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Diagnosis and Treatment of Severely Malnourished Children in Outpatient Therapeutic Program

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Abstract- Severe acute malnutrition among children is still one of the main public health challenges in the 21st century, particularly in developing countries. It is associated with a high risk of morbidity and mortality. The goals of management of SAM are to prevent short-term mortality, achieve sustained nutritional recovery to reduce susceptibility to life-threatening infections, and support neurocognitive development. In addition to that, SAM children need urgent lifesaving treatment to survive. The outpatient therapeutic feeding program is one dimension of the community-based management of acute malnutrition that provides screening, diagnostic, and treatment services for uncomplicated SAM children 6–59 months of age, by giving home-based treatment as Ready-to-use Therapeutic Food and routine medical treatment. This review article gives a comprehensive update on outpatient therapeutic programmes in light of recently published standard treatment guidelines for the management of uncomplicated severe acute malnutrition.

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Strictly as per the compliance and regulations of:

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Introduction

Severe acute malnutrition (SAM)among children is still one of the main public health challenges in the 21st century, particularly in developing countries (Bhutta & Salam, 2012). It is associated with a high risk of morbidity and mortality (Cashin & Oot, 2018).Children are the most vulnerable group to the effects of severe acute malnutrition during their most rapid physical growth and development, because of the additional nutritional requirements for growth and expansion at this time(Picot et al., 2012). It can manifest over a short period of time when the body does not receive adequate amounts of micronutrients or energy, either as a result of insufficient dietary intake or through malabsorption of nutrients or loss of appetite due to illness (James et al., 2015). It increases dramatically in emergencies and developing countries generally, where these settings are plagued by chronic poverty, poor hygiene, lack of education, poor diets and limited access to food (UNICEF, 2015c).

The goals of management of SAM are to prevent short-term mortality, achieve sustained nutritional recovery to reduce susceptibility life-threatening infections and to support neurocognitive development (Bhutta et al., 2017). In addition to that, SAM children need urgent lifesaving treatment to survive.

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The outpatient therapeutic feeding program is one dimension of the community-based management of acute malnutrition (CMAM) that provides screening, diagnostic and treatment services for uncomplicated SAM children 6–59 months of age, by giving home-based treatment as RUTF and routine medical treatment(Atnafe et al., 2019; UNICEF, 2015a). It brings the management of SAM closer to the community by making services available at decentralized treatment points within the primary health care (PHC) settings (John et al., 2018; WVI, 2017). RUTFs are highly fortified energy dense pastes designed to fulfill 100% of the nutritional needs of children during the recovery from SAM.

Child nutrition outcomes such as acute malnutrition in particular, is recognized as crucial indicator for tracking the nutrition and health status of children in a population (Fadare et al., 2019). The effectiveness of treatment of SAM has been proven through health interventions during emergency settings and routine development programs however there is high risk of program default and fatalities, if the interventions are not delivered adequately (Okello, 2016). The performance indicators for managing SAM of discharged children for SAM are made up of those who have cure≥75%, defaulted<15%, non-respondent or died<10%, based on the Sphere minimum standards are used as a threshold for OTP performance (Sphere, 2018).

Definition of SAM: SAM in children 6–59 months of age is defined as a weight for height/length<–3 Z-score of the WHO growth standard, and, or MUAC of less than 115 mm, or the presence of bilateral pitting edema (nutritional edema)(UNICEF, 2015a; WFP, 2012; WHO, 2013a).

Pathophysiology of SAM: Acute malnutrition typically develops during the first two years of life, when growth velocity and brain development are exceptionally high. The children are particularly susceptible to acute malnutrition if complementary foods are low nutrient density and have low bioavailability of micronutrients. Also, children's nutritional status will be further compromised if complementary foods are given at the wrong time as too early or late, or are contaminated (WHO, 2013a). During short-term starvation, free fatty acids (FFAs) and ketone bodies are primarily oxidized using available fat stores from adipose tissue, and myofibrillar proteins can be broken down into amino

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acids, which can be converted into glucose (through gluconeogenesis). After several days of starvation (when body fat has been depleted), myofibrillar proteins are extensively broken down to maintain essential metabolic processes. The short-term regulation of macronutrient oxidation and synthesis depends on insulin and glucagon, whereas the long-term regulation of these processes is mediated by other hormones, such as growth hormone, thyroid hormones, catechol amines and corticosteroids (Bhutta et al., 2017).

SAM can result in profound metabolic, physiological and anatomical changes. All organs and systems are involved in a "reductive adaptation" process due to nutrient shortage. Reductive adaptation is the physiological response of the body to low nutrition i.e., systems slowing down to survive on limited macro and micronutrient intake. The pathophysiological responses to nutrient depletion place children with SAM at increased risk of life threatening complications that lead to increased risk of death. Therefore, successful management of SAM requires both systematic medical therapy of underlying infections and nutritional treatment with therapeutic feeds (WFP, UNICEF, et al., 2017; WHO, 2013a).

Clinical picture of SAM

The common signs and symptoms of SAM include poor appetite, pallor, weight loss, increased thirst or vomiting and diarrhea plus behavior changes as well as excessive drooling(Kasio Iboyi & Zha, 2019). The clinical picture of SAM varies according to its two recognized forms such as marasmus and kwashiorkor (Mwangome et al., 2011):

Clinical signs of marasmus: Severe wasting is a massive loss of body fat and muscle tissue. Children who are severely wasted look almost elderly and their bodies are extremely thin and skeletal (AAH, 2022).

Clinical signs of kwashiorkor: In this form of severe acute malnutrition, edema is present on the lower limbs, and is verified when thumb pressure is applied on top of both feet for three seconds and leaves a pit or indentation in the foot, after the thumb is lifted. Edema may eventually spread to the legs and face, and the child appears puffy, and is usually irritable, weak, and lethargic. Other signs of edema include skin lesions, an enlarged liver and thinning hair. Underneath edema, the muscles have been severely weakened and the child experiences excruciating cramping and muscle pain (AAH, 2022).

Diagnosis of SAM in children

Globally, the most common method for screening and diagnosis of SAM among CU5 as individuals or populations can be done in different ways such as anthropometric measurements (nutritional index), clinical signs or nutritional edema (JMoH, 2013; WFP, 2012; WHO, 2009, 2013b).

Anthropometric measurements and indices

Anthropometry is a crucial tool measurement of the human body used by health providers. It is helpful in determining and monitoring the nutritional status, it is identifies the type of malnutrition and measuring progress toward improvement among children. However, it does not identify specific nutrient deficiencies (e.g., iron or vitamin A). Common anthropometric measurements include: height/length, weight and MUAC (Cashin & Oot, 2018; WFP, FAO, et al., 2017). It is the preferred anthropometric indicator to assess acute malnutrition, where MUAC better than WHZ at identifying high risk children in the community (MoPHP et al., 2008; WFP, UNICEF, et al., 2017). Age, sex and bilateral pitting edema are essential parameters in anthropometry(WFP, FAO, et al., 2017).

Weight for Height Z-scores (WHZ): Anthropometric Z-scores describe how far and in what direction an individual's measurement is from the reference populations' median value. According to the WHO Growth Standards, the reference population is children the same sex and age. Z-scores that fall outside of the normal range indicate a nutritional issue (Cashin & Oot, 2018). WHZ is considered to be an essential measure of nutritional status and helpful in identifying SAM, it is appropriate threshold for diagnosing marasmus. It is calculated from patient's weight, height and sex, using WHO Growth Standards. It can be estimated using growth charts/tables and, or calculated using computer software(Cashin & Oot, 2018; JMoH, 2013; Picot et al., 2012; WFP, 2012; WHO, 2009, 2013b, 2020).

Mid Upper Arm Circumference (MUAC): Measurement of MUAC provides a reliable and simple tool for screening nutritional status and also enables rapid assessment of large populations in epidemiological field studies. (Shinsugi et al., 2020). WHO and UNICEF recommended using the MUAC as an independent indicator of SAM. It is a helpful measure within community or during emergency situations, when measuring children's height and weight may prove difficult. MUAC is also used for diagnosis, admission and discharges of children with SAM, particularly in CMAM programs, because it is a simple and inexpensive measurement and does not require a chart to calculate. It is measured by a band around the mid-point of the upper left arm of the child (Cashin & Oot, 2018; JMoH, 2013; Picot et al., 2012; WFP, 2012; WHO, 2009, 2013b, 2020).Study conducted in India by Aguayo et al. (2015), concluded that MUAC appears to be an appropriate criterion for identifying SAM children.

Clinical signs of bilateral edema

Bilateral pitting edemais a clinical sign of a specific form of SAM known as nutritional edema (edematous malnutrition or kwashiorkor). It is a swelling caused by the accumulation of fluid in the body tissues and can be categorized as mild (edema in both feet/ankles), moderate (edema in feet plus lower legs, hands or lower arms) and severe (generalized edema including feet, legs, hands, arms and face)(WHO, 2020):

Outpatient treatment of SAM

The outpatient treatment of SAM programs aims for more widespread access to treatment primarily by establishing the appropriate facilities and activities within more communities (UNICEF, 2012).The rapid expansion of community based treatment programs worldwide, lead to every year millions of children being treated for SAM (Briend & Berkley, 2016). Typically, children treated in the community with uncomplicated SAM have a CFR less than 5%(Williams & Berkley, 2018). Uncomplicated severely malnourished children should be managed as outpatients, by providing them with weekly of RUTF, which can often follow at home if the child has clinically well, alert and retained appetite.(Jones & Berkley, 2014; Lenters et al., 2016; WHO, 2019; Williams & Berkley, 2018).

SAM treatment program depends on the four following principles; maximum coverage and access, timeliness, appropriate care and care for as long as it is needed (Lenters et al., 2016). Therefore the program strives to reach all severely malnourished children before the development of medical complications and to provide appropriate care until recovery. The program uses community health workers or volunteers to actively find cases of acute malnutrition within the community. The severely malnourished children treated should be supplemented with routine medications during the treatment course such as vitamin A, folic acid, antibiotics, deworming and measles vaccine(Al Amad et al., 2017).

Children with SAM should be treated proactively with intensive treatment regimens of short duration, aiming to rehabilitate the child in a few weeks. OTP is currently used to achieve rapid recovery from SAM, it provides services of SAM management closer to the community at primary health care facilities, where uncomplicated SAM children receive different amounts of RUTF as Plumpy'Nut sachets according to their body weight(Al Amad et al., 2017; WFP, UNICEF, et al., 2017).The caregivers visits the health facility or OTP point every week or two weeks with their child for a medical checkup and to receive a weekly supply of RUTF. OTP should be operated in as many health facilities as possible and should be incorporated into existing health services as a component of routine services for CU5, this ensures good geographic coverage so that as many malnourished children as possible can access treatment(WFP, UNICEF, et al., 2017).

Admission criteria in OTP: According to the national guidelines for management of SAM based on WHO, UNICEF and WFP recommendations, admission criteria in OTP are determined by a child's weight and height, by calculating weight-for-height as "Z-score" using the WHO Child Growth Standard, MUAC and presence of edema. Cutoffs are summarized as the following (UNICEF, 2012, 2015b; WFP, UNICEF, et al., 2017; WHO, 2013a, 2020):

- ✓ Bilateral pitting edema 1^{st} (+) or 2^{nd} (++) degree, or
- ✓ MUAC < 115 mm, and/or
- ✓ Weight-for Height/Length < -3 z-score, and
- ✓ Good appetite (passed appetite test for RUTF), and
- ✓ Clinically well and alert (no medical complications).

Routine medications and prevention package used in OTP

All SAM programs should include systematic treatments according to national or international guidance (Sphere, 2018). Children admitted directly to OTP should receive a short and routine course of essential oral medication such as antibiotic (Amoxicillin), anti worms (as Albendazole or Mebendazole), anti malaria, vit A, folic acid and measles vaccination, and some prevention package as soap and bed net. It reduced the risk of severe bacterial infection and improves the recovery rate (MoPHP, 2014; Pati et al., 2018; WFP, UNICEF, et al., 2017; WHO, 2013a).The use of broad-spectrum antibiotics has been conditionally recommended for treatment of uncomplicated SAM. (Black et al., 2016). A systematic review conducted byWilliams and Berkley (2018), concluded the current evidence supports the continued use of broad spectrum oral amoxicillin for treating children with uncomplicated SAM.

Nutritional treatment by RUTF: The development specially formulated RUTF has enabled treatment of SAM in the community and made a difference in child survival. It is provides 100% of the energy needed from foods(Osendarp et al., 2015). RUTF has become a standard method of treating SAM and is easier to use and distribute during nutritional emergencies. It is a very effective therapeutic food in the rehabilitation children with SAM in many settings (Bazzano et al., 2017; UNICEF, 2012).

Plumpy-Nut® is one of the most of RUTF used in the world, it is a commercial product of Nutriset (UNICEF, 2012). An average entier course of treatment for a child amounts to around 10-15 kilograms of RUTF over a 6-8 week period(Force, 2012; UNICEF, 2013).If the mother is still breastfeeding, she is advised to give the RUTF after breast milk, explain that clean water must be given to a child eating RUTF to keep them adequately hydrated and should be given RUTF before other foods. It should not be given to children who are allergic to peanuts or dairy products. About central nutritional values describe in the table (2.1)(NUTRISET, 2018).Each sachet of Plumpy'Nut® of 92g provides 500kcal. A child undergoing treatment for SAM should take in approximately 200kcal/kg/day. Provide a weekly

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supply of Plumpy'Nut® sachets based on the child's body weight (NUTRISET, 2018; WFP, UNICEF, et al., 2017). Some contexts, families receive additional rations to prevent household sharing of the child's RUTF ration (WVI, 2017).

Main nutritional values (NUTRISET, 2018)

.Plumpy'Nut® formula: elements for 92 g					
Energy	500 kcal	Copper	1.5 mg	Vitamin B1	0.46 mg
Proteins	12.8 g	Iron	10.3 mg	Vitamin B2	1.5 mg
Lipids	30.3 g	Iodine	98 µg	Vitamin B6	0.55 mg
Carbohydrates	45 g	Selenium	28 µg	Vitamin B12	1.5 µg
Calcium	302 mg	Sodium	165 mg	Vitamin K	14.4 µg
Phosphorus	343 mg	Vitamin A	0.79 mg	Biotin	56 µg
Potassium	1 171 mg	Vitamin D	14 µg	Folic acid	184 µg
Magnesium	80 mg	Vitamin E	18.4 mg	Pantothenic acid	2.8 mg
Zinc	11.8 mg	Vitamin C	46 mg	Niacin	4.6 mg

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