

Demographic Profile, Clinical Profile and Outcome of Severe Acute Malnutrition among Children Aged 6 to 59 Months at a Tertiary Care Hospital, North East India

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ABSTRACT

BACKGROUND

Malnutrition is one of the leading causes of morbidity and mortality in children under 5 years of age. Children with severe acute malnutrition have nine times higher mortality than those in well-nourished children. The purpose of this study was to describe the demography, clinical profile, and outcome of children with severe acute malnutrition aged between 6 months to 59 months admitted in nutrition rehabilitation centre at a tertiary care hospital in North East India.

METHODS

A cross sectional-observational hospital-based study was conducted between May 2019 and April 2020 on 140 children. Severe acute malnutrition was diagnosed as per WHO criteria by using standard techniques. Variables recorded were demographic factors, anthropometry, clinical profile, laboratory tests, and medical complications. The outcome indicators including hospital course were studied.

RESULTS

In the present study 63.6 % were males and the mean age of presentation was 20.0 ± 1.54 months. 57.1 % children were found to be having both weight for height z-score below - 3 SD and mid upper arm circumference less than 115 mm together. Acute gastroenteritis (45.2 %) was the most common co-morbid condition followed by respiratory tract infection (26.2 %). Iron deficiency anaemia was found in 70.7 % of study children. Recovery rate from severe acute malnutrition was 86.4 % with average weight gain of 6.4 g / kg / day.

CONCLUSIONS

Children with severe acute malnutrition tend to suffer from serious co-morbid conditions. Early identification and treatment in nutrition rehabilitation centre with facility for critical care support should become a key component of continuum of care for children with severe acute malnutrition.

KEYWORDS

Children, Clinical Profile, Facility-Based Care, Severe Acute Malnutrition, Outcome

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DOI: 10.18410/jebmh/2021/244

How to Cite This Article:

Devi RR, Singh CI. Demographic profile, clinical profile and outcome of severe acute malnutrition among children aged 6 to 59 months at a tertiary care hospital, North East India. J Evid Based Med Healthc 2021;8(18):1276-1280. DOI: 10.18410/jebmh/2021/244

*Submission 01-01-2021,
Peer Review 09-01-2021,
Acceptance 13-03-2021,
Published 03-05-2021.*

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BACKGROUND

"Malnutrition in children is widely prevalent in developing countries especially sub-Saharan Africa and South-East Asia including India. Nearly fifty percent of all deaths in children are attributed to malnutrition. Globally, every year 3 million children below 5 years of age reported death due to malnutrition.¹ Major health consequences of malnutrition in children includes delayed physical growth, impaired motor development, poor cognitive skills and vulnerability to serious infectious diseases. Severe acute malnutrition is both a medical and social disorder. The children with severe acute malnutrition have nine times higher risk of dying than well-nourished children. Severe acute malnutrition afflicts an estimated 8.1 million under-five children in India.^{2,3} Malnutrition is also believed to contribute to sixty-one percent of diarrheal deaths and fifty two percent of pneumonia deaths.⁴

Children with severe acute malnutrition should be managed as 'inpatients' preferably in a specialized units like Nutrition Rehabilitation Centre with skilled manpower and adequate resources for medical and nutritional therapeutic care.⁵ Severe acute malnutrition is defined as per WHO recommendations by a mid-upper arm circumference (MUAC) below 115 mm and / or a weight-for-height / length z-score (WHZ) below -3 SD of WHO Child Growth Standards and / or bilateral nutritional pedal oedema and / or visible severe wasting. Severe acute malnutrition with co morbidities and medical complications need to be managed and followed up in nutrition rehabilitation centre.⁶ Early detection of severe acute malnutrition will ensure that these children will be identified before they develop medical complications.⁷ Dietary interventions using WHO F 75 and F 100 formulae in the management of inpatient care of severe acute malnutrition have improved outcomes including reduced mortality, early recovery and higher weight gain.⁸ There were lack of data on the demographic and clinical presentation of children with severe acute malnutrition in North East India.

The purpose of the study was to describe the demographic, clinical profile and outcome of children with severe acute malnutrition aged between 6 months to 59 months in a tertiary teaching hospital in Manipur.

METHODS

"A cross sectional-observational study was carried out over a period of 12 months, from May 2019 to April 2020 in the nutrition rehabilitation centre, Department of Paediatrics, Manipur, North East India. Ethical clearance was obtained from the institutional ethics committee. Written informed consent was obtained from the parents in the local language before entering the study. At the nutrition rehabilitation centre, the age, weight, height / length, mid upper arm circumference, and presence or absence of bilateral pitting pedal oedema were assessed in all study subjects. Severe acute malnutrition was diagnosed as per WHO recommendation when the child had any one of the following criteria: weight for height (z score) less than -3

standard deviation (SD), mid-upper arm circumference (MUAC) less than 115 mm, nutritional bipedal oedema or visible severe wasting".⁹ Electronic weighing scale were used for measuring the weight of the child. Standing height were measured using the stadiometer for children aged 2 years and above whereas for children younger than 2 years' length on lying down position were measured using infantometer. The weighing scale, stadiometer and infantometer were calibrated each week before the start of the data collection. MUAC was measured using the multicolour (red, yellow, green zones) mid arm insertion tape on left arm. Height was measured to the nearest 0.1 cm, weight to the nearest 0.1 kg and MUAC measured to 2 mm precision. All the children were also assessed for visible severe wasting and bilateral pedal oedema. Detailed history was taken for all the children and examined clinically to detect the presence of co morbidities and medical complications as per guidelines on Integrated Management of Neonatal and Childhood Illnesses.¹⁰ The necessary laboratory investigations and treatment were done according to clinical outcome of the enrolled children.

Inclusion Criteria

1. All children with severe acute malnutrition aged between 6 to 59 months admitted in the nutrition rehabilitation centre were enrolled for the study.
2. Severe acute malnutrition with co-morbidities were included.
3. Severe acute malnutrition with complications were included.
4. Severe acute malnutrition with micronutrient deficiencies were included.

Exclusion Criteria

Children with HIV and malignancies were excluded from the study.

Statistical Analysis

The data was collected and entered into excel sheet. Statistical analyses were performed using SPSS for Windows version 22.0. Descriptive analyses were done to calculate mean, ratio, percentage and standard deviation. Categorical variables were reported as proportions. Comparison of MUAC by weight-for-height z-score (WHZ) using Chi-square test were done and P-value less than 0.05 was considered statistically significant.

RESULTS

A total of 140 children aged between 6 to 59 months who made the criteria for severe acute malnutrition were enrolled for the study. The sociodemographic characteristics of the study population were detailed in Table 1. Majority (55.7 %) of children were in the age group of 12 to 24 months. The mean (SD) age of presentation was 20.0 months $\pm$ 1.54 SD. Boys (89) were more affected than girls (51) with a ratio of

1.7:1. More children (62.1 %) from rural area were affected with severe acute malnutrition than urban area. Only 6 children were not breastfed, and 35 children were fully immunized as per national immunization schedule. Of the total 140 children enrolled 75.7 % had weight-for-height z-score (WHZ) below - 3 SD, 64.3 % had mid upper arm circumference (MUAC) < 115 mm and only 6.4 % had nutritional bipedal oedema. 57.1 % children were found to be having both WHZ score below - 3SD and MUAC < 115 mm together. Table 2 shows that children with weight-for-height z-score (WHZ) < - 3 SD have significantly higher proportion of MUAC < 115 mm as compared to other groups (P-value 0.0001). 126 children with severe acute malnutrition had one or the other co morbidities which is detailed in Table 3. Acute gastroenteritis was the most common co morbidity followed by acute respiratory tract infection. One child had Kawasaki disease and another child suffered from hepatic abscess. Table 4 indicates various micronutrient deficiency status present among the study participants. 70.7 % children had iron deficiency anaemia with mean haemoglobin (gm / dl) level of 9 ± 0.16 SD. Table 5 shows complications following severe acute malnutrition. Out of 77 children, the most common complication was found to be dehydration (50.6 %) followed by hyponatremia (15.6 %). Table 6 details outcome of children with severe acute malnutrition admitted in our nutrition rehabilitation centre. 86.4 % children recovered and were discharged with average weight gain of 6.4 g / kg / day. Average length of hospital stay was 8.7 days. 3 children became defaulter due to family problem. 2 children required referral to higher centre for surgical condition and one child expired due to sepsis. 26 % children came back for three follow up visits, 30 % for 2 visits, 33 % for one follow up visit and 11 % did not come back for any follow up visit.

Observation	Number (N = 140)	
	F	%
Age category (months)	6 - < 12	42 30.00
	12 - 24	78 55.71
	> 24 - 59	20 14.29
Gender	Male	89 63.57
	Female	51 36.43
Residence	Rural	87 62.14
	Urban	53 37.86
Religion	Hindu	87 62.14
	Muslim	29 20.71
	Others	24 17.14
Family type	Nuclear	92 65.71
	Joint	48 34.29
Socioeconomic status	Upper	0 0
	Upper middle	20 14.29
	Lower middle	79 56.43
	Lower	41 29.29
Feeding type	Exclusive breast feeding upto 6 months	78 55.71
	Partially breast fed	56 40.00
	Non breast fed	6 4.29
Immunisation	Complete	35 25.00
	Incomplete	88 62.86
	Unimmunised	17 12.14

Table 1. Demographic Characteristics of the Study Subjects (N = 140)

Weight-for-Height Z-Score (SD)	MUAC $\geq$ 115 mm N (%)	MUAC < 115 mm N (%)	P-Value
< - 2	10 (83.3)	2 (16.7)	0.0001*
< - 3	25 (23.8)	80 (76.2)	
< - 4	16 (69.6)	7 (30.4)	

Table 2. Comparison of MUAC by Weight-for-Height Z Score (SD) Using Chi-Square Test

*Fisher's exact test

Type of Co-Morbidities	Number (N = 126)	Age Group in Months		
		6 - < 12 F (%) (N = 44)	12 - 24 F (%) (N = 61)	> 24 F (%) (N = 21)
Acute gastroenteritis	57 (45.24)	25 (56.82)	26 (42.62)	6 (28.57)
Respiratory tract infection	33 (26.19)	7 (15.91)	20 (32.79)	6 (28.57)
Tuberculosis	7 (5.56)	0	4 (6.56)	3 (14.29)
Sepsis	9 (7.14)	6 (13.64)	3 (4.92)	0
Urinary tract infection	5 (3.97)	0	3 (4.92)	2 (9.52)
Hepatic abscess	1 (0.79)	0	0	1 (4.76)
Meningitis	2 (1.59)	1 (2.27)	0	1 (4.76)
Measles	3 (2.38)	2 (4.55)	1 (1.64)	0
Kawasaki disease	1 (0.79)	0	1 (1.64)	0
Pyoderma	6 (4.76)	3 (6.82)	2 (3.28)	1 (4.76)
Helminthiasis	1 (0.79)	0	1 (1.64)	0
Scrub typhus	1 (0.79)	0	0	1 (4.76)

Table 3. Percentage of Comorbidities among the Participants (N = 126)

Observation	Number (N = 140)	
	F	%
No deficiency sign	7	(5.00)
Rickets	6	(4.29)
Iron deficiency anaemia	99	(70.71)
Vitamin A deficiency	10	(7.14)
Scurvy	2	(1.43)
Vitamin B	16	(11.43)

Table 4. Micronutrient Deficiency Status among the Participants

*Mean haemoglobin level in gm / dl is 9 ± 0.16 with P-value less than 0.001

Complications	Number (N = 77)	
	F	%
Dehydration	39	(50.65)
Hyponatremia	12	(15.58)
Hypernatremia	2	(2.60)
Hypokalaemia	5	(6.49)
Hyperkalaemia	3	(3.90)
Hypoglycaemia	6	(7.79)
Hypothermia	10	(12.99)

Table 5. Percentage of Complications among Children with Severe Acute Malnutrition

Observation	Number (N = 140)	
	F	%
Recovery (rate)	121	(86.43)
Defaulter	3	(2.14)
Referred	2	(1.43)
Not recovered	13	(9.29)
Death	1	(0.71)

Table 6. Outcome of the Children with Severe Acute Malnutrition admitted in Nutrition Rehabilitation Centre. Average Weight Gain in gm / Kg / Day was 6.4 and Average Length of Hospital Stay in Days was 8.7.

DISCUSSION

"Children with severe acute malnutrition should be clinically monitored closely for early detection of co morbidities and complications. These children should be managed in the facility-based health care centre to reduce the morbidity and mortality. In our study, the WHO weight for height z score < - 3 SD associated with mid upper arm circumference (MUAC) < 115 mm were found to be 57.1 %. This finding was slightly lower than the previous study (70.7 %) done by Singh et al.¹¹ as we had smaller sample size restricted to facility based tertiary health centre only. Our study also revealed 6.4 % nutritional pedal oedema which is lower than the previous reports.

In this study the mean (SD) age of presentation among children with severe acute malnutrition was 20.0 ± 1.54 months. The maximum number of children belonged to the age group of 12 to 24 months which have similar findings in a study done by Syed Tariq et al.¹² There was male to female ratio of 1.7:1 showing higher number of males and the

reason could be more male children were brought to the health care facility than the female child. The present study shows that severe acute malnutrition was more common among the rural children than the urban and most of them significantly belonged to the lower socio-economic strata. These findings were in accordance with a community-based-control study done by David SM et al.¹³

Globally, exclusive breastfeeding up to six months is advised for all the new-borns as it reduces morbidity and mortality in children. The current study shows no statistically significant association between breast feeding and children with severe acute malnutrition. Immunization against childhood diseases like tuberculosis, diphtheria, whooping cough and measles reduce under five child death. Children suffering from these diseases develop malnutrition as well as impaired cognitive, emotional and social skills.¹⁴ In the present study, severe acute malnutrition was more common among partially immunized children than fully immunized children and 12.1 % children did not receive any immunization, Table 1. In a study done in Ethiopia it was observed that fully vaccinated children had a higher chance of getting recovered from severe acute malnutrition compared to partially or not vaccinated children.¹⁵

According to literature, malnourished children tend to suffer from infectious and communicable diseases. In a Columbian study, 68.4 % of malnourished children were suffering from diarrheal diseases and 9 % had sepsis at the time of admission in nutrition rehabilitation centre.¹⁶ In our study the most common co morbid disease associated with severe acute malnutrition was acute gastroenteritis followed by acute respiratory tract infection and Sepsis. Table 3- These findings were similar with previous studies which reported that severe malnourished children suffer in greater proportion from bacterial acute gastroenteritis and respiratory tract infection. Two different studies done in Kenya and Zambia also showed high incidence of diarrhoea in children with severe acute malnutrition as 49 % and 67 % respectively.^{17,18} Measles has severe consequences on the nutritional status in children. In the present study 3 cases (2.38) of measles were found among the children with severe acute malnutrition. Previous studies done by Bhaskaran P in India reported that 3 - 4 % of children with severe acute malnutrition were suffering from measles.¹⁹

In the present study, one case of hepatic abscess, Kawasaki disease and scrub typhus each were found among the children with severe acute malnutrition. These findings need to be studied more to know the correlation with the malnutrition. In our study, the causative organism identified in hepatic abscess was *Staphylococcus aureus*. Other studies also showed that *Staphylococcus aureus* was the most common causative organism for hepatic abscess in children.²⁰

According to previous studies it was presumed that an unknown ongoing process involved the nutrition status in addition to vascular inflammation in Kawasaki disease. In a study done by I-Hsin Tai et al. found that low serum albumin level was associated with Kawasaki disease outcome, but no further investigation was addressed.²¹ In our study, scrub typhus was confirmed serologically in a child. A study done by Nowneet KB et al. among North Indian children found

that child as young as 8 months was diagnosed serologically as scrub typhus.²²

Protein energy malnutrition is usually overlapped with micronutrient deficiencies and it is seen that lack of one micronutrient is typically associated with deficiency of others.²³ In the present study, iron deficiency anaemia was the most common micronutrient deficiency associated with severe acute malnutrition.

Other micronutrient deficiency signs were also found among the participants. Table 4- These findings were consistent with the previous reports.^{24,25} In our study the most common complication developed among children with severe acute malnutrition was dehydration followed by hyponatremia and hypothermia. Table 5- These findings were similar with the previous studies done by Rinki H et al.²⁶

All the co-morbid conditions and complications were managed as per national guidelines for severe acute malnutrition. The micronutrient supplementation was given as per need of the child. In our study the recovery rate of children with severe acute malnutrition was 86.4 % which is remarkably good. 9.3 % of children with severe acute malnutrition did not recover and death rate was only 0.7 %. Table 6- These findings were in consistent with national standards being recovery rate more than 75 %, defaulter rate less than 15 % and case fatality rate less than 5 %.²⁷

Average weight gain in the present study was 6.4 gm / kg / day and average length of hospital stay was 8.7 days which is acceptable if more than 8 days as per national severe acute malnutrition guidelines.

CONCLUSIONS

Our study shows that morbidity and mortality of children suffering from severe acute malnutrition can be reduced dramatically by managing them in a facility-based health care centre though they can be cared at community level through various national health programmes. Children with clinical comorbidities and complicated severe acute malnutrition should preferably be treated in a facility-based care centre. However, the upgradation of nutritional rehabilitation centre for the management of severe acute malnutrition is needed in respect of good laboratory facility and critical care support.

Limitations

Absence of a comparative group, no biochemical evaluation for micronutrient deficiencies and lack of information on risk factors for severe acute malnutrition were the major limitations of the study.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.

Financial or other competing interests: None.

Disclosure forms provided by the authors are available with the full text of this article at jebmh.com.

We would like to thank the staff of department of Paediatrics, Jawaharlal Nehru Institute of Medical Sciences for their cooperation and support during the study. We also thank Mrs. Kshetrimayum

Rojita Devi nutritionist of nutrition rehabilitation center for her technical support in the collection of the data.

REFERENCES

- [1] Malnutrition in children. UNICEF DATA. [accessed 12 Jan 2018]. <https://data.unicef.org/topic/nutrition/malnutrition>.
- [2] Participant Manual - Facility Based Care of Severe Acute Malnutrition: National Rural Health Mission, Ministry of Health and Family Welfare Government of India, 2013.
- [3] National Family Health Survey (NFHS-3), 2005-2006. India: Vol.1. Mumbai: IIPS 2007 [accessed 16 May 2018]. <http://www.iipsindia.ac.in>.
- [4] Caulfield LE, de Onis M, Blossner M, et al. Undernutrition as an underlying cause of child deaths associated with diarrhea, pneumonia, malaria and measles. *Am J Clin Nutr* 2004;80 (1):193-198.
- [5] Shinjini B, Rakesh L, Panna C, et al. Indian Academy of Pediatrics (IAP) guidelines 2006 on hospital - based management of severely malnourished children (adapted from the WHO guidelines). *Indian Pediatr* 2007;44 (6):443-461. <https://www.indianpediatrics.net>.
- [6] Elizabeth KE. Nutrition rehabilitation centers and locally prepared therapeutic food in the management of severe acute malnutrition pediatrician's perspective. *Indian Pediatr* 2014;51 (1):19-20.
- [7] Linneman Z, Matilsky D, Ndekha M, et al. A large - scale operational study of home based therapy with ready - to - use therapeutic food in childhood malnutrition in Malawi. *Maternal Child Nutr* 2007;3 (3):206-215.
- [8] Collins S. Treating severe acute malnutrition seriously. *Arch Dis Child* 2007;92 (5):453-461.
- [9] WHO Child Growth Standards and the Identification of Severe Acute Malnutrition in Infants and Children. A joint statement by the World Health Organization and the United Nations Children Fund, Geneva, Switzerland: 2009. http://www.who.int/nutrition/publications/severe_malnutrition/9789241598163/en/index.html. [Accessed on 15 Aug 2018].
- [10] World Health Organization. Technical updates of the guidelines on the Integrated Management of Childhood Illnesses: evidence and recommendation for further adaptations. World Health Organization, Geneva, 2005. <http://apps.who.int/iris/handle/10065/43303>; [accessed 10 Aug 2018].
- [11] Singh K, Badgaiyan N, Ranjan A, et al. Management of children with severe acute malnutrition: experience of nutrition rehabilitation centers in Uttar Pradesh, India. *Indian Pediatr* 2014;51 (1):21-25.
- [12] Tariq SA, Naik SA, Rafiq WA, et al. Demographic, clinical profile of severe acute malnutrition and our experience of nutrition rehabilitation centre at children hospital Srinagar Kashmir. *Int J Contemp Pediatr* 2015;2 (3):233-237.
- [13] David SM, Pricilla RA, Paul SS, et al. Risk factors for severe acute malnutrition among children aged 6-59 months: a community - based case -control study from Vellore, Southern India. *J Family Med Prim Care* 2020;9 (5):2237-2243.
- [14] Shuaib FMB, Kimbrough D, Roofe M, et al. Factors associate with incomplete childhood immunization among residents of St. Mary, Jamaica. *West Indian Med J* 2010;59 (5):549-554.
- [15] Adimasu M, Sebsibie G, Abebe F, et al. Recovery time from severe acute malnutrition and associated factors among under-5 children in Yekatit 12 Hospital, Addis Ababa, Ethiopia: a retrospective cohort study. *Epidemiol Health* 2020;42:e2020003.
- [16] Bernal C, Velasquez C, Alcaraz G, et al. Treatment of severe malnutrition in children: experience in implementing the World Health Organization guidelines in Turbo, Colombia. *J Pediatr Gastroenterol Nutr* 2008;46 (3):322-328.
- [17] Talbert A, Thuo N, Karisa J, et al. Diarrhoea complicating severe acute malnutrition in Kenyan children: a prospective descriptive study of risk factors and outcome. *PLoS One* 2012;7 (6):e38321.
- [18] Irene AH, Mwambazi M, Mulenga V. Diarrhea is a major killer of children with severe acute malnutrition admitted to inpatient set- up in Lusaka, Zambia. *Nutr J* 2011;10:110.
- [19] Bhaskaram P. Measles and malnutrition. *Indian J Med Res* 1995;102:195-199.
- [20] Muorah M, Hins R, Verma A, et al. Liver abscesses in children: a single center experience in the developed world. *J Pediatr Gastroenterol Nutr* 2006;42 (2):201-206.
- [21] Tai IH, Wu PL, Kuo HC, et al. Prognostic nutrition index as a predictor of coronary artery aneurysm in Kawasaki Disease. *BMC Pediatrics* 2020;20:203. <https://doi.org/10.1186/s12887-020-02111-y>.
- [22] Nowneet KB, Minakshi D, Garima M, et al. Scrub typhus in children at a tertiary hospital in north India: clinical profile and complications. *Iran J Pediatr* 2014;24 (4):387-392.
- [23] Muller O, Krawinkel M. Malnutrition and health in developing countries. *CMAJ* 2005;173 (3):279-286.
- [24] Ejaz MS, Latif N. Stunting and micronutrient deficiencies in malnourished children. *J Pak Med Assoc* 2010;60 (7):543-547.
- [25] Chainani N, Sharma P, Meena N, et al. Pattern of vitamin deficiencies among the malnourished preschool children in ICDS blocks of Jaipur city. *Indian J Matern Child Health* 1994;5 (4):109-111.
- [26] Shah RH, Bakul B, Javedkar. Management of children with severe acute malnutrition: experience of nutrition rehabilitation centre at Baroda, Gujarat. *Int J Contemp Pediatr* 2014;1 (1):3-6. <http://doi;10.5455/2349-3291.ijcp20140502>.
- [27] Ministry of Health and Family Welfare, Government of India. Operational guidelines on facility - based management of children with severe acute malnutrition. New Delhi, India: National Rural Health Mission, Ministry of Health and Family Welfare, 2011. <https://rajswasthya.nic.in>MTC Guidelines-MDHFV>.