Original Article

Comorbidities in children hospitalized with severe acute malnutrition

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ABSTRACT

Background: As per the National Family Health Survey-4 data, 7.9% of under-five children in the state of Tamil Nadu are severely wasted. The outcome of hospitalized severe acute malnutrition (SAM) children is dependent on the comorbidities present. **Objective:** The objective of this study is to describe the comorbid conditions in SAM children hospitalized in a tertiary care center. **Methodology**: This study was a hospital-based descriptive study, conducted from July 2015 to June 2016. A total number of 200 children, who were admitted with SAM as per the World Health Organization criteria, were included in the study. Systemic illness, anemia, vitamin deficiencies, sepsis, retroviral infection, tuberculosis, pneumonia, acute gastroenteritis, urinary tract infection (UTI), measles, skin infections, and worm infestations were the comorbidities considered. **Results**: Among 200 hospitalized SAM children, the median (interquartile) age was 15 (11–21.75) months; there were 93 (46.5%) boys. Acute gastroenteritis (57.5%) was the most common comorbidity, followed by pneumonia (44.5%), anemia (27%), systemic illness (17%), worm infestation (13.5%), UTI (13.5%), sepsis (13%), skin infection (8%), measles (6%), vitamin deficiency (4%), retroviral infections (3.5%), and tuberculosis (1%). The case fatality rate was 10.5%. **Conclusion:** Prompt identification of comorbidities is crucial in hospitalized SAM children, which will pave way for their treatment, resulting in better outcomes.

Key words: Comorbidities, Outcome, Severe acute malnutrition

Severe acute malnutrition (SAM) is defined by a very low weight for height (below −3z scores of the median WHO growth standards), by visible severe wasting, or by the presence of nutritional edema [1]. Decreasing child mortality and improving maternal health depend heavily on reducing malnutrition which is responsible, directly or indirectly, for 35% of deaths among children under-five. Although the median under-five case-fatality rate, for SAM, typically ranges from 30% to 50%, it can be reduced substantially with the management of SAM according to the WHO guidelines. Global burden of SAM in 2016 was estimated to be 16 million [2]. As per the National Family Health Survey-4 (2015-16) data, 7.9% of under-five children in the state of Tamil Nadu are severely wasted, while the corresponding national figure is 7.5% [3]. SAM children, who have medical complications and fail appetite test, are hospitalized and treated as inpatients [1].

Although nutritional rehabilitation is the mainstay of therapy in hospitalized SAM children, their outcome is dependent on the comorbidities present [4]. Currently, systematic reporting of comorbidities in SAM children at the time of admission or during hospital stay is lacking. Such information can pave the way for studies on spectrum and outcome of these children. In this study, we present the description of comorbid conditions present in hospitalized SAM children.

MATERIALS AND METHODS

This hospital-based descriptive study was conducted in the pediatric wards of a tertiary care center from July 2015 to June 2016. All the children, admitted to the hospital with SAM as per the World Health Organization (WHO) criteria [3], were included in the study. There were no specific exclusion criteria and a convenient sample size of 200 was planned. The study was commenced after obtaining clearance from the Institutional Ethics Committee.

After obtaining informed consent from parents, demographic data such as age, sex, locality, and socioeconomic status of the family as per modified Kuppuswamy classification were collected. [5] Medical history was also collected which included birth weight, hospitalization during newborn period, developmental history, and immunization status. The detailed systemic examination was done, and anthropometry such as weight, height/length and mid-upper arm circumference (MUAC) was measured as per standard procedures. Supine length was recorded using infantometer in children <2 years of age to nearest 0.1 cm, whereas standing height was recorded using a stadiometer in children above the age of 2. Weight was recorded using electronic weighing scale in all children. MUAC was measured to nearest 0.1 cm midway between acromion and olecranon using

flexible, non-stretchable tape. The presence of edema or wasting was noted.

Comorbidities considered were systemic illness, severe anemia, vitamin deficiencies, sepsis, retroviral infection, tuberculosis, pneumonia, acute gastroenteritis, urinary tract infection (UTI), measles, skin infections, and worm infestations. Children were treated depending on comorbidity present and based on the WHO management guidelines. All children were followed up during the course of hospital stay and presence or absence of various comorbidities, up till discharge or death and their outcome was noted down. All children were followed.

Systemic illness was defined as any disease involving major organ systems, namely cardiovascular system, nervous system, gastrointestinal system, and respiratory system. Cardiac illness described in the study included congenital cardiac defects diagnosed by echocardiogram. Neurological illness included cerebral palsy diagnosed clinically by pediatric neurologist. Gastrointestinal disease included chronic diarrhea with malabsorption diagnosed by small bowel biopsy. Severe anemia was defined as hemoglobin concentration <7 mg/dl. Vitamin deficiencies included clinically diagnosed Vitamin A, B, C, and D deficiencies; no vitamin assays were performed. Sepsis included cases with polymorphonuclear leukocytosis and c-reactive protein positivity with accompanying systemic inflammatory response syndrome with or without blood culture positivity. Retroviral infections included serologically positive cases. Tuberculosis included only microbiologically confirmed cases as per the Revised National Tuberculosis Control Program. Pneumonia was diagnosed clinically in a child presenting with cough, cold, fever, and respiratory distress as per the WHO criteria. Acute gastroenteritis was defined as passing watery stools more than thrice in 24 hours. UTI was diagnosed in a child presenting with dysuria with or without fever with urine culture positivity.

Measles was diagnosed clinically in febrile children with typical rash. Skin infections were diagnosed clinically by treating pediatrician. Worm infestations were defined as the presence of ova in stool examination. Data were entered into Excel sheet, and the statistical analysis of data was performed by statistical software SPSS version 21. Outcome variables were expressed as proportion with 95% confidence interval [6].

RESULTS

In a total of 200 hospitalized SAM children, who were included in the study, the median (interquartile) age was 15 (11–21.75) months. Maximum children were in 1–3 years of age group 117 (58.5%), followed by infancy 68 (34%), while those between 3 and 5 years were least 15 (7.5%); of 200 children, 93 (46.5%) were males. Age and sex distribution is shown in Table 1. Among 200 hospitalized SAM children, 122 (61%) children were from rural area and 78 (39%) were from urban area. 1 (0.5%) child belonged to an upper middle class, 16 (8%) to lower middle class, 89 (44.5%) belonged to upper-lower class, and majority 94 (47%) belonged to lower–lower class as per Kuppuswamy scale.

138 (69%) were born with a normal birth weight, while 58 (29%) were born as low birth weight and 4 (2%) as large for gestational age. As much as, 86 (43%) children were hospitalized during newborn period. 94 (47%) children had normal development, while 84 (42%) had isolated motor delay, 10 (5%) had isolated speech delay, and 12 (6%) had global developmental delay. Only as much as 119 (59.5%) children were fully immunized, while 81 (40.5%) were not immunized, appropriate for age, respectively.

Various comorbidities of SAM children are shown in Table 2. Among children with systemic illnesses, 26 (76%) had cardiac illness in the form of congenital heart defects, 6 (18%) had neurological illness in the form of cerebral palsy, and 2 (6%) had gastroenterological illness, namely chronic diarrhea, with malabsorption syndrome. In children with anemia, 43 (80%) had iron deficiency anemia, while rest 11 (20%) had dimorphic anemia. Among with sepsis, 9 (35%), had culture-positive sepsis, while 17 (65%) had culture-negative sepsis. 179 (89.5%) were discharged successfully after clinical improvement and 21 died the case fatality being 10.5%.

DISCUSSION

In this study, it was found that acute gastroenteritis (57.5%) was the most common comorbidity, followed by pneumonia (44.5%), anemia (27%), systemic illness (17%), worm infestation (13.5%), UTI (13.5%), sepsis (13%), skin infection (8%), measles (6%), vitamin deficiency (4%), retroviral infections (3.5%), and tuberculosis (1%). The case fatality rate was 10.5%.

Table 1: Age and sex distribution

Age category	Sex		Total
	Male n (%)	**Female n (%)**	
<1 year	33 (48.5)	35 (51.5)	68 (34)
1–3 years	51 (43.6)	66 (56.4)	117 (58.5)
3–5 years	9 (60)	6 (40)	15 (7.5)
Total	93 (46.5)	107 (53.5)	200 (100)

Table 2: Prevalence of comorbidities in hospitalized SAM children

Comorbidity	Number (%)	95% confidence interval
Systemic illness	34 (17)	12–23
Anemia	54 (27)	21–34
Vitamin deficiencies	8 (4)	1.7–7.7
Sepsis	26 (13)	9–18
Retroviral infection	7 (3.5)	1.4–7.1
Tuberculosis	2 (1)	0.1–3.6
Pneumonia	89 (44.5)	38–52
Acute gastroenteritis	115 (57.5)	50–64
Urinary tract infection	27 (13.5)	9–19
Measles	12 (6)	3–10
Skin infection	16 (8)	5–13
Worm infestations	27 (13.5)	9–19

SAM: Severe acute malnutrition

The average age of presentation, in other studies, is <24 months as seen in ours [7,8]. This could be explained because rapid growth occurs in the first 2–3 years, and the requirement of nutrition for energy and bodybuilding increases. Hence, the deficiency of protein and energy and other micronutrients might lead to SAM, in this age group. Sex ratio with a slight preponderance of female children was found in this study as was also seen in few other studies [7-9]; however, some other studies report a male predominance [10,11]. Female children are more commonly affected due to gender inequality and neglect of the female child. Children with SAM mostly belonged to lower socioeconomic class as seen in other studies [9-11]. The proportion of SAM children with developmental delay reported, in our study, was slightly less compared to other reported studies [8,10]. The immunization rate, prevalent among our study population, was better than that reported in other studies [7,8]. This was probably due to better immunization rates prevalent in the state [3].

Acute gastroenteritis and pneumonia were the common comorbidities noted in our study similar to many other studies [7-11]. However, their relative frequency was more in our study compared to others which report a prevalence of around 25–35%. UTI and sepsis too were more frequently encountered in our study population compared to others [7,10,11]. In SAM children, both humoral immunity and cell-mediated immunity are depressed, because of certain defects present in skin barrier, mucosal defense mechanism, phagocytic, and free radical scavenging function. Poor hygiene and handling of caretakers also make SAM children susceptible to infection. Hence, SAM children are more vulnerable to life-threatening infections such as acute gastroenteritis, pneumonia, UTI, and sepsis.

The prevalence of anemia is as high as 60–80% in other studies, whereas in our population, it was as low as 27% [7,9]. Anemia in SAM children is due to iron deficiency and ineffective erythropoiesis due to folic acid and Vitamin B-12 deficiencies, infections, worm infestations, and anemia of chronic disease. We included only cases of severe anemia with hemoglobin <7 g/dl which was the reason for the low prevalence. Tuberculosis and skin infections were less commonly reported in our study than others [8,11]. We included only microbiologically confirmed cases as tuberculosis which could have been the reason for low prevalence apart from low prevalence of tuberculosis in our state. Retroviral positivity rate reported in our study was similar to that reported in another Indian study while it was much less than that reported in an African study [11,12]. The main limitation of this study was the lack of the comparative group, being a descriptive study. The other limitation was that micronutrient levels were not measured.

CONCLUSION

As stated previously, although nutritional rehabilitation is the mainstay of therapy in hospitalized SAM children, their outcome is dependent on the comorbidities present. Hence, prompt and timely identification of comorbidities are crucial and will pave way for treatment. Breaking the vicious cycle of under nutrition-disease-under nutrition will result in recovery.

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