Clinical profile of severe acute malnutrition among children under five years of age living in Bundelkhand region of Uttar Pradesh

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ABSTRACT

Introduction: Malnutrition is a general term and often refers to undernutrition resulting from inadequate consumption, poor absorption, or excessive loss of nutrients, but the term also encompasses overnutrition. **Objective:** The objective is to study the clinical profile of children with severe acute malnutrition (SAM) and also to assess the effectiveness of Nutrition Rehabilitation Center in providing therapeutic care for children with SAM. **Materials and Methods:** This prospective study was conducted at the department of pediatrics of a tertiary care center at Jhansi for a period of 12 months among 152 children with SAM. A detailed history and physical examination finding were recorded in pretested pro forma at the time of admission using the standard methodology and anthropometric measurement expressed in standard deviation from the median of the reference population (WHO). **Results:** Majority of the patients (96, 63.15%) belonged to age group of 6–24 months. Male patients constituted 52% of the total with a ratio of M:F = 1.1:1. The most common symptom reported was fever (53.28%), and the most common comorbidity was anemia 84.42%. An average hospital stay of patients was 8.72 days, and average weight gain/kg/day was 10.39 g. Suckling supplement technique was administered in 19 patients, with success in 13 (68.42%) cases while failure in 6 (31.57%) cases. **Conclusion:** Determinants of severe malnutrition include faulty feeding practices, ignorance about nutritional needs, repeated infections, large family size, and low socioeconomic status. Weight-height ratio is one of the best among the criteria for identifying SAM, and hence, every child should be screened adequately on presentation.

Key words: *Anemia, Nutrition rehabilitation center, Severe acute malnutrition, Suckling supplement technique*

Malnutrition is a general term and often refers to undernutrition resulting from inadequate consumption, poor absorption, or excessive loss of nutrients, but the term also encompasses over nutrition [1]. Malnutrition in children is widely prevalent in developing countries including India (15.8%) [2]. It is one of the leading causes of morbidity and mortality in children throughout the world. More than 33% of deaths in the age group of 0–5 years are associated with malnutrition. India is home to the largest population of severely malnourished children of the world and accounts for over 20% of under-five childhood deaths every year, and 2.1 million children do not survive till their 5th birthday [3].

Severe acute malnutrition (SAM) is a unique type of malnutrition and is different from severe underweight and severe stunting. It is a medicosocial disorder. Lack of exclusive breastfeeding, late introduction of complementary feeds, feeding diluted feeds containing less amount of nutrients, repeated enteric and respiratory tract infections, ignorance, and poverty are some of the factors responsible for SAM [4]. In Bundelkhand region, exact data of SAM among under-five children are poor. Hence, the present work was undertaken to study the clinical profile of children with SAM and also to assess the effectiveness of Nutrition Rehabilitation Center (NRC) in providing therapeutic care for children with SAM.

METHODS

This was a hospital-based prospective study conducted among children with SAM and admitted to the NRC of a tertiary care hospital, Jhansi. The data were collected during 1 year period (November 2016–October 2017). The study protocol was reviewed by the Ethical Committee of Institutional Review Board and was granted ethical clearance. Written informed consent was obtained from the parents/caregivers of the children. We have included 152 children satisfying the following inclusion criteria. A total of 261 patients were admitted in the NRC of the hospital during the study period. Of these, 58 patients defaulted and 51 patients were excluded to various reasons. Thus, 152 patients enrolled in our study.

Children in the age group of 6–59 months, admitted to NRC and satisfying any of the following criteria, were diagnosed as under SAM and included in our study: (1) Weight-for-height: Less than −3 SD and for infants (1–6 months): <−3 SD (in infants >45 cm), (2) visible severe wasting, (3) mid-upper arm

circumference (MUAC) ≤115 mm, and (4) bilateral pitting edema (+/++/+++).

Children <1 month of age, children with history of neonatal Intensive Care Unit admission, and children with congenital anomalies (cleft lip and cleft palate), gastroesophageal reflux disease, surgical conditions, chronic renal failure, congenital heart disease, liver disorder, mental retardation, and cerebral palsy were excluded from the study. Children whose parents did not give consent were also excluded.

A detailed history and physical examination finding were recorded by the same resident for all the cases in a pretested pro forma at the time of admission. Socioeconomic status (SES) was measured using modified Kuppuswamy scale. Detailed anthropometric measurement was done at the time of admission including weight, height, and MUAC. Weight was measured using electronic weighing machine (Error 20 g). Length/height using infantometer (below 2 years) and/or stadiometer (above 2 years of age). MUAC was measured on the left arm, midway between the acromion and the olecranon using Shakir tape. Detailed examination was done at the time of admission, and active illness along with comorbidity was noted.

Following investigations were done in all patients: Blood glucose, complete blood counts, serum electrolytes, and renal function tests. Other investigations such as liver function tests, stool and urine examination, erythrocyte sedimentation rate, C-reactive protein (CRP), blood and urine cultures, and chest X-ray were performed wherever required.

The data were collected, compiled systematically in tabular form, and analyzed using Statistical Package for Social Sciences (SPSS Inc., Chicago, Version 22.0) for descriptive data, and the results were then tabulated for calculation of response percentage.

RESULTS

A total of 261 patients were admitted in the NRC of the hospital during the study period. Of these, 58 patients defaulted and 51 patients were excluded to various reasons. Thus, 152 patients were enrolled in our study. Among 152 children, 52.6% were males (male:female ratio - 1.1:1) and 63.15% belonged to age group of 6–24 months. SAM was more common in lower SES (83.55%), and 70% of them continued the breast-feeding practice only for 1 month after birth (Table 1). Among the 152 children, 79.60% had weight-for-height <−3 SD, 48.68% with MUAC <115 mm, 41.44% with visible severe wasting, and 9.86% with bilateral pitting edema (Table 2).

The most common symptom was fever (53.28%) followed by not gaining weight (51.97%), and cough and cold (23.68%) (Table 3). The most common comorbidity was anemia 84.42% followed by acute lower respiratory tract infection (28.94%) (Table 4). Pallor was the most common sign, i.e., in 84.42% followed by skin and hair changes (23.68%), signs of Vitamin A deficiency (13.57%), edema (10.50%), lymphadenopathy (9.86%), Vitamin D deficiency (7.23%), dehydration (5.92%), and icterus (3.94%). Hepatomegaly was found in 39 (25.65%) cases, splenomegaly in 24 (15.78%), respiratory sign in 15 (9.86%), neurological dysfunction in 8 (5.26%), while infantile tremor syndrome in 8 (5.26%) cases.

Table 1: Distribution of age, sex, SES, and breastfeeding pracice

Demographic detail	Total (%)
Gender	
Male	80 (52.63)
Female	72 (47.36)
Age (Months)	
<6	21 (13.81)
6–24	96 (63.15)
24–60	35 (23.02)
SES	
Lower	127 (83.55)
Upper lower	12 (7.89)
Lower middle	4 (2.63)
Upper middle	9 (5.92)
Breast feeding (Months)	
Up to 1	107 (70.39)
Up to 2	95 (62.50)
Up to 3	80 (52.63)
Up to 4	55 (36.18)
Up to 5	31 (20.39)
Up to 6	16 (10.59)
>6	3 (1.97)

SES: Socioeconomic status

Table 2: Distribution of SAM criteria

Criteria	Total (%)
Weight-for-height	121 (79.60)
MUAC	74 (48.68)
Visible severe wasting	63 (41.44)
Bilateral pitting edema	15 (9.86)

SAM: Severe acute malnutrition, MUAC: Mid-upper arm circumference

Table 3: Distribution of symptoms in SAM children

Symptoms	Number of cases (%)
Fever	81 (53.28)
Cough and cold	36 (23.68)
Not gaining weight	79 (51.97)
Loose stool	32 (21.05)
Vomiting	19 (12.5)
Weak sucking	5 (3.28)
Abdominal pain	2 (1.31)
Swelling all over body	2 (1.31)
Abdominal distension	5 (3.28)
Bleeding disorder	2 (1.31)
Cough	7 (4.60)
Weakness of lower limb	3 (1.97)
Respiratory distress	11 (7.23)
Convulsion	8 (5.26)
Abnormal movement of upper limb and head	8 (5.26)

SAM: Severe acute malnutrition

Table 4: Distribution according to disease pattern

Morbidity	Total (%)
Anemia	128 (84.21)
Lower respiratory tract infection	44 (28.94)
Acute diarrhea	32 (21.05)
Severe pneumonia	18 (11.84)
Infantile tremor syndrome	8 (5.26)
Septicemia	7 (4.6)
Malaria	6 (3.94)
Acute gastroenteritis	5 (3.28)
Acute hepatitis	3 (1.97)
Urinary tract infection	3 (1.97)
Tuberculosis	3 (1.97)
Typhoid fever	2 (1.31)
Coeliac disease	1 (0.65)
Otitis media (CSOM)	1 (0.65)
Rickets	1 (0.65)

CSOM: Chronic suppurative otitis media

Among 152 children, hypoglycemia was reported in 14 (9.21%) patients, serum electrolyte abnormality among 7 (4.60%) children, positive CRP in 4 (2.63%), urine pus cells in 4 (2.63%), positive widal test in 3 (1.97%), positive mantoux in 3 (1.97%), positive *Plasmodium vivax* in 3 (1.97%), urine candida growth in 2 (1.31%), and presence of *Entamoeba histolytica* in stool of 2 (1.31%) patients, while tTg-IgA test was positive in 1 (0.65%).

Average NRC stay of patients was 8.72 days (range 2–17 days), average weight gain was 540 g (range 20–1510 g), and average weight gain/kg/day was 10.39 g (range 2.05–26.85). Among the enrolled patients, 18.42% were weaned before 6 months of age, 48.68% between 6 and 9 months of age, and 32.89% after 9 months of age. Suckling supplement technique (SST) was administered in 19 patients of <6 months of age where maternal lactation success in 13 (68.42%) cases while failure was observed in 6 (31.57%) cases. Of total 152 patients in our study, 81 (53.28%) were cured while 71 (46.71%) defaulted from treatment.

DISCUSSION

Severe malnutrition not only causes significant morbidity and mortality but also leads to permanent impairment of physical and possibly mental growth of those who survive. In addition to critical care, nutritional therapy followed by nutritional rehabilitation is an important aspect of these children. Despite concerted efforts in recent years involving policy makers, health-care providers and social organizations management of malnutrition remain a challenge [5].

This hospital-based study included 152 patients with 76.97% of patients below 24 months of age. Similar findings were reported in several studies done in the past. In one of the studies, Aguayo *et al.* [6] reported that 77.7% of children were below 24 months of age. Kumar *et al.* [7] performed a study on comorbidities in hospitalized children with SAM and reported that 59.6% of children were in the age group of 6–12 months of age, and Choudhary *et al*. [8] observed that 96% of the sample population was below 24 months of age. In the initial 2–3 years of life, human body witnesses tissue building and rapid growth requiring increased amount of substrate for energy. Inadequate supply demand ratio in this age group makes them more susceptible to SAM, explaining higher incidence in this age group as compared to other age groups.

In the present study, males were more common than females (52% vs. 48%) with a ratio of 1.1:1. In one of the studies, Choudhary *et al*. [8] also reported that SAM was relatively more common in males (74.6% vs. 25.4%). Likewise, Tariq *et al.* [9] and Lal *et al.* [10] in their studies observed that 54.8% and 52% of children with SAM were males, respectively. However, Aguayo *et al.* [6] observed that the incidence of malnutrition was higher in females (55%) as compared to males (45%). Kumar *et al.* [7] and Shah and Javdekar [11] in their studies also demonstrated female preponderance.

In our study, 83.55% of our study population belonged to lower SES (modified Kuppuswami scale) [12]. Kumar *et al.* [7] and Choudhary *et al.* [8], in their studies, reported that the majority of malnourished children belonged to lower SES, i.e., 75% and 96%, respectively. Other authors have also reported that malnutrition is related to per capita income and socioeconomic condition [9]. Unavailability of food, poor purchasing power, inappropriate distribution, and inadequate utilization make children vulnerable to malnutrition in a deprived community, as observed in above studies.

Analysis of different WHO criteria used for the diagnosis of SAM revealed that the majority of patients (121, 79.6%) fulfilled weight/length criteria of SAM. Similarly, Lal *et al.* [10] reported that the majority, i.e., 48% of the children satisfied weight/length (or height) criteria. Ganesh *et al.* [13] too observed that weight/height criteria were the most frequent criteria to be fulfilled in his study population. Aguayo *et al.* [6] demonstrated that 97.4% of children had severe wasting, whereas Kumar *et al.* [7] reported 24.03% severe visible wasting and 27% had bilateral pitting edema in their study.

The most common presenting symptom in the present study was fever (53.28%) followed by others as illustrated in Table 4. Aguayo *et al.* [6], in his study, also reported the similar spectrum of presentation with high fever (9.9%), followed by severe anemia (6.9%). Kumar *et al.* [7] reported that diarrhea (54%) and acute respiratory tract infection (27.8%) were common presenting symptoms. Shah and Javdekar [11] too demonstrated that fever (65%) was the most common symptom followed by diarrhea (40%). Fever in 70.7% and vomiting in 52% were again noted to be common by Choudhary *et al.* [8]. This underlines the fact that infections form the major presenting profile in these cases.

In this present study, the most common comorbidity was anemia (84.21) followed by lower respiratory tract infection (28.94%) and acute diarrhea (21.05%). Berti *et al.* [14] reported that most common associated illness at admission was pneumonia (10%) followed by tuberculosis (6.6%). Aguayo *et al.* [6], in their study, found a significant association with severe anemia

(6.9%) followed by respiratory tract infection (3.5%), while Kumar *et al.* [7] inferred in his study that 54% had diarrhea and 27.8% had acute respiratory tract infections. Tuberculosis was diagnosed in 22% of cases (60.8% of cases in children of 6–12-month-old). Shah and Javdekar [11] observed that the most common associated illness at admission was diarrhea followed by bronchopneumonia and acute gastritis. Choudhary *et al.* [8], in their study, quoted that gastrointestinal infection (60%) was most common followed by respiratory tract infection (52%). Tariq *et al.* [9] had similar observations with diarrhea (30.1%) as the most common comorbidity followed by acute respiratory infection (26.3). Respiratory and gastrointestinal tract infections were thus the two most common comorbidities associated with malnutrition in these studies which also correlates with our study. The variation in the incidence of these two may be explained on the basis of environmental factors such as exposure to dust, smoke, overcrowding, and access to hygienic drinking water.

In the present study, 69.73% of patients were anemic at the time of admission and with severe anemia in 7.89%. Skin and hair changes (23.68%) were the second most common finding at admission followed by Vitamin A deficiency (20%) and edema (16%). Similar to our study, Shah and Javdekar [11], in their study, illustrated that the incidence of anemia was 96.6% in malnourished children. Similarly, Choudhary *et al.* [8] also observed that 85% of patients were anemic at admission, and of them, 10.9% had mild, 59.3% moderate, and 29.7% severe anemia. Vitamin B deficiency (40%) was the most common vitamin deficiency followed by Vitamin A (28%), Vitamin D (6.7%), and Vitamin C (1.3%). There is general agreement that fasting blood glucose is lower in malnourished children, though there is wide variation in the blood glucose levels in various studies.

We observed that, in the enrolled patients, 9.21% of patients had hypoglycemia. Similar to our study, Shah and Javdekar [11] and Choudhary *et al.* [8] observed hypoglycemia in 5% and 21.3% of patients, respectively. Symptomatic hypoglycemia is life-threatening and requires urgent treatment, and sugar monitoring should be emphasized.

Breast milk is the best available food for infant and those who have been deprived of this are expected to show a greater prevalence of malnutrition. We observed that only 20.39% of patients had received exclusive breastfeeding up to 5 months of age though 70.39% were exclusively breastfed up to 2 months of age. Similarly, Choudhary *et al.* [8] and Aneja *et al*. [15] have also demonstrated that breastfeeding was seen up to 2 months in 74.7% and 41% of cases, respectively, and only in 9.3% and 20% till 5–6 months of age. 18.42% of patients in this study were weaned off breast milk before 6 months of age and 32.89% after 9 months of age. Similar to our study, Choudhary *et al.* [8] observed that weaning was started before 6 months of age in 25% of cases and in 40.7% after 9 months of age. Rasania and Sachdev [16] stated that duration of breastfeeding was found to be significantly associated with malnutrition. Hossain *et al*. [17] and Nube and Assenso-Okyere [18] while assessing the effect of prolonged breastfeeding on the nutritional status observed considerably lower nutritional status of children who continue to receive breast milk up to 2nd and 3rd year of life. Thus, early as well as delayed weaning is detrimental to health. Prevalence of malnutrition was more in children when breastfeeding was continued for longer period because as the age advances, breast milk becomes inadequate for the child.

SST was administered in 19 patients, with success in 13 (68.42%) cases while failure in 6 (31.57%) cases. Singh *et a*l. [19] reported that SST was successful in 55.7% of infants and failed in 43.5%. Similar observations were made by Vyge*n et al*. [20], with a success rate of 85% with SST in their NRC. Failure included those babies who could not be shifted back to exclusive breastfeeding or those mothers who left the hospital before establishment of relactation.

In our study, the average duration of stay in hospital was 8.73 days with an average weight gain of 10.39 g/kg/day. Shah and Javdekar [11] observed that mean weight gain was 9.3 g/kg/day. Tariq *et al.* [9], however, reported that average weight gain in SAM patients was 5.5 g/kg/day and average hospital stay was 16 days. Lal *et al.* [10] demonstrated mean weight gain of 14.18±5.42 g/kg/day and mean hospital stay of 14.93±4.10 days. Ganesh *et al.* [13] too observed that average duration of stay in the hospital was 7.02 days with an average weight gain of 8.9 g/kg/day. This variability observed in these studies, and ours could be due to various epidemiological factors of the sample population as well as the degree of motivation of parents.

Limitation

Patients in our study were not followed up so as to access the weight gain and feeding adequacy after discharge. Adequacy of counseling of mothers of children was not assessed on discharge. Hence, further randomized trials with larger sample size and overcoming these limitations should be conducted in future.

CONCLUSION

SAM still remains prevalent despite recent advances in medicine and technology. Determinants of severe malnutrition include faulty feeding practices, ignorance about nutritional needs, repeated infections, large family size, and low SES. Weight-height ratio is one of the best among the criteria for identifying SAM, and hence, every child should be screened adequately on presentation. Skilled therapeutic nutritional care, guidance, and counseling, especially, SST administration in NRC play a major role in improving the outcome.

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