Kcal/kg and protein intake was gradually increased from 2 g/kg to 5 g/kg. Tube feeding was done if child had appetite loss or mouth ulcers. Mineral mix as prescribed by WHO was not available and was replaced by multivitamin syrups along with vitamin A and zinc supplements. Magnesium sulphate in the form of intramuscular injections was given on first day followed by oral. Iron supplementation was started after first week and dehydration was treated by giving ORS. All children received at least 5 days of antibiotic therapy to treat suspected infection accordingly. Electrolyte replacements with potassium and calcium syrups was given to each where needed. Children diagnosed with tuberculosis were given ATT. Vaccination status of children was updated before discharge.

Complete blood analysis, urea, creatinine, electrolytes, serum total protein, serum albumin, SGOT, SGPT, serum alkaline phosphatase, serum phosphorus urine culture, chest X-rays, MT- tests for tuberculosis and stool examination were done in all the children. The treatment and investigations were free for the patients. During hospital stay, children were involved in playful activities and mothers were counselled on feeding and hygiene practices. Discharging criteria: Edema had resolved, child achieved weight gain >15% or had satisfactory weight gain for 3 consecutive days (>5 gm/kg/day), child was

eating an adequate amount of nutritious food that the mother can prepare at home, all infection and medical complications have been treated, immunization is updated

Outcome of these children were recorded as onset of edema reduction, complete disappearance of edema, mean weight fall, mean length of stay in hospital, mean weight gain in gm/kg/day and case fatality rate. Data were entered and analysed using Statistical Package for Social Sciences (SPSS) version 21. P value <0.05 was considered significant.

RESULTS

Total 50 children were analysed for various clinical, laboratory and outcome variables. Mean age of children was 16.54±11.05 months, 52.0% were male and 48.0% were female children. Average weight was 6.77±1.42 kg. Average height/length was 71.25±7.24 cm and mean MUAC was 11.57±1.11cm.

Table 1 Shows study population distribution as per WHO WFH/L z-score. According to severity of edema majority of study population having moderate grade of nutritional edema (52.0%) followed by severe grade (34.0%) of edema whereas only 14.0% of children of E-SAM having mild grade of edema. Various co morbidities were as shown in Table 2 and Figure 1.

Table 3 shows the various co morbidities affect the outcome of edematous SAM. Pneumonia associated with decreased weight gain whereas tuberculosis associated with faster recovery and faster weight gain. We observed that mean hemoglobin level was 6.94±2.11gm/dl. Out of 50 children, 28 (56.0%) children had severe anemia, out of which 22 (44%) children were given blood transfusion at the time of admission.

Table 1: Distribution of study population according to Weight –for -length/height (WHO SD, Z score) reference card and severity of edema.

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%

p value=0.88

Table 2: Various co-morbidities in patients with edematous SAM.

Co-morbidities	No. of children	Percentage
Pallor	37	74.0%
Diarrhea	15	30.0%
Pneumonia	12	24.0%
Vit A deficiency	7	14.0%
Otitis media	4	8.0%
Tuberculosis	2	4.0%

Table 4 shows outcome of edematous SAM with grade of edema. In mild (+1) grade edema, onset of edema reduction occurs on 2.43±0.53 day, complete disappearance of edema occurs on 6.86±1.77 days, average weight fall in percentage/ day, was 0.68±0.26, average length of stay was 10.43±2.23 days, and Avg. weight gain was 10.66±2.38 gm/kg/day.

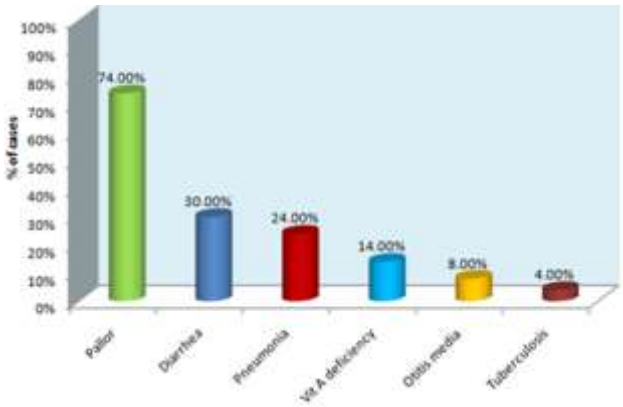

Figure 1: Various co-morbidities in patients with edematous SAM.

In moderate (+2) grade edema, onset of edema reduction occurs on3.23±0.82 day, complete disappearance of edema occurs on10.04±2.44 days, average weight fall in percentage/ day, was 0.90±0.29, average length of stay

was 14.71 ± 3.81 days, and Avg. weight gain was 14.23±5.87 gm/kg/day.

In severe (+3) grade edema, onset of edema reduction occurs on 3.53±01.01 day, complete disappearance of edema occurs on 11.29±2.71 days., average weight fall in percentage/ day, was 1.03±0.30, average length of stay was 17.12±3.60 days, and Avg. weight gain was 15.33±5.15 gm/kg/day.

Table 5 shows over all outcome of edematous SAM. Onset of edema reduction occurs on 3.22±0.91days, complete disappearance of edema occurs in 10.02±2.80 days, Avg. weight fall in percentage/day was 0.91±0.31% per day, Average Length of stay was 14.93± 4.10days, and average weight gain was 14.18±5.42 gm/kg /day.

Case fatality rate in our study was nil.

DISCUSSION

In the present study 50 children of edematous SAM were enrolled. majority of the patients were in the age group of 6-<24 months(82.0%).Nutrition deprivation in the early years of life especially during latter half of infancy and 2nd year of life is known to be responsible for development of SAM. This explains the importance of the need for appropriate complementary feeding after 6 months of life. While remaining 18.0% of children were in age group of 2-5 years. This shows the importance of proper feeding practices even after infancy. In a similar study conducted by Ece et al had enrolled 74 malnourished children with mean age in months studied was 29.6±14.0.[6]

Table 3: Outcome of edematous SAM with grade of edema.

Co morbidities	Onset of edema reduction (day)	Disappearance of edema (day)	Length of stay (days)	% of wt. fall (body weight)	Wt. gain (gm/kg/day)
Pneumonia (n=12)	3.33 ± 0.89	10.08 ±3.03	15.38 ± 4.79	1.01 ± 0.32	11.19 ±4.92 (p=0.024)
Diarrhea (n=15)	2.93 ± 0.7	9.47 ±1.85	13.93 ± 2.84	0.95 ±0.31	14.31 ±6.35
Anemia (n=45)	3.2 ± 0.89	9.98±2.78	14.97 ± 4.17	0.92 ± 0.31	14.375 ± 5.54
Tuberculosis (n=2)	3 (P=0.094)	8 (p=0.001)	13 (P=0.002)	0.92 ± 0.23 (p=0.96)	18.08 ± 1.62 (p=0.005)

Table 4: Outcome of edematous SAM with grade of edema.

Grade of edema	Onset of edema reduction(day)	Disappearance of edema (day)	Length of stay (days)	% of wt. fall (body weight)	Wt. gain (gm/kg/day)
Mild (1+)	2.43±0.53	6.86±1.77	10.43±2.23	0.68±0.26	10.66±2.88
Moderate(2+)	3.23±0.82	10.04±2.44	14.71±3.81	0.90±0.29	14.23±5.87
Severe(3+)	3.53±1.01	11.19±2.71	17.12±03.60	1.03±0.30	15.33±5.15
P value	0.02	0.001	0.0006	0.03	0.154

Table 5: Over all outcome of edematous SAM.

Outcome	Mean ±SD	P value
Onset of edema reduction (day)	3.22±0.91	0.02
Complete disappearance of edema (day)	10.02±2.80	0.001
Average length of stay (days)	14.93±4.10	0.0006
Average weight fall in percentage/day (body weight)	0.91± 0.31	0.03
Average weight gain (gm/kg/day)	14.18± 5.42	0.154

We observed in our study that out of 50 children, 26 were males (52.0%) and 24 were female (48.0%). So there is no significant sex difference in study population because male and female admitted have same frequency. In similar study conducted by Ahmed MM had enrolled 402 undernourished children out of which 229 (57%) was male.[7]

On the basis of SD z-score, we found out that extremes like <-5SD was also noted in 10.0% of population. There was one child who has SD z- score <-8SD. This signifies that severe form of malnutrition is still rampant in our

society and efforts are needed to be made at larger scale and more efficient ways to handle this social and health problem. Various studies have been done on malnourished children but they use either IAP classification or Gomez classification. No one has classified on basis of WHO z-score.

We observed that, in 6m-2years age group, out of 41 children, 34 were on breast feeding and 20 (only around 50%) children were receiving complementary feeding when they develop edema. In 2y-5y age group out of 9 children, 2 were on breastfeeding and all 9 children were receiving complementary feeding

In our study out of total 50 children, only 20 (40.0%) children received supplementary nutrition from AWC and out of 20 only 3 (6.0%) children were eaten the received supplementary nutrition, in rest of 17 (34.0%) children they received supplementary nutrition but it was distributed in other family members. It signifies that accesses to ICDS facilities at root level are very poor.

This study shows relationship between co morbidities like pneumonia, diarrhea, anemia and tuberculosis with outcome of E-SAM. Pneumonia was associated with slower weight gain rather than children without pneumonia (p value=0.024).There was no significant association between diarrhea and anemia with outcome (onset of edema reduction, disappearance of edema, length of stay, wt. fall, wt. gain) of E-SAM (p value >0.05). There was statistically significant association between tuberculosis and outcome of E-SAM. Disappearance of edema was faster in tubercular rather than non-tubercular (p value=<0.001) E-SAM children. Length of stay was less (p value=0.002) and weight gain was more (p value=0.005) in tubercular rather than non-tubercular group. This was so, because ATT acts like anabolic steroids, so there was fast recovery and faster weight gain.

Outcome of E-SAM with grade of edema, In mild (+1) grade edema, onset of edema reduction occurs on 2.43±0.53 day, complete disappearance of edema occurs on 6.86±1.77 days, average weight fall in percentage/day, was 0.68±0.26, average length of stay was 10.43±2.23 days, and Avg. weight gain was 10.66±2.38 gm/kg/day.

In moderate (+2) grade edema, onset of edema reduction occurs on3.23±0.82 day, complete disappearance of edema occurs on10.04±2.44 days, average weight fall in percentage/day, was 0.90±0.29, average length of stay was 14.71±3.81 days, and Avg. weight gain was 14.23±5.87 gm/kg/day .

In severe (+3) grade edema, onset of edema reduction occurs on 3.53±01.01 day, complete disappearance of edema occurs on 11.29±2.71 days., average weight fall in percentage/day, was 1.03±0.30, average length of stay was 17.12±3.60 days, and Avg. weight gain was 15.33±5.15 gm/kg/day. In our study the length of stay is little bit longer than usual recommended. It may be probably because in severe grade of edema it was difficult to control intake of children as most of the children were on breastfeeding.

Overall outcome of our study that onset of edema reduction occurs on 3.22±0.91days and there was significant increase in days at which edema start to reduce with increase in severity of edema (p value=0.02). Complete disappearance of edema occurs in 10.02±2.80 days and there was significant increase in days at which edema disappears completely with increase in severity of edema (p value=0.001). Avg. weight fall in percentage/day was 0.91± 0.31 and which was significantly increase (P value = 0.03) with increase in severity of edema. Average Length of stay was 14.93±4.10days and days in hospital stay were significantly increase (P value =0.0006) with increase in severity of edema. Average weight gain was 14.18±5.42 gm/kg/day and there was no significant difference (p value=0.154) in weight gain according to grade of edema.

Singh K, Badgaiyan N, and Kushwaha KP, conducted a similar study in Uttar Pradesh, which was done in 2010 and 2011. Results showing that 54.6% were boys, 81.6% were in the age group 6-23 months old, and 42% had edema or medical complications. 14 (1.2%) children died 657 (47.2%) children defaulted, and 610 (51.7%) children were discharged. The average (SD) weight gain was 12.1 (7.3) g/kg body weight/day and the average (SD) length of stay was 13.2 (5.6) days. 206 (46.8%) children were discharged after recovery (weight gain ≥15%) while 324 (53.2%) were discharged, non-recovered (weight gain <15%).[8]

CONCLUSION

Majority of the patients were in WHO z-score of <-3SD and <-4SD z-score but extremes are also occurring even up to <-8SD z-score. Less than fifty percent of children were on complementary feeding between 6 months to 24 months of age. Less than half of the children attached with AWC and only a few received supplementary nutrition. Most of the patient of E-SAM had anemia and almost half of them required blood transfusion after hospitalization. Pneumonia and tuberculosis are the affected co-morbidities for outcome of E-SAM children. Disappearance of edema, and length of stay are little bit longer than usual WHO guideline recommendations and they had a significant association with grade of edema. Percentage of wt. fall also had association with grade of edema.

So we recommend from this present study that more stress and strategic efforts are needed to tackle severe acute malnutrition. Infant and young child feeding (IYCF) activities are to be strengthening through ICDS functionaries as well as every health facility. Whenever a child comes in contact to these points he should always be counseled about correct feeding practices.

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