

Management of Severe Acute Malnutrition in Children Under 5 Years of Age at Chittagong Medical College Hospital, Bangladesh

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Abstract— *Background:* Severe acute malnutrition (SAM) is the leading cause of death in children under the age of 5, and its prevention and treatment are essential for the survival and development of children. Children are the most vulnerable demographics and are more prone to be malnourished in an emergency due to a lack of awareness. The main motto of this study is to research their health and nutritional status and also improve their health conditions with proper feeding formulas. **Methods:** Data were collected from children 6-59 months old admitted to the Chittagong Medical College Hospital to assess the determinants of SAM. The nutritional status of the child was assessed by measuring height, weight, and mid-upper arm circumference (MUAC). Facility-based inpatient treatment was performed to control complications such as diarrhea, hypothermia, hypoglycemia, infectious diseases, and deficiency of micronutrients in malnutrition. **Results:** Initial data from some SAM patients were collected during hospitalization. Among the patients, Z-score fluctuated between -3SD and -4SD, which were indications for SAM. Initial data of some SAM patients were taken during admission to the hospital. However, after feeding with F-75 and F-100 respectively, proper treatment and follow-up, showed that the z-score becomes -2SD and gross wasting was decreased and malnutrition tended to recover from the severe stage to a normal state. **Conclusion:** Institutional inpatient care is essential if SAM has advanced to the stage where the child suffers from life-threatening complications. New initiatives for managing SAM, such as Ready-to-Use Therapeutic Food (RUTF), and community-based therapeutic care - reduce barriers to entry, facilitate early presentations, and are associated with treatment. It is designed to reduce opportunity costs and promote patient compliance.

Keywords— SAM, Nutritional status, Under-5 children, Edema, Feeding formulas.

I. INTRODUCTION

Malnutrition occurs when a feeder is not provided with enough nutrients or cannot absorb nutrients from the feed. Bangladesh is home to an estimated 3 million malnourished people, and many more are at risk of malnutrition. There are many reasons for this, including restricted mobility, long-term health problems, and low income [1]. Malnutrition in children is a pervasive health problem at the global level and has significant repercussions on the survival of children, harming children's cognitive and physical development and the financial productiveness of people and societies [2].

Decreasing child fatality rate and rising maternal health believe deeply in reducing deficiency disease that is accountable, directly or indirectly, for thirty-fifth of deaths among youngsters under five years previous [3]. Albeit the median under-five case-fatality rate for severe acute deficiency disease generally take issue between half-hour and five hundredths, it may be decreased considerably once physiological and metabolic changes area unit taken into thought. Severe acute deficiency disease is taken by really low weight for height (below -3z countless the median United Nations agency growth standards), by visible severe exhaustion, or by the presence of nutritional edema—characterized by swollen feet, face, and limbs [4].

The clinical status of kwashiorkor and severe exhaustion are indistinguishable due to similar treatments. Children <-3SD weight-for-age may be delayed (short stature) but not seriously wasted. Stunted infants the ones who are not harshly wasted do not demand clinic admittance unless they have a severe ailment. Severe acute malnutrition is the ultimate extreme and apparent form of undernourishment [5]. Its face is a child – frail and wasted – the one that demands an urgent situation to endure. Approximately two-third bases of these children stay in Asia and nearly individual third reside in Africa [6].

Excessive acute malnutrition is a prime motive of death in kids under five, and its prevention and remedy are essential to infant survival and improvement. Toddler under nutrients is an important public health difficulty ubiquitous in lots of developing nations where diverse infectious diseases are rampant [7]. Numerous studies have confirmed the affiliation between SAM and poverty [8, 9], a huge circle of own family size [10], low nutritional range and unimproved sanitation, and hygiene [8, 11], exposure to pathogens, and recurrent infections [12, 13].

Throughout the globe, an anticipated 20 million youngsters beneath the age of five are tormented by extreme acute malnutrition [14, 15]. This quantity is surprising – most importantly, due to the fact kids with intense acute malnutrition are 9 times much more likely to die than nicely-

nourished children [6]. These deaths are the direct result of malnutrition itself, as well as the oblique result of infancy ailments like diarrhea and pneumonia that malnourished youngsters are too vulnerable to live on [16].

Kids with intense acute malnutrition need to first be evaluated with a complete clinical inspection to verify whether they have got any widespread hazard signal or scientific complexities. Kids with extreme acute malnutrition with a lack of urge for food, infections, or other scientific hassle have extreme situations and ought to be admitted for inpatient care. Babies who have an amazing appetite and no clinical intricacy may be controlled as outpatients. Principal demanding situations remain to execution of valuable use of growth tracking in number one health-care settings, to factor out the most at-chance babies and kids who want medical and dietary interferences to prevent extreme morbidity and mortality. The importance of that is highlighted with the aid of the robust epidemiological proof that low weight-for-height, weight-for-length, or mid-upper arm circumference are enormously associated with a five–twenty-fold multiplied chance of mortality [17].

The primary goal of this takes a look at are to study the health and dietary status of intense acute malnourished kids and to control complications which include diarrhea, hypothermia, hypoglycemia, infections & deficiencies of micronutrients with the use of proper medications and feeding formulation.

II. MATERIALS AND METHODS

Study area:

This study was conducted amongst kids who were admitted to the pediatric department of Chittagong Medical College Hospital, Bangladesh. It is the oldest and most renowned medical college in the south-eastern part of the country. This hospital has a specialized zone for the control of children who are extremely acute malnourished referred especially from rural and urban settings surrounding the Chittagong metropolitans.

Study design, period, and population:

A facility-based management examination was performed amongst children 6-59 months from March to April 2020. In the course of this period, four kids had been observed thoroughly and had been admitted to the hospital in severe situations. SAM in babies beneath 6 months of age turned into recognized as weight-for-length z-rating <-3, or the presence of bilateral pitting edema. Kids between 6-59 months of age turned tested as weight-for-height/length z-score <-3, or MUAC <115mm, or presence of bilateral edema. Preferred inpatient control of SAM involves stages: i) preliminary stabilization segment whilst life-threatening complexities are picked out and dealt with; ii) nutritional rehabilitation phase when capture-up growth takes place; emotional and physical stimulation is elevated; breastfeeding is resumed and/or re-initiated; the mother or caregiver is trained to hold care at domestic, and arrangements are made for the discharge of the kid [18].

Assessment of severe acute malnutrition: Length measurement:

Recumbent length is used to measure toddlers and kids much less than years of age. Recumbent duration also can be used for kids two to a few years of age who have extraordinary problem status on their very own; these kids have to be measured lying down and the dimension needs to be recorded as recumbent period. The recumbent period refers to stature has taken whilst lying down. Two humans must be used to measure recumbent length. A board with table paper may be used to put down the child. The baby’s head and shoulders have to be an inaccurate condition to read and take out the length measurement.

Weighing infants:

Beam Balance Scale or Digital Infant Scale can be used for weight measurement. Children should be placed in the center of the scale tray.

Screening:

Edema: Edema is the retention of water in the tissues of the frame. Bilateral edema is an indication of kwashiorkor, a shape of intense acute malnutrition. To pick out edema, regular thumb pressure is carried out to the tops of the feet for approximately 3 seconds. If there is edema, an influence stays for a while (as a minimum a few seconds) wherein the edema fluid has been pressed out of the tissue. The kid has to only be recorded as edematous if each foot present pitting edema. These children are at excessive hazard of mortality and need to be treated in a therapeutic feeding program immediately.

Checking for Edema



Fig. 1. A) bilateral edema and B) indication of edema.

Mid-upper Arm Circumference (MUAC):

MUAC is a brief and easy way to decide whether or not a baby is malnourished by the usage of a simple colored plastic strip. First, the mid-point between the elbow and the shoulder needs to be decided after which the tape ought to be positioned throughout the LEFT arm to study the dimension [19, 20].

The general management of a child with severe acute malnutrition:

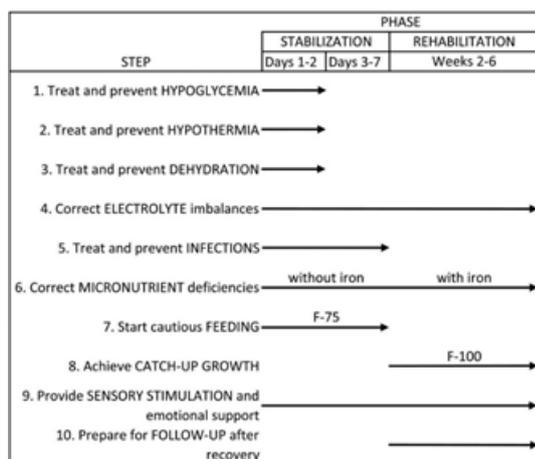


Fig. 2. Steps and phases of the SAM management process.

- Treat/prevent hypoglycaemia:** Hypoglycaemia and hypothermia sometimes do together and are signs of infection. Hypoglycaemia may also do if the starved child has not been fed for 4-6 hours. Consider hypoglycaemia whenever hypothermia is begin (axillary <35°C or <95°F), or there's languor, slackness, spasm, and loss of consciousness. 50 ml bolus of 10% glucose or sucrose solution (5 g or 1 rounded teaspoon of sugar in 50 ml or 3.5 tablespoons water), orally or by a nasogastric (NG) tube should be given to the child. Two-hourly feeds, day and night should be maintained.
- Treat/prevent hypothermia:** If the auxiliary temperature is <35 °C or 95°F then to re-warm the child and feed with F-75 formula including breastfeeding should be continued.
- Treat/prevent dehydration:** Every 30 min for the first two hours Rehydration Solution for Malnutrition (ReSoMal) 5ml/kg orally or by way of the nasogastric tube, then substitute hours for four-ten hours, ReSoMal 5-10 ml/kg/h should be given. [21]
- Step 4. Correct electrolyte imbalance:** Additional potassium 4mmol/kg/d for 1 week and further 50% magnesium sulphate 0.1ml/kg/day for 1 week ought to be given. Food has to be organized without salt.
- Treat/prevent infection:** The sign of infections are often hidden, therefore should be treated with broad-spectrum antibiotics.
- Correct micronutrient deficiencies:** Vitamin A should be given orally on day-1, then each day for at least two weeks: a multivitamin supplement (without iron), Folic acid 1 mg/d, and Zinc 2mg/kg/d should be given.
- Start feeding cautiously:** Milk-based formulations such as starter components F-75 containing 75 kcal/100 ml and 0.9g protein /100 ml are first-rate for most kids.
- Achieve catch-up growth:** In the rehabilitation section, starter method F-75 should be replaced with the same amount of capture-up components F-100 every 4 hours for 48 hours which incorporate 100 kcal and 2.9 g protein/ 100 ml.
- Provide sensory stimulation and emotional support:** Extreme malnutrition influences intellectual and behavioral development, which can be maybe reversed

through suitable remedies encompassing sensory stimulation and emotional assistance.

- Prepare for follow-up after recovery:** Parents should know what to feed at domestic to help the kid to recover. Prescribed weekly comply with-up maintained [36].

ReSoMal oral rehydration solution:

ReSoMal contains about forty-five mmol sodium, forty mmol K and three mmol mg/liter.

TABLE I: Recipes for ReSoMal oral rehydration solution.

Ingredient	Amount
WHO-ORS (new formulation)	One 500 ml-packet
Water (boiled and cooled)	850 ml
Electrolyte-mineral solution	16.5 ml
Sugar	20 g

F-75 and F-100 recipes:

TABLE II: F-75 recipes if cereal flour and cooking facilities are available.

Types of milk	Ingredients	Amount for F-75
Dried whole milk	Dried whole milk	35 g
	Cereal flour	35 g
	Electrolyte mineral mix	20 ml
	Water makes up to	1000 ml
	Sugar	70 g
Cow's milk	Vegetable oil	20 g
	Full-cream milk	300 ml
	Cereal flour	35 g
	Electrolyte mineral mix	20 ml
	Water: make up to	1000 ml
	Sugar	70 g
	Vegetable oil	20 g

TABLE III. F-75 recipes if cereal flour or cooking facilities are unavailable and F-100 recipes.

Types of milk	Ingredients	Amount for F-75	Amount for F-100
Dried whole milk	Dried whole milk	35 g	110 g
	Electrolyte/mineral mix	20 ml	20 ml
	Water make up to	1000 ml	1000 ml
	Sugar	100 g	50 g
	Vegetable oil	20 g	30 g
Cow's milk	Full-cream Milk	300 ml	880 ml
	Electrolyte/mineral mix	20 ml	20 ml
	Water make up to	1000 ml	1000 ml
	Sugar	100 g	75 g
	Vegetable oil	20 g	20 g

III. RESULTS

Initial data of some SAM patients were taken during their admission to the hospital. All the patients were suffering from serious illnesses.

TABLE IV. Anthropometric data and z-score of admitted babies in the preliminary phase.

Name	Gender	Length	Weight	Z-score
Muntaha	Female	54 cm	3.2 kg	- 3 SD
Nisa	Female	56cm	3.4 kg	- 4 SD
Ayatullah	Male	57 cm	3.9 kg	- 3 SD
Khadiza	Female	64 cm	4.8 kg	- 4 SD

From table IV, all patients' weight ranges from 3-4 kg & length 50-60cm on average. Here, the 4th patient's weight was the highest & the 1st patient's weight was the lowest & z-score showed -4SD and -3SD respectively. Therefore, they

should be examined properly with other complications to evaluate their health status and to take up necessary medication according to the severity.



Fig. 3. Severe acute malnourished child.

So patient’s treatment started with F-75 Formula & with other antibiotics.

TABLE V. The change in weight and z-score in children after feeding with F-75 and proper medication.

Name	Gender	Length	Weight	Z-score
Muntaha	Female	54 cm	3.4 kg	- 3 SD
Nisa	Female	56 cm	3.7 kg	- 3 SD
Ayatullah	Male	57 cm	4.1 kg	- 3 SD
Khadiza	Female	64 cm	5.3 kg	- 3 SD

All patients’ weight increased rapidly. But their z-score was still -3SD. Moreover, some changes and further treatment were required. Children needed to be monitored continuously to avoid abnormalities. Pulse rate, respiration rate, urine frequency, and stool/vomit frequency were all monitored half-hourly for 2 hours, then hourly for the next 4-10 hours. Rapid breathing and pulse rates should settle down throughout treatment, and the infant should start passing urine. Rehydration is also indicated by the return of tears, a moist mouth, eyes, and fontanelle that appear less sunken, enhanced skin turgor, and urination. However, even when thoroughly rehydrated, many children with severe acute malnutrition will not display these changes.

During rehydration, fast respiration and pulse may indicate a concomitant infection as well as over-hydration. If there is any evidence of over-hydration, especially indicators of heart failure, fluids should be discontinued promptly. Improved hydration status is indicated by the following signs: the kid is therefore no longer thirsty, passing urine, a reduction of respiratory and pulse rates from earlier high rates, a slower skin pinch, and tears.

In the catch-up growth phase, the F-100 formula was used instead of F-75 after electrolyte balance, infection control, and vitamin deficiencies were corrected.

TABLE VI. The required change in weight and z-score after feeding conversion and other medication.

Name	Gender	Length	Weight	Z-score
Muntaha	Female	52 cm	3.6 kg	- 2 SD
Nisa	Female	56 cm	4.0 kg	- 2 SD
Ayatullah	Male	57 cm	4.3 kg	- 2 SD
Khadiza	Female	64 cm	5.7 kg	- 2 SD

From table VI, weight growth is rapid in all patients, with a Z score of -2 SD. As a result, various issues such as dehydration, fever, and infections were resolved during this phase, signaling the conclusion of the stabilization phase. They were well enough to be released from the hospital. The remaining phases could be performed at home by maintaining a balanced homemade diet and following up weekly.

IV. DISCUSSION

In this study, during admission, almost all the children were suffering from severe wasting, and the children’s age was below 2 years. All the children came from poor families with low socioeconomic levels. Children with a z-score of -3 SD or < -3SD were suffering from severe acute malnutrition. But after feeding with F-75 and proper treatment, it showed that the weight increased rapidly but not satisfactorily. Then the feeding diet was changed to F-100, and antibiotics and follow-up were also maintained. Therefore, the z-score became -2SD, gross wasting was also decreased, and malnutrition recovered from the severe stage and changed to a normal state.

Care for inpatient sufferers with severe malnutrition and other problems consists of the primary seven steps of institutional-based care. Those steps must take four to seven days to complete, and the kid should be in community-based care to carry on managing SAM. At some point during the stabilization phase, life-threatening complexities can be recognized and dealt with, unavoidable deficiencies are corrected, metabolic problems are reversed, and feeding is initiated with caution, which includes breastfeeding [22].

A vigorous feeding approach is required during the rehabilitation period to attain very high intakes and rapid weight gain. Ready to enter the rehabilitation period is usually indicated by a recovery of appetite about a week after admission.

Children will be discharged from the intensive unit if they meet the following criteria: sufficient appetite and initiated consumption of ready-to-use therapeutic foods (RUTF); elevating weight curve; no edema; no signs of infection. Furthermore, they are not actively treated with injectable antibiotics, and mothers can attend outpatient sessions on a regular weekly basis at the Outpatient Feeding and Therapeutic Unit.

Ready-to-use therapeutic food was developed in the form of peanut butter-based pastes and cookies. They are nutritious and packed with high levels of protein and energy. RUTF does not contain water, which reduces exposure to bacteria in the water. They do not require refrigeration and are ready to serve, ensuring that important nutrients are not lost until the product is consumed. With no need for water, heating, or preparation, RUTF avoids all the major inconveniences of milk-based treatment products, which are the standard treatment in the inpatient management of severe acute malnutrition [23, 24].

There is a significant relationship between SAM and other components like family size, mother’s education level, and birth interim. The children of fathers who were ignorant; were found to be essentially related to SAM, which is reliable with thinks about from Vietnam, Pakistan, and Ethiopia [10, 25, 26,

27]. The explanation for this variation might be that the fathers were the choice producers, agriculturists, and cash workers as they seem not to give adequate time to care for their children. Socio-economic status was too found to be altogether related to SAM, a finding steady with those of case-control thinks about from India, Pakistan, Iran, Vietnam, and Ethiopia [10, 26, 28, 29, 30]. These can explain by the reality that children from families of low financial status have constrained get to nourishment, well-being administration, cleanliness, and sanitation.

SAM in children has typically been treated at the institutional level in Bangladesh, with inpatient therapy care [31]. Because effective case screening in the community is unusual or absent, many families cannot afford the monetary and opportunity expenses associated with facility-based inpatient care, and health facilities cannot fairly handle such a large caseload, only a limited proportion of patients receive this therapy [32].

When SAM has progressed to the point where children are experiencing life-threatening medical issues, facility-based inpatient care is required [27, 33, 34]. When there are no difficulties, the technical aspects of treatment are quite straightforward. There is widespread agreement that severe acute malnutrition without complexities does not require hospitalization and can be managed well in the community [28].

V. CONCLUSION

Exclusive inpatient treatment options are resource-intensive and necessitate a large number of highly trained personnel. Because SAM is most common in resource-poor areas, there is generally a significant mismatch between a large number of patients in need of treatment and the few competent people and limited resources available to treat them. The HIV/AIDS epidemic is reducing resource availability and increasing the proportion of children who are chronically malnourished. Community-based treatment, for example, is a new approach to SAM management that complements the existing WHO inpatient standards. The majority of children with SAM are treated as outpatients using Ready-to-Use Therapeutic Food (RUTF), with inpatient therapy reserved for those with problems. These are created to decrease obstacles to access, spur former performance, decrease opportunity costs joined accompanying situations, and encourage agreement by sufferers. Treatment of most inmates with SAM only as outpatients reduces inpatient caseloads to a more controllable level, which helps decongest cramped inpatient units, decreases the risks of nosocomial contamination, and increases the occasions possible for staff to assign to the most displeased babies.

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