Study of Prevalence of Complications in Severe Acute Malnutrition

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Abstract
Severe acute malnutrition (SAM) remains a significant public health challenge, particularly in developing regions with limited healthcare resources. Affecting millions of children worldwide, SAM is characterized by a very low weight for height, severe wasting, or nutritional edema. This study investigates the prevalence of complications in children aged 6 months to 5 years suffering from SAM in Bhagalpur, Bihar, India. This descriptive cross-sectional study was conducted at Jawaharlal Nehru Medical College and Hospital (JLNMCH), Bhagalpur, from October 2020 to July 2021. A total of 78 children aged 6 months to 5 years diagnosed with SAM were enrolled. Data collection involved demographic details, clinical history, physical examinations and laboratory investigations. Standard treatment protocols were followed and data were analyzed using SPSS software version 25.0, with descriptive statistics and chi-square tests employed to assess associations. The majority of the children were between 13-24 months (32.1%) and 6-12 months (28.2%). Males constituted 56.4% of the subjects and 69.2% belonged to low-income families. Respiratory infections were the most common complication (57.7%), followed by diarrhea (50.0%), electrolyte imbalances (41.0%), micronutrient deficiencies (61.5%), and edema (25.6%). Laboratory findings indicated widespread anemia, low serum sodium and potassium levels, and reduced serum albumin and zinc levels. Anthropometric measurements showed severe wasting and stunting. Treatment outcomes included a 66.7% recovery rate, 12.8% referrals and a 10.3% mortality rate. The study highlights the high prevalence of complications associated with severe acute malnutrition among children in Bhagalpur. The findings emphasize the need for integrated healthcare strategies addressing both nutritional and medical needs. Early intervention, adequate healthcare resources, and targeted nutritional programs are crucial to improving health outcomes in children with SAM. Continued research and policy efforts are essential to combat malnutrition and enhance child health and survival in vulnerable populations.

INTRODUCTION

Severe acute malnutrition (SAM) remains a significant public health challenge, particularly in developing regions where healthcare resources are often limited. Affecting millions of children worldwide, SAM is a critical condition characterized by a very low weight for height, visible severe wasting, or the presence of nutritional edema. Children aged 6 months to 5 years are particularly vulnerable to SAM, which can lead to a variety of severe complications and increased mortality if not addressed promptly and effectively[1-4].

In the context of India, malnutrition continues to be a pervasive issue, contributing to high rates of child morbidity and mortality. Bhagalpur, located in Bihar, is no exception, with many children suffering from the adverse effects of malnutrition. The Jawaharlal Nehru Medical College and Hospital (JLNMCH) in Bhagalpur has been at the forefront of addressing this critical health concern. Despite numerous interventions, the burden of SAM and its complications remains substantial, necessitating detailed research to inform better clinical practices and policy decisions.

This study aims to investigate the prevalence of complications in children aged 6 months to 5 years suffering from severe acute malnutrition. By examining 78 subjects at JLNMCH over a period from October 2020 to July 2021, we seek to identify common complications such as respiratory infections, diarrhea, electrolyte imbalances, micronutrient deficiencies and edema. Through comprehensive clinical examinations, laboratory investigations and growth monitoring, this research endeavors to provide a thorough understanding of the health challenges faced by children with SAM.

Understanding the spectrum and prevalence of these complications is vital for developing effective treatment protocols and management strategies. The insights gained from this study will contribute to improved healthcare outcomes, guiding both immediate clinical interventions and long-term public health strategies. As we delve into the complexities of severe acute malnutrition and its associated complications, this research underscores the urgent need for sustained efforts to combat malnutrition and enhance child health and survival in vulnerable populations.

MATERIALS AND METHODS

Study Design and Setting: This descriptive cross-sectional study was conducted at Jawaharlal Nehru Medical College and Hospital (JLNMCH) in Bhagalpur, Bihar, from October 2020 to July 2021. The hospital serves as a major healthcare provider in the region, offering both inpatient and outpatient services to a diverse population.

Study Population: The study included children aged 6 months to 5 years who were diagnosed with severe acute malnutrition (SAM) and admitted to JLNMCH during the study period. A total of 78 subjects were enrolled based on the following inclusion and exclusion criteria:

Inclusion Criteria:

- Children aged 6 months to 5 years.
- Diagnosed with severe acute malnutrition, defined by a very low weight-for-height/length (Z-score below-3 SD of the median WHO growth standards), the presence of nutritional edema, or a mid-upper arm circumference (MUAC) <115 mm.

Exclusion Criteria:

- Children with chronic medical conditions or congenital anomalies.
- Those who had received treatment for SAM prior to admission.

Data Collection: Data were collected using a structured proforma that included demographic details, clinical history, physical examination findings, and laboratory results.

Clinical Assessment:

- **Demographic Information:**
- Age, gender, socio-economic status, and feeding practices.
- **Clinical Examination:**
- Comprehensive physical examination focusing on signs of malnutrition and its complications such as respiratory infections, diarrhea, electrolyte imbalances, micronutrient deficiencies, and edema.
- Measurement of anthropometric parameters including weight, height/length, and mid-upper arm circumference (MUAC).
- **Laboratory Investigations:**
- Complete blood count (CBC)
- Serum electrolytes (sodium, potassium, chloride)
- Serum albumin and total protein levels
- Micronutrient levels (e.g., iron, zinc, vitamin A)
- Stool examination for pathogens

Management and Follow-Up: Children diagnosed with SAM received standard treatment protocols as per the World Health Organization (WHO) guidelines. This included therapeutic feeding, antibiotics for infections, rehydration solutions for diarrhea and micronutrient supplementation. Regular follow-up was conducted to

monitor progress and detect any emergent complications.

Data Analysis Data were entered into a Microsoft Excel spreadsheet and analyzed using SPSS software version 25.0. Descriptive statistics were used to summarize demographic characteristics and the prevalence of complications. Continuous variables were expressed as means and standard deviations, while categorical variables were presented as frequencies and percentages. Chi-square tests were performed to assess the association between variables, with a $p<0.05$ considered statistically significant.

Ethical Considerations: The study protocol was reviewed and approved by the Institutional Ethics Committee of JLNMCH, Bhagalpur. Informed consent was obtained from the parents or guardians of all participating children. Confidentiality and anonymity of the subjects were maintained throughout the study.

RESULTS AND DISCUSSIONS

The demographic characteristics of the 78 study subjects are summarized in Table 1. The age distribution of the children showed that the majority were between 13-24 months (32.1%), followed by those aged 6-12 months (28.2%). Fewer children were in the older age brackets of 25-36 months (20.5%), 37-48 months (12.8%) and 49-60 months (6.4%). In terms of gender, males constituted a larger proportion (56.4%) compared to females (43.6%). Socio-economic status was predominantly low among the study population, with 69.2% of the children coming from low-income families and 30.8% from middle-income families.

Table 2 highlights the prevalence of various clinical complications associated with severe acute malnutrition (SAM). Respiratory infections were the most common complication, affecting 57.7% of the children. Diarrhea was also prevalent, observed in 50.0% of the subjects. Electrolyte imbalances were noted in 41.0% of the cases, while micronutrient deficiencies were present in 61.5% of the children. Edema, a significant indicator of malnutrition severity, was found in 25.6% of the study participants.

The distribution of specific micronutrient deficiencies among the 48 children diagnosed with these issues is detailed in Table 3. Iron deficiency was the most frequent, affecting 45.8% of the children. Zinc deficiency was observed in 31.3% of the cases, and vitamin A deficiency was present in 22.9% of the children. These deficiencies highlight the critical nutritional gaps contributing to the overall malnutrition status.

Laboratory findings for the study subjects are presented in Table 4. The mean hemoglobin level was 8.2±1.5 g/dL, significantly lower than the reference range of 11.5-15.5 g/dL, indicating widespread anemia. Serum sodium levels averaged 130.4±4.2 mEq/L, below the normal range of 135-145 mEq/L. Similarly, serum potassium levels were low, with a mean of 3.1±0.8 mEq/L compared to the reference range of 3.5-5.0 mEq/L. Serum albumin levels were also reduced, averaging 2.8±0.5 g/dL against the normal range of 3.5-5.0 g/dL, indicating poor nutritional status. Additionally, serum zinc levels were significantly lower than the reference range, with a mean of 55.3±9.6 µg/dL, further underscoring the micronutrient deficiencies prevalent among the subjects.

Anthropometric measurements of the children with SAM are detailed in Table 5. The mean weight of the children was 6.8±1.5 kg, which is significantly lower than the expected weight for their age. The mean height/length was 67.4±8.2 cm, also reflecting stunted growth. The mid-upper arm circumference (MUAC) averaged 10.5±1.3 cm, corroborating the diagnosis of severe acute malnutrition.

Table 6 outlines the treatment outcomes for the study population. A significant proportion of the children (66.7%) showed recovery following the administered treatment protocols. However, 12.8% of the children required referral to higher centers for advanced care. The mortality rate among the subjects was 10.3%, highlighting the severity and risks associated with SAM. Additionally, 10.3% of the children were lost to follow-up, which presents a challenge for the continuity of care and long-term outcomes.

Overall, these results provide a comprehensive view of the demographic profile, clinical complications, nutritional deficiencies, laboratory abnormalities, anthropometric measurements and treatment outcomes of children suffering from severe acute malnutrition. The high prevalence of complications and deficiencies underscores the critical need for effective management and intervention strategies to improve the health and survival of these vulnerable children.

Severe acute malnutrition (SAM) continues to pose a significant challenge in developing regions, particularly among children under the age of five. This study aimed to assess the prevalence and types of complications associated with SAM in children aged 6 months to 5 years at Jawaharlal Nehru Medical College and Hospital (JLNMCH), Bhagalpur. The findings from this study provide valuable insights into the demographic characteristics, clinical complications, nutritional deficiencies, laboratory abnormalities and treatment outcomes of this vulnerable population.

Table 1: Demographic Characteristics of Study Subjects

Characteristics	Frequency (n=78)	Percentage (%)
Age Group		
6-12 months	22	28.2
13-24 months	25	32.1
25-36 months	16	20.5
37-48 months	10	12.8
49-60 months	5	6.4
Gender		
Male	44	56.4
Female	34	43.6
Socio-economic Status		
Low	54	69.2
Middle	24	30.8

Table 2: Prevalence of Clinical Complications in SAM

Complications	Frequency (n=78)	Percentage (%)
Respiratory Infections	45	57.7
Diarrhea	39	50.0
Electrolyte Imbalances	32	41.0
Micronutrient Deficiencies	48	61.5
Edema	20	25.6

Table 3: Distribution of Micronutrient Deficiencies

Micronutrient Deficiency	Frequency (n=48)	Percentage (%)
Iron	22	45.8
Zinc	15	31.3
Vitamin A	11	22.9

Table 4: Laboratory Findings in SAM Children

Parameter	Mean ± SD	Reference Range
Hemoglobin (g/dL)	8.2 ± 1.5	11.5-15.5
Serum Sodium (mEq/L)	130.4 ± 4.2	135-145
Serum Potassium (mEq/L)	3.1 ± 0.8	3.5-5.0
Serum Albumin (g/dL)	2.8 ± 0.5	3.5-5.0
Serum Zinc (μg/dL)	55.3 ± 9.6	70-120

Table 5: Anthropometric Measurements

Measurement	Mean ± SD
Weight (kg)	6.8 ± 1.5
Height/Length (cm)	67.4 ± 8.2
Mid-Upper Arm Circumference (cm)	10.5 ± 1.3

Table 6: Treatment Outcomes

Outcome	Frequency (n=78)	Percentage (%)
Recovery	52	66.7
Referral to Higher Center	10	12.8
Mortality	8	10.3
Lost to Follow-up	8	10.3

The demographic analysis revealed that the majority of children with SAM were between 13-24 months (32.1%), followed closely by those aged 6-12 months (28.2%). This aligns with the critical window of vulnerability identified in global literature, where children under two years are at the highest risk for malnutrition due to the rapid growth and high nutritional requirements. Similar age distributions were reported in earlier studies, emphasizing the need for targeted interventions during this crucial developmental period[5-8].

Gender distribution in our study showed a higher prevalence of SAM among males (56.4%) compared to females (43.6%). This finding is consistent with several studies, which have reported a higher incidence of malnutrition among boys. The reasons for this gender disparity could be multifactorial, including biological vulnerabilities and socio-cultural practices that might favor girls in some communities[7-10].

Socio-economic status was predominantly low among our study population, with 69.2% of the children coming from low-income families. This highlights the strong association between poverty and malnutrition, as documented in numerous studies worldwide. Poor socio-economic conditions often correlate with limited access to nutritious food, healthcare services, and education, thereby increasing the risk of malnutrition[11-13].

The prevalence of clinical complications in our study was alarmingly high. Respiratory infections were the most common complication, affecting 57.7% of the children, followed by diarrhea (50.0%), electrolyte imbalances (41.0%), micronutrient deficiencies (61.5%), and edema (25.6%). These findings are consistent with other studies that have documented high rates of infections and nutritional deficiencies among malnourished children. The high prevalence of these complications underscores the need for

comprehensive healthcare approaches that address both nutritional rehabilitation and the management of associated health issues[14-16].

The distribution of specific micronutrient deficiencies revealed that iron deficiency was the most prevalent (45.8%), followed by zinc (31.3%) and vitamin A deficiencies (22.9%). These deficiencies contribute significantly to the overall morbidity and mortality associated with SAM. Our findings are in line with studies, which also reported high rates of micronutrient deficiencies among malnourished children. Addressing these deficiencies through targeted supplementation programs is crucial for improving the health outcomes of these children[17-19].

Laboratory findings in our study indicated widespread anemia, with a mean hemoglobin level of 8.2±1.5 g/dL, significantly lower than the reference range. This is consistent with the findings from past studies, which reported similar hemoglobin levels among children with SAM. Low serum sodium and potassium levels were also observed, indicating electrolyte imbalances that are common in severely malnourished children. Serum albumin levels averaged 2.8±0.5 g/dL, reflecting poor nutritional status and chronic protein deficiency, which aligns with the findings from previous studies[19-21].

Anthropometric measurements in our study showed a mean weight of 6.8±1.5 kg and a mean height/length of 67.4±8.2 cm, indicating severe wasting and stunting, respectively. The mid-upper arm circumference (MUAC) averaged 10.5±1.3 cm, further corroborating the diagnosis of SAM. These measurements are consistent with WHO standards for diagnosing severe acute malnutrition and similar studies conducted in other developing countries[11-15].

The treatment outcomes in our study were encouraging, with 66.7% of the children showing recovery following standard treatment protocols. However, 12.8% of the children required referral to higher centers for advanced care, and the mortality rate was 10.3%. These outcomes are comparable to those reported in other studies. The high mortality rate underscores the severity of SAM and the need for effective and timely interventions to reduce fatalities[9-14].

CONCLUSION

In conclusion, this study highlights the high prevalence of complications associated with severe acute malnutrition among children in Bhagalpur. The findings emphasize the need for integrated healthcare strategies that address both the nutritional and medical needs of these children. The results are consistent with global trends and reinforce the critical importance of early intervention, adequate healthcare

resources and targeted nutritional programs to improve the health outcomes of children suffering from SAM. Continued research and policy efforts are essential to combat malnutrition and enhance child health and survival in vulnerable populations.

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