e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2022; 14(8); 1102-1109

Original Research Article

Clinical Characteristics and Hospital Outcomes of Children with Severe Acute Malnutrition: A Retrospective Observational Study

Binay Ranjan

Assistant Professor, Department of Pediatrics, Narayan Medical College and Hospital, Sasaram, Bihar, India

Received: 17-06-2022 / Revised: 19-07-2022 / Accepted: 20-08-2022
Corresponding Author: Dr. Binay Ranjan
Conflict of interest: Nil

Abstract:

Background: Severe acute malnutrition (SAM) is an important cause of morbidity and mortality among under-five children, particularly when accompanied by infectious and metabolic complications.

Aim: To assess the clinical profile, associated morbidities, hospital outcomes, and predictors of adverse outcomes among children with SAM.

Methodology: This one-year retrospective observational study included 142 children aged 6–59 months admitted with SAM at Narayan Medical College and Hospital, Sasaram, Bihar. Clinical, anthropometric, laboratory, and outcome data were analyzed using appropriate statistical tests and logistic regression.

Results: Fever, diarrhea, anemia, and respiratory infections were common. Overall, 83.8% improved and were discharged, while in-hospital mortality was 7.0%. Sepsis, hypoglycemia, and hypothermia were significant independent predictors of adverse outcomes.

Conclusion: SAM was associated with substantial infectious and metabolic morbidity. Early identification and prompt management of high-risk complications may improve hospital outcomes and reduce mortality.

Keywords: Severe acute malnutrition; Children; Clinical profile; Hospital outcomes; Mortality; Sepsis

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0) and the Budapest Open Access Initiative (http://www.budapestopenaccessinitiative.org/read), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Severe acute malnutrition (SAM) continues to be a serious public health problem among children aged less than five years, especially in low- and middle-income nations, where nutritional deficiencies occur together with other diseases and poor access to medical care [1]. SAM involves severe wasting, decreased mid-upper arm circumference, and/or pitting edema, and is associated with poor immune system, metabolic problems, growth retardation, and susceptibility to infections [2]. The children suffering from SAM and needing hospital admission usually have various clinical issues such as diarrhea, pneumonia, anemia, dehydration, sepsis, hypoglycemia, and electrolyte imbalances [3]. Even though there have been developments in nutritional rehabilitation and standardization of care, problems such as unfavorable outcomes and mortality still persist, especially among children with complicated SAM [4]. It is imperative that we understand the clinical features, comorbidities, and risk factors related to hospital outcomes in order to identify high-risk patients and optimize inpatient care [5]. In this context, this current retrospective observational study was conducted to investigate the clinical features and hospital outcomes of children with SAM admitted to a tertiary-care hospital within a span of one year [6].

Background of the Study: Severe Acute Malnutrition (SAM) is an advanced case of undernutrition among children that is often linked to poor health outcomes and even death, especially in young children less than five years of age [7]. Some of the factors that contribute to the development of this condition include poor eating habits, infections, socioeconomic hardship, and lack of access to medical care [8]. Children suffering from SAM often develop other conditions such as diarrhea, pneumonia, anemia, dehydration, sepsis, low blood sugar, and imbalances in electrolytes, all of which can affect their health outcomes. Undernutrition among children continues to be a problem in India. Thus, the study of SAM in this country is crucial for improving their clinical profiles [9].

Clinical Profile and Outcomes of Children with Severe Acute Malnutrition: The clinical picture of children with severe acute malnutrition (SAM) involves significant nutritional deficiencies along with high levels of complications from infections and metabolic disorders [10]. Children who have SAM usually suffer from severe wasting, decreased mid-upper arm circumference, nutritional edema, poor appetite, fever, diarrhea, respiratory symptoms, paleness, and overall weakness [11].

Additional disorders like anemia, gastroenteritis, pneumonia, dehydration, sepsis, hypoglycemia, hypothermia, and electrolyte imbalance could make the disease even more severe and influence the outcome of the patient's hospital stay [12]. The success of the hospital treatment does not depend only on the severity of malnutrition, but also on additional complications and their treatment. Though proper rehabilitation and management could help children get recovered and discharged, complicated cases of SAM could cause prolonged hospitalization, referrals, and even death [13]. Therefore, early identification of high-risk clinical features and appropriate treatment of infections and metabolic disorders are extremely important for children with SAM [14].

Research Objectives

The objectives of the study are:

- To describe the demographic, anthropometric, and nutritional features of the children admitted with severe acute malnutrition.
- To determine the clinical presentation, co-morbidities, complications, and laboratory parameters in children with severe acute malnutrition.
- To document the hospital outcomes of the children with severe acute malnutrition in terms of clinical improvement, length of hospital stays, referral, discharges against medical advice, and hospital deaths [15].
- To study the relationship between certain clinical and nutritional variables and the adverse hospital outcomes in children with severe acute malnutrition.

Methodology

This current study is aimed at assessing the clinical profile, morbidity conditions, and hospital outcome of the children who have been admitted for SAM. The retrospective method was used where all the records that were obtained within a one-year period from the clinical and hospital files were analyzed. This involved demographic information, anthropometric findings, presentation of clinical symptoms, complications, treatment details, and hospital outcome.

Study Design: This study was carried out using a retrospective observational design. This is because medical records from cases where children were diagnosed to have acute malnutrition and admitted within the stated study period were accessed. Since it was a retrospective study design, there was no intervention done on the treatment of these patients.

Study Area: The research was conducted at the Department of Pediatrics of Narayan Medical College & Hospital, Sasaram, Bihar, India.

Study Duration: This study was conducted for a period of one year from January 2019 to December 2019.

Study Participants: The subjects of this study were children with ages ranging from 6 months to 59 months who have been enrolled in the Department of Pediatrics at the time of this study and met the diagnostic criteria for SAM. The diagnosis of SAM was made based on the anthropometric and/or clinical criteria that included weight-for-length/height Z-score less than -3 standard deviation scores, a mid-upper arm circumference (MUAC) <11.5 cm in children aged 6–59 months and/or bilateral pitting nutritional edema.

Inclusion and Exclusion Criteria

Inclusion Criteria

Children participated in the study if they:

- Age between 6 and 59 months;
- Clinical classification of severe acute malnutrition at the time of hospital admission;
- Admission to the Department of Pediatrics during the stipulated one-year study period; and
- Availability of complete medical records containing the demographic, anthropometric, clinical, and hospital outcome data required for the study.

Exclusion Criteria

Exclusion criteria for children were:

- Incomplete or substantially missing medical records that prevented proper evaluation of nutritional status and hospital outcomes;
- Serious congenital disorders, skeletal abnormalities, or other conditions that substantially hindered the accurate interpretation of anthropometric data;
- Admission for a short observation period without adequate clinical assessment; or
- Duplicate admission records related to the same episode of illness.

Sample Size: A total of 156 medical case files of children with severe acute malnutrition were identified in the one-year period of the study. Of these 156 children, after applying inclusion and exclusion criteria, a total of 142 patients with clinically complete records were selected for further analysis. Due to the retrospective nature of the study, all eligible patients who met the set criteria of the study were selected consecutively from the study period.

Procedure: Following the identification of patients meeting the criteria from the pediatric admission registers and hospital records, the information related to these cases was extracted using a standardized format of information gathering.

Information that was gathered included age, sex, place of residence, socio-economic and feeding history wherever available, clinical presentations, duration of illness, immunization status, and any past medical history relevant to the diagnosis. Information related to anthropometry, such as weight, length/height, mid upper-arm circumference, and presence or absence of bilateral pitting edema, was taken from the case files available. Nutritional status noted on admission was reviewed for confirming the diagnosis of SAM.

Clinical presentations along with illnesses occurring during the hospital stay period were also noted. Specific emphasis was placed on the identification of complications that commonly occur among SAM cases, such as diarrhea, vomiting, fever, acute respiratory infection/ pneumonia, anemia, dehydration, hypoglycemia, hypothermia, sepsis and any other relevant infections. Lab results, such as hemoglobin levels, total leucocytes count, serum electrolyte status, glucose level and other diagnostic tests done on clinical indications, were also gathered when available.

Details related to the treatment of the patients, hospitalization period, complications, and discharge status were then extracted. The outcome during hospital stay was classified as improved and discharged, referred or transferred, left AMA (against medical advice), or expired during the hospital stay. Hospitalization period and mortality rate were identified as key determinants of hospital outcome. All data collected were validated for integrity and consistency prior to statistical analysis. Patient confidentiality was ensured all throughout the study. Personal identifiers were excluded from the data set and the information collected was strictly limited to research purposes only.

Statistical Analysis: The gathered data were fed into the computer-based database and statistically analyzed using IBM SPSS Statistics. Age, anthropometric measures, selected laboratory tests, and duration of stay at the hospital were reported in terms of mean ± standard deviation if data were normally distributed, while median and interquartile range were reported for continuous data otherwise. Other variables, such as gender, symptoms, complications, and hospital outcomes, were reported as frequency counts and percentages.

The Chi-square or Fisher's Exact test, wherever applicable, was performed to find any association between categorical clinical factors and hospital outcomes. Comparison of continuous variables among relevant outcome categories was done with an independent-samples t-test or non-parametric test, whichever is appropriate based on the nature of distribution of the data. The clinical or statistical factors which showed association with the adverse outcomes in hospital were further analyzed by binary logistic regression, wherever applicable, to find predictors of the adverse outcomes in cases of SAM in children. The findings were presented in terms of odds ratio with 95% confidence intervals. A p-value of <0.05 was taken as statistically significant.

Results

A total of 156 records of children with SAM were screened in the one-year study period. Out of these 156 records, 14 records were discarded owing to missing information of the patients' clinical or anthropometric data, making the final number of children 142 for further analysis. It was found that there was huge variability in the demographics, nutritional status, and other parameters among the admitted children.

Table 1: Demographic characteristics of children with severe acute malnutrition (n = 142)

Characteristics	Frequency (n)	Percentage (%)
Age group		
6–11 months	34	23.9
12–23 months	55	38.7
24–35 months	27	19.0
36–47 months	16	11.3
48–59 months	10	7.0
Sex		
Male	78	54.9
Female	64	45.1
Residence		
Rural	96	67.6
Urban	46	32.4
Immunization status		
Complete for age	67	47.2
Partial	58	40.8
Unimmunized	17	12.0

As illustrated in Table 1 below, the greatest number of children was in the age category of 12-23 months old (38.7%), followed by 6-11 months old (23.9%). Male children represented 54.9% of the study population. Most children (67.6%) came from the rural setting. Only 47.2% of children were fully vaccinated according to their age level, 40.8% were partially vaccinated and 12% were not vaccinated.

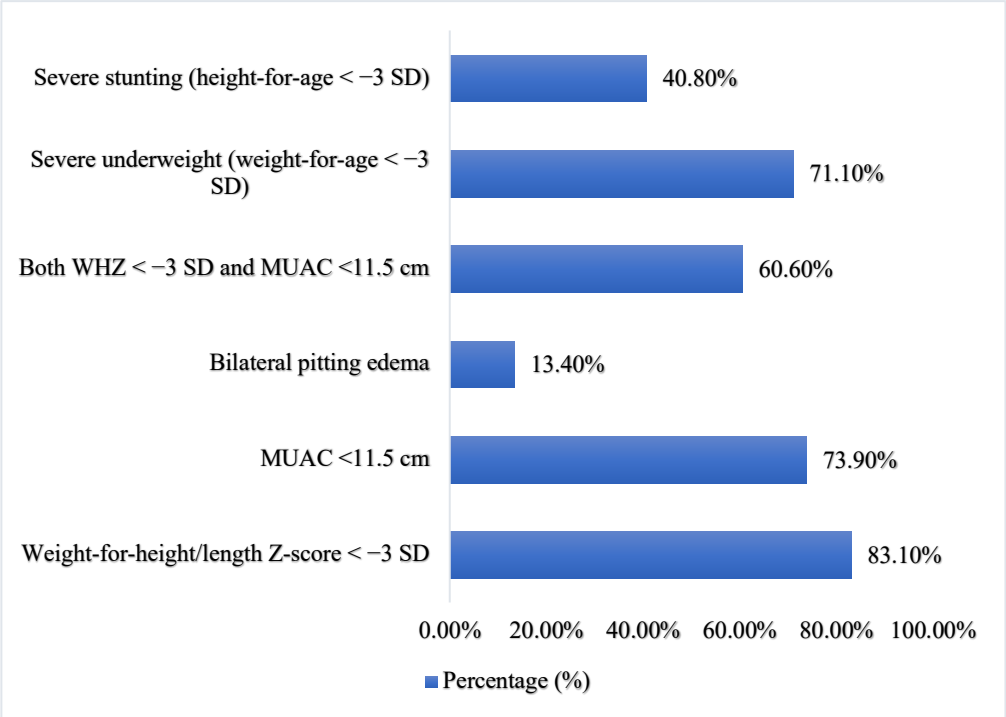

Figure 1: Anthropometric and nutritional characteristics of the study participants (n = 142)

The anthropometric evaluation showed that 83.1% of the children had a Z score of less than −3 for the weight for height/length, whereas 73.9% had a MUAC of below 11.5 cm. Bilateral pitting edema was found in 13.4% of children. Over two-thirds of the children were severely underweight (71.1%), whereas 40.8% were severely stunted.

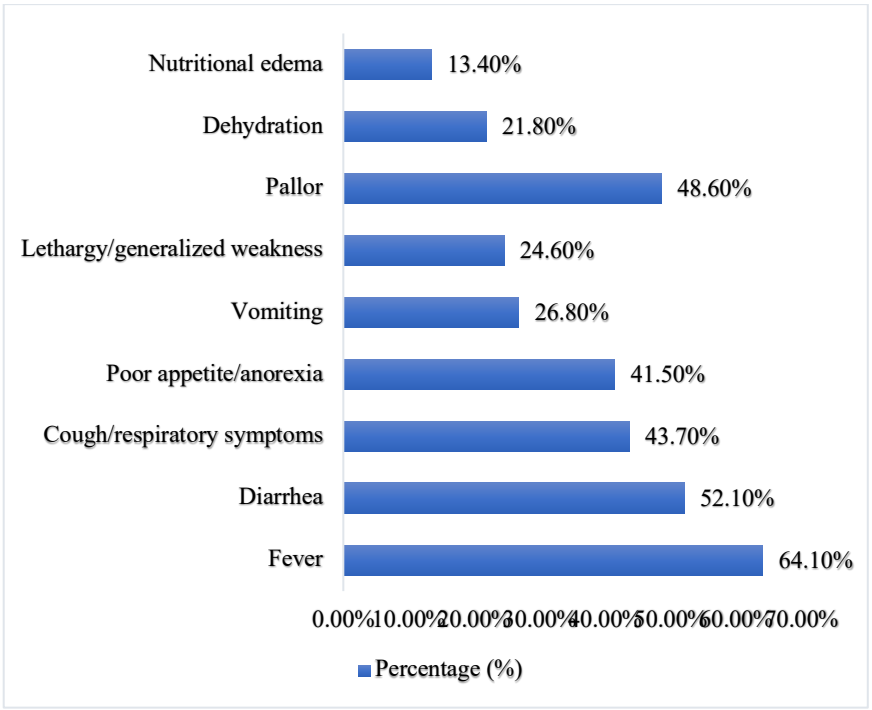

Figure 2: Clinical manifestations at the time of admission (n = 142)

Various clinical presentations were seen among some children, and thus the percentage was not equal to 100%. The most common presentation was that of fever (64.1%) followed by diarrhea (52.1%), pallor (48.6%), and respiratory problems (43.7%). Poor appetite was also found in 41.5% of the children. Dehydration was present among almost one-fifth of the children while nutritional edema among 13.4%.

Table 2: Associated illnesses and complications among children with SAM (n = 142)

Associated illness/complication	Frequency (n)	Percentage (%)
Anemia	82	57.7
Acute diarrhea/gastroenteritis	68	47.9
Acute respiratory infection/pneumonia	54	38.0
Dehydration	31	21.8
Sepsis	22	15.5
Electrolyte disturbance	20	14.1
Hypoglycemia	15	10.6
Urinary tract infection	13	9.2
Hypothermia	9	6.3

*More than one associated illness or complication could have occurred in the same child.

Anemia was the most frequent complication, with 57.7% of patients having this disease. Acute diarrhea or gastroenteritis occurred in 47.9%, acute respiratory infection or pneumonia in 38.0%. Other complications were as follows: sepsis in 15.5%, electrolyte imbalance in 14.1%, hypoglycemia in 10.6%, and hypothermia in 6.3% of patients.

Table 3: Selected laboratory parameters of children with SAM

Laboratory parameter	Mean ± SD	Range
Hemoglobin (g/dL)	8.9 ± 1.8	4.8–12.6
Total leukocyte count (/mm³)	12,460 ± 5,180	3,900–28,600
Random blood glucose (mg/dL)	82.7 ± 21.5	38–146
Serum sodium (mEq/L)	134.2 ± 5.6	119–147
Serum potassium (mEq/L)	3.8 ± 0.7	2.3–5.6

The average hemoglobin concentration was 8.9 ± 1.8 g/dL, reflecting a significant prevalence of anemia in the admitted children. The average total leukocyte count was 12,460 ± 5,180/mm³. Changes in the concentration of blood glucose and serum electrolytes were also noted, which is in line with the metabolic disorders that commonly accompany complicated SAM.

Table 4: Duration of hospital stay among children with SAM (n = 142)

Duration of hospital stay	Frequency (n)	Percentage (%)
≤5 days	28	19.7
6–10 days	67	47.2
11–15 days	32	22.5
>15 days	15	10.6
Mean hospital stay	9.2 ± 4.1 days	—

Approximately half of the children (47.2%) were kept in hospitals for 6–10 days, while 22.5% stayed in the hospital for 11–15 days. A hospital stay of more than 15 days was observed in 10.6% of children. The average duration of stay in the hospital was 9.2 ± 4.1.

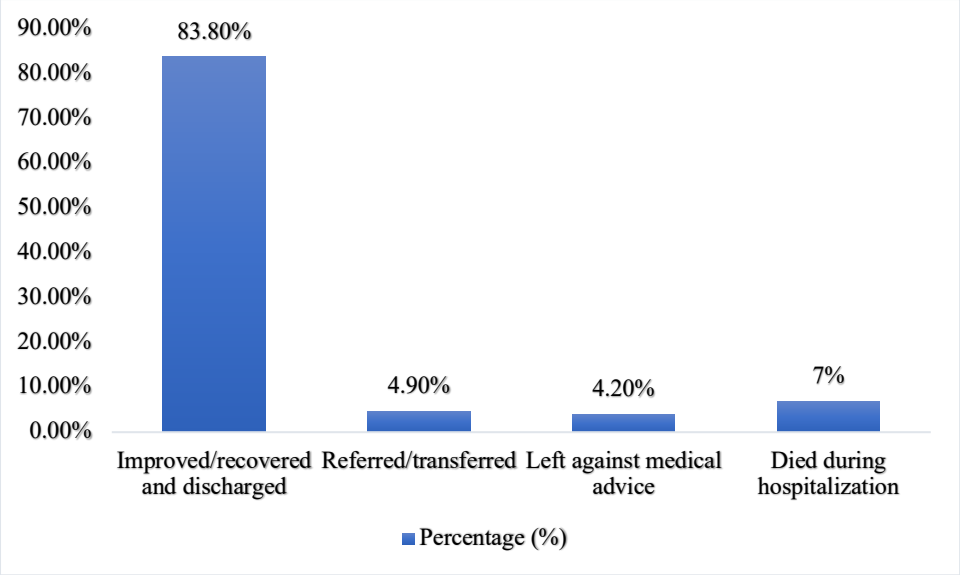

Figure 3: Hospital outcomes among children with SAM (n = 142)

The majority (83.8%) of the children had improved clinically and were discharged after inpatient treatment. Seven children (4.9%) were referred or transferred, and 4.2% left the hospital against medical advice. Ten children died in the hospital, which gave an in-hospital mortality rate of 7.0%.

Regarding the identification of predictors of hospital outcome, the patients were divided into two categories based on their outcomes; favorable and unfavorable outcomes. Favorable outcome consisted of improvement/recovery followed by discharge, while unfavorable outcomes were comprised of referral/transfer, leaving against medical advice, and in-hospital death. In all, 119 (83.8%) children had favorable outcomes and 23 (16.2%) had unfavorable outcomes.

Table 5: Association of selected clinical factors with adverse hospital outcomes (n = 142)

Clinical factor	Favorable outcome n = 119	Adverse outcome n = 23	p-value
Sepsis present	13 (10.9%)	9 (39.1%)	0.001
Hypoglycemia present	8 (6.7%)	7 (30.4%)	0.001
Hypothermia present	4 (3.4%)	5 (21.7%)	0.001
Pneumonia/ARI present	40 (33.6%)	14 (60.9%)	0.014
Dehydration present	22 (18.5%)	9 (39.1%)	0.026
Bilateral pitting edema	12 (10.1%)	7 (30.4%)	0.008
Anemia present	65 (54.6%)	17 (73.9%)	0.086

Adverse outcome was more prevalent in children who had sepsis, hypoglycemia, hypothermia, pneumonia/acute respiratory infection, dehydration, and bilateral pitting edema ($p<0.05$). While anemia was prevalent in children who had adverse outcomes, the relationship was statistically insignificant ($p=0.086$).

Table 6: Binary logistic regression analysis of predictors of adverse hospital outcomes

Predictor	Adjusted Odds Ratio (AOR)	95% CI	p-value
Sepsis	3.74	1.31–10.69	0.014
Hypoglycemia	3.21	1.01–10.18	0.048
Hypothermia	3.86	1.02–14.61	0.047
Pneumonia/ARI	2.42	0.91–6.46	0.078
Dehydration	2.08	0.74–5.87	0.166
Bilateral pitting edema	2.63	0.86–8.03	0.090

Using multivariable binary logistic regression analysis, sepsis, hypoglycemia, and hypothermia were found to be statistically significant independent predictors of adverse outcomes among admitted children. The children that presented with sepsis were found to have almost 3.7 times increased risk of adverse outcomes (AOR = 3.74; 95% CI: 1.31-10.69; $p=0.014$). Hypoglycemia was also found to increase the risk of adverse outcomes by three times (AOR = 3.21; 95% CI: 1.01-10.18; $p=0.048$), and hypothermia increased it by nearly four times (AOR = 3.86; 95% CI: 1.02-14.61;

p=0.047). Pneumonia, dehydration, and bilateral pitting edema showed increased odds of adverse outcomes; however, these associations did not remain statistically significant after adjustment for other clinical factors.

In conclusion, the study results revealed that children who were admitted with SAM had coexisting infections, anemia, GI disorders, and respiratory morbidities. While most children improved and were discharged, there were a significant number who had poor clinical outcomes in the hospital setting. Poor outcomes were more likely with sepsis, hypoglycemia, and hypothermia, underscoring the need for the early recognition and treatment of such complications in children with SAM.

Discussion

The current study examined the clinical characteristics and outcomes of 142 cases of severe acute malnutrition (SAM). The highest proportion (38.7%) was found among children aged 12–23 months, while 54.9% of the children were male and 67.6% came from rural areas. Anthropometric analysis revealed that 83.1% of the children had weight-for-height/length Z-scores <−3 SD, 73.9% had MUAC <11.5 cm, and 71.1% were severely underweight. These results were consistent with Munthali et al. (2015) [16], who also found a high burden of SAM among hospitalized under-five children in Zambia. In a similar vein, Burza et al. (2015) [17] described a high burden of SAM among children aged 6–59 months in Bihar. Mishra et al. (2014) [18] further noted incomplete immunization and adverse socio-economic and feeding determinants as the significant correlates of SAM among Indian children.

The main clinical features included fever (64.1%), diarrhea (52.1%), pallor (48.6%), and respiratory signs (43.7%). Other morbidities included anemia (57.7%), gastroenteritis (47.9%), pneumonia/acute respiratory infection (38.0%), dehydration (21.8%), and sepsis (15.5%). These results were in agreement with Page et al. (2013) [19] who found that children with complicated SAM had high rates of infections in hospitals in Niger. Pneumonia and gastroenteritis were also noted to be common conditions in malnourished children who were admitted in hospitals by Benyera and Hyera (2013) [20]. The results therefore confirmed the strong association between SAM and infections.

The majority of the children (83.8%) were successful in improving and being discharged, while the mortality rate was 7.0% in-hospital. The mortality was equivalent to the mortality rate of about 9%, which was observed by Page et al. (2013), but higher mortality was associated with the children suffering from severe malnutrition. In the current study, sepsis, hypoglycemia, and hypothermia were found to be significant independent predictors of poor hospital outcome, which increased the chances of poor outcomes by about three to four times. It is in line with the previous hospital-based studies, where it has been found that infectious and metabolic complications play a major role in affecting the outcome of children with SAM.

Conclusion

Severe Acute Malnutrition is still a major clinical concern among hospitalized children between 6 to 59 months as most cases reported were within the age bracket of 12-23 months and children from rural settings. There was evidence of poor nutritional status since there was a high percentage of children who suffered from severe wasting, low MUAC, underweight, and stunting. SAM was also characterized by high levels of morbidity including anemia, diarrhea, respiratory infections, dehydration, and sepsis. It can be seen that most of the children had co-morbidity which showed how complicated SAM can be and the high level of burden of disease. While most of the children were able to recover and were discharged successfully, the in-hospital mortality rate was 7.0% showing the continuing risk of mortality in complicated SAM. Sepsis, hypoglycemia, and hypothermia were found out to be the major independent factors affecting mortality in hospital settings. This shows that prognosis is significantly dependent on infection and metabolism related complications.

References

1. Devi, R. U., Krishnamurthy, S., Bhat, B. V., & Sahai, A. (2015). Epidemiological and clinical profile of hospitalized children with moderate and severe acute malnutrition in South India. The Indian Journal of Pediatrics, 82(6), 504-510.
2. Benyera, O. (2013). Outcomes in malnourished children at a tertiary hospital in Swaziland: post implementation of the WHO treatment guidelines. University of Pretoria (South Africa).
3. Anthony, A. C. (2013). Assessment of clinical practices in children admitted with severe acute malnutrition in three District hospitals, in the Western Cape, South Africa.
4. Bahwere, P., Mtimuni, A., Sadler, K., Banda, T., & Collins, S. (2012). Long term mortality after community and facility based treatment of severe acute malnutrition: analysis of data from Bangladesh, Kenya, Malawi and Niger. J Public Health Epidemiol, 4(8), 215-25.
5. Alcoba, G., Kerac, M., Breysse, S., Salpeteur, C., Galetto-Lacour, A., Briend, A., & Gervaix, A. (2013). Do children with uncomplicated severe acute malnutrition need antibiotics? A

systematic review and meta-analysis. PloS one, 8(1), e53184.
6. Kerac, M., Bunn, J., Chagaluka, G., Bahwere, P., Tomkins, A., Collins, S., & Seal, A. (2014). Follow-up of post-discharge growth and mortality after treatment for severe acute malnutrition (FuSAM study): a prospective cohort study. PloS one, 9(6), e96030.
7. Muzigaba, M. (2015). Paediatric severe-acute malnutrition and the recommended WHO treatment modality: an epidemiological and quality care assessment in the context of HIV comorbidity (Doctoral dissertation, University of the Western Cape).
8. Lenters, L. M., Wazny, K., Webb, P., Ahmed, T., & Bhutta, Z. A. (2013). Treatment of severe and moderate acute malnutrition in low- and middle-income settings: a systematic review, meta-analysis and Delphi process. BMC public health, 13(Suppl 3), S23.
9. Jones, K. D., & Berkley, J. A. (2014). Severe acute malnutrition and infection. Paediatrics and international child health, 34(sup1), S1-S29.
10. Gelaw, T. (2013). Response to conventional nutritional treatment of severely malnourished hospitalized children in the context of HIV infection at Yekatit 12 hospital, Addis Ababa, Ethiopia. Science Journal of Clinical Medicine.
11. World Health Organization. (2012). Recommendations for management of common childhood conditions: evidence for technical update of pocket book recommendations: newborn conditions, dysentery, pneumonia, oxygen use and delivery, common causes of fever, severe acute malnutrition and supportive care.
12. Berkley, J., & Jones, K. (2013, May). Severe, Acute Malnutrition and Infection. CMAM forum.
13. Dasgupta, R., Ahuja, S., & Yumnam, V. (2014). Can nutrition rehabilitation centers address severe malnutrition in India?. Indian pediatrics, 51(2), 95-99.
14. Rytter, M. J. H., Namusoke, H., Babirekere-Iriso, E., Kæstel, P., Girma, T., Christensen, V. B., ... & Friis, H. (2015). Social, dietary and clinical correlates of oedema in children with severe acute malnutrition: a cross-sectional study. BMC pediatrics, 15(1), 25.
15. Abdul-Latif, A. M. C., & Nonvignon, J. (2014). Economic cost of community-based management of severe acute malnutrition in a rural district in Ghana. Health, 6(10), 886-889.
16. Munthali, T., Jacobs, C., Sitali, L., Dambe, R., & Michelo, C. (2015). Mortality and morbidity patterns in under-five children with severe acute malnutrition (SAM) in Zambia: a five-year retrospective review of hospital-based records (2009–2013). Archives of public health, 73(1), 23.
17. Burza, S., Mahajan, R., Marino, E., Sunyoto, T., Shandilya, C., Tabrez, M., ... & Mishra, K. N. (2015). Community-based management of severe acute malnutrition in India: new evidence from Bihar. The American journal of clinical nutrition, 101(4), 847-859.
18. Mishra, K., Kumar, P., Basu, S., Rai, K., & Aneja, S. (2014). Risk factors for severe acute malnutrition in children below 5 y of age in India: a case-control study. The Indian Journal of Pediatrics, 81(8), 762-765.
19. Page, A. L., de Rekeneire, N., Sayadi, S., Aberrane, S., Janssens, A. C., Rieux, C., ... & Baron, E. (2013). Infections in children admitted with complicated severe acute malnutrition in Niger. PloS one, 8(7), e68699.
20. Benyera, O., & Hyera, F. L. (2013). Outcomes in malnourished children at a tertiary hospital in Swaziland after implementation of the World Health Organization treatment guidelines. South African Journal of Child Health, 7(4), 135-138.