

Original Research Article

Clinical spectrum of severe acute malnutrition among children admitted to nutritional rehabilitation centre of a tertiary care hospital with special reference to incidence of bilateral pitting pedal oedema in children with severe acute malnutrition

M. R. Prashanth*, M. R. Savitha, H. N. Yashwanth Raju, M. Shanthi

Department of Pediatrics, Mysore Medical College and Research Institute, Mysore, Karnataka, India

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***Correspondence:**

Dr. M. R. Prashanth,

E-mail: drprashu@gmail.com

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ABSTRACT

Background: Malnutrition is a major cause of morbidity and mortality in under five children globally, according to global nutrition report 2016, forty five percent of deaths in under five children are linked to malnutrition. The objective of this study was to study the clinical spectrum in children with Severe Acute Malnutrition (SAM) admitted to nutritional rehabilitation center of a tertiary care hospital.

Methods: Children between the age group of 6 months to 5 years admitted in the nutritional rehabilitation centre during the period of 1 year (from April 2016 to March 2017) meeting our inclusion criteria were included in the study. We retrospectively reviewed the medical records of these children. Clinical spectrum of SAM was compared with comparison group.

Results: A total of 100 cases were included in the study. Ninety five percent of children met the criteria of weight for height less than 3SD, 45% of children met the criteria of Mid Upper arm Circumference (MUAC) less than 11.5 cms and 5% of children met the criteria of bilateral pitting pedal oedema. Mean age of presentation of children in the present study was 15.8 months among which 45% were males and 55% were females. Major symptoms of the study group were fever, cough, hurried breathing, loss of appetite and loose stools with 79%, 45%, 27%, 26% and 23% as respective frequencies. Pneumonia (43%) was the major comorbidity among children admitted with severe acute malnutrition. Diarrhoea (21%), meningitis (8%), urinary tract infection (6%) were the other co-morbidities present in the study group.

Conclusions: Pneumonia and diarrhoea are the major co-morbidities present in children with SAM. Majority of children fulfil the criteria of weight for height $\leq 3SD$ for diagnosis of SAM. There is a low incidence of oedematous malnutrition in the present study.

Keywords: Oedema, Pneumonia, Severe acute malnutrition

INTRODUCTION

Malnutrition is a major cause of morbidity and mortality in under five children globally, according to global nutrition report 2016, forty five percent of deaths in under five children are linked to malnutrition.^{1,2} Malnutrition

and diet are now the largest risk factors responsible for the global burden of disease.³ Severe acute malnutrition being the major problem in developing countries including India, 15.1% of children in India are wasted.¹ According to NFHS 4 survey prevalence of SAM in state of Karnataka is 10.5%.⁴ Malnutrition occurs due to

various factors, majority of being illiteracy among mothers, faulty feeding practices and incomplete immunization.⁵ Clinical features of children with malnutrition being variable majority present with fever, loss of appetite and many present to hospital with co morbid conditions like pneumonia and diarrhea.^{6,7} There are two major clinical spectrum of malnutrition-oedematous and non edematous (wasted) malnutrition. Although various explanations are given for pathophysiology of oedema in malnutrition, mortality still remains high in children with oedematous malnutrition, but little is known about burden of oedematous malnutrition and few large-scale surveys are yet to measure it.^{8,9} This study was intended to study the clinical correlates with severe acute malnutrition and to know the incidence of oedematous malnutrition among children with severe acute malnutrition.

METHODS

The present study was cross sectional study which was conducted by retrospectively analysing the records of admissions to Nutritional rehabilitation centre of Mysore Medical College from April 2016 to March 2017. Children were included in the study based on the following inclusion and exclusion criteria:

Inclusion criteria

- Children in age group 6months to 5 years
- Children meeting WHO criteria of severe acute malnutrition:
 - a) Weight for height ≤ 3 SD as per WHO growth chart.
 - b) Mid upper arm circumference < 11.5 cm
 - c) Bilateral pitting pedal oedema.

Exclusion criteria

Child having oedema due to other (renal, hepatic, cardiovascular) causes were excluded.

Methodology

A minimum sample size of 90 cases was calculated with the prevalence of SAM amongst admitted patients in department of Pediatrics, Mysore Medical College being 6% at 0.05 significance level using the formula,

Sample size, $n = z^2pq/d^2$.

Where,

$z = 1.96$,

$p =$ prevalence of the disease,

$q = 1-p$

$d = 95\%$ confidence interval.

Hence 100 children with SAM & 100 children without SAM as comparison group were taken up for the study.

After obtaining institutional ethical committee clearance, we retrospectively reviewed the case records of children admitted to nutritional rehabilitation centre attached to Mysore medical college. A comparison group of 100 children with no evidence of severe acute malnutrition were selected from children admitted in department of paediatrics of Mysore Medical College during the same period by simple random sampling. Clinical variables between the two groups were analysed statistically using SPSS version 20.0 for windows.

RESULTS

A total of 100 cases were included in the study who met the inclusion criteria. 90% of children met the criteria of weight for height less than 3SD, 45% of children met the criteria of MUAC less than 11.5cms and 5% of children met the criteria of bilateral pitting pedal oedema (Table 1).

Table 1: Distribution of study group according to inclusion criteria.

Inclusion criteria	No. of cases (n=100)	Percentage
Weight for height ≤ 3 SD	90	90
MUAC < 11.5 cm	45	45
Bilateral pitting pedal edema	5	5

Mean age of presentation of children in our study was 15.8 months among which 45% were males and 55% were females. Among 5% of children with oedematous malnutrition all of them had grade one pedal oedema according to WHO grading. Among 5 children who had oedema, two of them had concurrent iron deficiency anemia, one child had septicaemia with methicillin resistant staphylococcus aureus who improved well with treatment, another case had severe pneumonia and other two cases were associated with cerebral motor disability and febrile seizures respectively.

Table 2: Distribution of clinical features among study group and comparison group.

Clinical features on admission	cases	Comparison group	p value
Fever	79	76	0.611
Cough	45	50	0.479
Hurried breathing	27	2	0.000
Loose stools	23	12	0.041
Vomiting	18	14	0.440
Ear discharge	1	8	0.004
Convulsions	9	9	1.00
Rash	1	5	0.097
Loss of appetite	26	5	0.000

Major symptoms in children with severe acute malnutrition was fever, cough, hurried breathing, loss of

appetite and loose stools with 79%, 45%, 27% ($p = 0.00$), 26% ($p = 0.00$) and 23% ($p = 0.041$) as respective frequencies and major symptoms in comparison group was fever, cough, vomiting and loose stools with 76%, 50%, 14% and 12% as respective frequencies (Table 2).

Pneumonia (43%, $p = 0.00$) was the major comorbidity among children admitted with severe acute malnutrition. Among 43 children with pneumonia, 8 children had severe pneumonia and other 35 children had pneumonia with no danger signs according to WHO classification, all the children with pneumonia improved well with the appropriate treatment. In the comparison group only 7 children had pneumonia which was categorised as severe pneumonia according to WHO classification of pneumonia. Diarrhoea (21%, $p = 0.03$), Meningitis (8%, $p = 0.004$), urinary tract infection (6%) were the other comorbidities present in the study group. Otitis media and measles were present in each of two children in study group. Seventy percent of the children had concurrent anaemia with all of them having nutritional anaemia secondary to iron deficiency and two children presented with severe anaemia with haemoglobin less than 4gm/dl. Diarrhoea, pneumonia, otitis media, and UTI were the other co morbidities present in comparison group with respective frequencies 10%, 7%, 6%, and 3% (Table 3).

Table 3: Distribution of co-morbidities among study group and comparison group.

Comorbidities	Cases	Comparison group	p value
Pneumonia	43	7	0.00
Diarrhoea	21	10	0.03
Urinary tract infection	6	3	0.306
Sepsis	7	0	0.007
Otitis media	1	6	0.054
Meningitis	8	0	0.004
Tuberculosis	0	0	-
Measles	1	0	0.316
Malaria	0	0	-
Anemia	76	4	0.00

Among the 21 children with diarrhoea, 18 children had dehydration without shock and 3 children presented with shock. Only 10% children in the comparison group had diarrhoea compared to 21% of children with SAM. Among 6 children with UTI, one child had complicated UTI with septicaemia and other children had simple UTI. Only 3% of the children in comparison group had UTI compared to 6% of children with SAM. All the cases of UTI improved well with appropriate treatment.

Though children with oedematous malnutrition were associated with complications like pneumonia (20%), septicaemia (20%) and anaemia (40%), it was comparatively less when compared to complications (pneumonia: 44%, septicaemia: 6%, anemia: 78%) in children with non-oedematous malnutrition. In the 100

cases of children with SAM 26% were wasted and 20% of children had skin and hair changes. Among 100 cases in study group one child died due to severe sepsis by methicillin resistant *Staphylococcus aureus*.

DISCUSSION

Mean age of children with severe acute malnutrition in our study was 15.8 months which was similar to study done by Rakeshkumar et al and mean age in our study is slightly less when compared to study done by Tarachandsaini et al (19.7 months).^{7,10} The early age of children presenting with severe acute malnutrition i.e. less than two years could be due to poor feeding practices such as early introduction of complementary foods and inadequate breast feeding.

The sex ratio in the present study was 1:1.2 with slight female preponderance, these results were similar to studies by Mutambo et al and Beranl C et al.^{11,12} Fever (79%), cough (45%) and hurried breathing (27%) were the most common clinical symptoms present in our study. The incidence of fever, cough and hurried breathing ($p = 0.00$) were slightly high compared to the study done by Chiabi A et al.⁶ Pneumonia (43%, $p = 0.00$) was the major co-morbidities present in our study. Andreaschiabi et al had incidence of 25% and Rakeshkumar et al study had 27.9% of children with pneumonia. The high prevalence of severe acute malnutrition in children with pneumonia can be due to depressed cell mediated and humoral responses in children with severe acute malnutrition along with combination of higher circulating levels of bacterial endotoxin and small bowel overgrowth associated with increase in oxidative stress leading to treatment failure and increases mortality in children with severe acute malnutrition.^{13,14}

Diarrhoea ($p = 0.03$) was present in 21% of children in our study which was less compared to studies done by Irena et al (67%) and Garg M et al (42%).^{15,16} Diarrhoea in children with severe acute malnutrition increases life threatening complications such as hypoglycaemia, hypothermia, serious infections and electrolyte imbalances.¹⁷ Septicemia (7%) and meningitis (8%) were the other statistically important co morbidities present in the present study. The incidence of septicaemia (7%, $p = 0.007$) in the present study was similar to study done by Jobayerchisti et al (7%) and lesser when compared to study done by Page AL et al (23%).^{18,19}

Severe sepsis is associated with oxidative stress that leads to endogenous production of nitric oxide, this nitric oxide is responsible for uncontrolled vasodilation leading to death.^{20,21} On the other hand both high intracellular and high extracellular sodium content and simultaneous reduction of alveolar epithelial sodium and chloride transport in severely malnourished children impedes clearance of fluid from alveolus. This mechanism is more pronounced in children having pneumonia and severe sepsis.^{22,23} Oedema was present in 5% of cases and 1% of

comparison group in our study with p value of 0.024 which was statistically significant. Oedema in children with severe acute malnutrition can occur due to multiple factors like protein deficiency, hormonal imbalance, aflatoxin poisoning and oxidative stress.²⁴⁻²⁷ A Jamaican retrospective study has found that children with higher birth weight having oedematous malnutrition more than non-oedematous malnutrition suggesting prenatal factors influencing clinical presentation of malnutrition.²⁸

Though the oedematous malnutrition is associated with more mortality than non-oedematous malnutrition, the incidence of oedematous malnutrition is in declining trend in the recent years (Table 4).²⁹⁻³¹

CONCLUSION

Pneumonia and Diarrhoea are the major co-morbidities present in children with SAM. Majority of children fulfil the criteria of weight for height $\leq 3SD$ for diagnosis of SAM. There is a low incidence of oedemaous malnutrition in the present study. Even though children with oedematous malnutrition were associated with major co-morbidities like pneumonia and sepsis, their incidence were not more when compared to children with non-oedematous malnutrition.

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