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Clinical Profile and Treatment Outcome among Patients Managed for Severe Acute Malnutrition in a Tertiary Facility in Sokoto State

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Abstract

Background: Severe acute malnutrition (SAM) affects more than 20 million children worldwide, and it is highly prevalent in the African region where health systems are also coping with other highly prevalent infectious and non-infectious diseases. World Health Organization (WHO) recommends more research in facilities on treatment outcomes in relation to risk factors and standards of follow up care. This study evaluated the clinical profile at presentation and outcome of treatment of SAM among patients admitted into a tertiary hospital in Sokoto

Methods: A retrospective review of records of children aged six months to 5 years who were admitted for SAM over a two-year period. A proforma was used to collect the information on their socio-demographics, type of malnutrition, anthropometric characteristics, packed cell volume, complications, therapy received and outcome. Data were analysed using IBM SPSS version 25.

Results: Out of the 1862 patients admitted during the period, 159 (8.5%) had SAM, and of these, 107 records were available. Most cases were admitted in the rainy months of July to September. The male to female ratio was 1.43:1. The mean age was 21.0 ± 8.6 months. There were 66 (61.7%) cases of non-oedematous SAM and 41 (38.3%) cases of oedematous SAM. Oedematous SAM had lower pack cell volume and higher occipitofrontal circumference than non-oedematous SAM ($p=0.03$). Nutritional rehabilitation diet given included WHO formula milk and the hospital prepared nutrient kwash pap. Mean weight gain was 14g/kg/day, mortality was 45.8%, recovery rate 17%, and a large proportion 70.6% did not attend follow up. Weight was the only anthropometry documented subsequently till discharge.

Conclusions: There was high mortality and poor follow up among the SAM patients. The managing team needs to improve refeeding practices with uniform diet, monitor all anthropometric indicators of recovery and ensure follow up of these patients in the community by appropriate referral.

Keywords: Treatment, profile, outcome, Severe acute malnutrition, Sokoto

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Introduction

Severe acute malnutrition as a form of undernutrition is defined by the World Health Organization (WHO) as severe wasting (weight-for-height/length < 3 standard deviation (sd) or mid-upper arm circumference < 115 mm) or as the presence of oedema of both feet (1). This classification replaced the older ones, which were found to be suboptimal in identifying those at the highest risk of mortality among the affected (2). It is the worst form of undernutrition in terms of the outcome as case fatality rates of up to 50% have been reported and affected children require urgent commencement of a therapeutic feeding program which can be in form of out-patient care or in-patient management depending on the associated complications (3). Adherence to WHO guidelines can reduce the case-fatality rate in hospital settings. Severe acute malnutrition affects more than 20 million children worldwide, and it is highly prevalent in the African region, where health systems are poor in capacity while also coping with other highly prevalent infectious and non-infectious diseases (4). In Nigeria, estimates quote that about two and a half million children are affected, and Sokoto is one of the worst-hit states with almost half of the children being undernourished (5). The WHO/UNICEF community-based management of acute malnutrition (CMAM) was set up due to challenges of in-patient management such as limited bed spaces and increased workload for the healthcare workers, (6) however, the sheer number of affected children still makes the tertiary facilities to receive quite a number of these cases. A recent review of children treated on an outpatient basis with CMAM in Sokoto revealed that after being cured, they were still significantly at risk of SAM post-discharge (7). WHO also recommends more research in understanding the relapse rate, risk factors and standards of follow up care (8). This review of cases of SAM who had in-patient management in a tertiary facility over a two-year period seeks to assess the anthropometric status at presentation, nutritional rehabilitation, outcome and follow up status with a view to identifying challenges of management.

METHODS

Study Location

The study was conducted at the Paediatrics Department of Usmanu Danfodiyo University Teaching Hospital, Sokoto, which is a major referral centre for paediatric cases in the North-Western region of Nigeria and the neighbouring Niger and Benin Republic. The Emergency Paediatric Unit and Paediatric Medical ward together comprise a 60 bedded unit available for admitting critical emergencies and sub-acute and chronic cases, respectively.

Sokoto State, which is one of the Northern states with a high burden of malnutrition according to the Nigerian Demographic and Health Survey 2018(9) is located in the dry Sahel region, surrounded by sandy Savannah. It has an annual average temperature of 28.3°C, which can be as high as 45°C during the hot dry months. The dry season is longer and comprises the hot dry season before the rains from March to April and the cold, dry season from November to February while the rainy season is shorter and begins late in May till September with a mean annual rainfall of 550mm. Intensive farming activities take place during this raining season period. The inhabitants engage in crop farming and animal husbandry in addition to small to medium-scale business activities. There is also a large population of civil servants in the several institutions and establishments in the State.

Study design: This was a retrospective study conducted over a 2-year period (January 2017 to December 2019).

Study population: Comprised children aged 6 months to 5 years admitted into the EPU with severe acute malnutrition (SAM).

Inclusion and exclusion criteria: We selected case files with children aged 6 to 59 months admitted with weight for length/height of $< -3\text{SD}$, the mid-arm circumference of < 11.5 centimetres, or symmetrical oedema with poor nutritional history were enrolled. We excluded were cases of malnutrition of non-nutritional origin from chronic illnesses like cardiac failure, chronic renal diseases, malignancies and gross congenital malformations.

Care rendered for SAM patients admitted to the unit

Patients admitted with SAM were diagnosed with the standardized WHO weight for length/height charts, MAC and presence of oedema. They were managed according to the WHO protocol in 3 phases, including resuscitation, rehabilitation and follow up. They were acutely ill with various life-threatening conditions, and due to reductive adaptation from decreased metabolic rate from the malnutrition, care was taken to optimize them gradually to prevent acute recovery syndromes. They were commenced on oral rehydration via Nasogastric tube and feeding within 30 minutes of admission. Blood samples were taken for investigations to assess hypoglycaemia, anaemia, electrolyte derange-

ments and infections. WHO recommended refeeding formulae or ready to use therapeutic feed (RTUTF) used were F75 starter formula which is low protein and low calorie-dense, followed by F100 formula or paste which is high protein and high calorie. However, the nutrition unit of the hospital prepared nutrient pap - kwashpap from millet, soyabean, ground-nut, crayfish and other vitamin-rich nutrients for feeding these children to recovery when the manufactured RTUTF were not available.

Procedure of data extraction

The records of all patients admitted with SAM during the period under review were accessed, and the following information were extracted from them. This was based on the care stipulated for SAM patients by the WHO guidelines. The age and gender of the patients, month of admission, anthropometry (weight, height, mid-upper arm circumference, occipitofrontal circumference), type of malnutrition (non-oedematous/oedematous), packed cell volume, type of feeds administered, associated complications, duration of admission, weight at discharge and follow up condition were all entered into a proforma. The available anthropometric characteristics documented were weight (kg), length/height (cm), weight for height z-score (sd), OFC (cm) and MAC (cm) where available. The weight and height were further subcategorized by the WHO z-score charts into weight for height or length for age. Also, the age independent MAC was re-categorized. The socio-economic class was derived from the educational status and occupation of both parents where documented. It was derived into scores according to Oyediji classification of social status. (10) Three of the researchers (KOI, MAS and AA) extracted the data independently and there was complete agreement in the content of the data.

Classification of the anthropometric indices used to assess malnutrition: (1)

a.Weight for length/height

- i.Moderate acute malnutrition: $-2\text{sd} > \text{z-score} \geq -3\text{sd}$
- ii.Severe acute malnutrition: $\text{z-score} < -3\text{sd}$

b.Weight for age

- i.Moderate underweight: $-2\text{sd} > \text{z-score} \geq -3\text{sd}$
- ii.Severe underweight: $\text{z-score} < -3\text{sd}$

c.Height for age

- i.Moderate stunting: $-2\text{sd} > \text{z-score} \geq -3\text{sd}$
- ii.Severe stunting: $\text{z-score} < -3\text{sd}$

d.MUAC

- i.Moderate malnutrition: 11.5cm to 12.4cm
- ii.Severe malnutrition: $< 11.5\text{cm}$

Weight gain at discharge in g/kg/day was calculated as: (1)

$$\frac{\text{weight on discharge} - \text{weight on admission} \times 1000}{\text{duration of treatment}}$$

Cure/recovery was defined as weight for length/height improving up to 85% of the median i.e. median to $\geq -2\text{sd}$ (1).

Ethical issues

Ethical approval was sought and approved by the Usmanu Danfodiyo University Teaching Hospital, Sokoto Ethics and Research Committee with approval number **UDUTH/HREC/2020/957**. Data was treated with utmost confidentiality.

Data entry and analysis

All relevant data were entered into the SPSS statistical software version 25. Quantitative data like age, weight and height were expressed as means and standard deviation while categorical variables like gender, type of malnutrition and subclassifications of the anthropometry were expressed as proportions. Chi-square or where necessary, Fisher's Exact test, was used to test for statistical significance. A p-value of <0.05 was considered statistically significant.

RESULTS

Out of 1862 patients admitted during the period, 159 (8.5%) had SAM and were admitted during the 2-year period. Of these, 107 case notes were accessible and had adequate information for analysis.

Sociodemographic profile of the SAM patients:

The male to female ratio was 1.43:1 with 63 (58.9%) males and 44 (41.1%) females. The mean age was 21.0 ± 8.6 months with a range of 10 months to 48 months. Majority 75 (70.1%) were aged 12 to 23

months. They were mainly from the lower socio-economic class (76/107, 71%). There were 66 (61.7%) cases of non-oedematous SAM and 41 (38.3%) cases of oedematous SAM. This is shown in Table 1.

Monthly prevalence:

During the two-year period studied, the highest number of cases were seen between July to September, accounting for 67 (62.7%) of the total number assessed as seen in Figure 1. There were no cases in January and February and only one case was seen in the preceding month of December. The trend increased gradually from March to peak in July and September.

Proportion of mortality per month:

Figure 2 below shows the mortality shows that the proportion of mortality per month also followed the trend of the number of the cases seen and was highest between July and September.

Figure 1: Showing the monthly distribution of the cases

Nutritional status of the SAM patients:

The nutritional status of the SAM is presented in Table 2. The SAM patients were categorised as diagnosed in the case notes as oedematous and non-oedematous SAM.

Table 1: Sociodemographic profile of SAM patients admitted from 2017 to 2019 in UDUTH. Sokoto

Variable	Total cases	Non-oedematous SAM (n =66)	Oedematous SAM (n =41)	Test of significance
Gender				
Male	63 (58.1)	36 (57.1)	27 (42.9)	$\chi = 1.33$ $p = 0.25$
Female	44 (41.9)	30 (68.2)	14 (31.8)	
Mean age (months)	21.0 ± 8.6	20.7 ± 12.9	20.1 ± 5.3	$t = -0.3$ $p = 0.75$
Age category				
6.0 - 12 months	21 (19.6)	16 (76.2)	5 (23.8)	$\chi = 8.01$ $p = 0.90$
12.1 - 24.0 months	75 (70.1)	41 (54.7)	34 (45.3)	
24.1 - 36.0 months	4 (3.7)	2 (50.0)	2 (50.0)	
36.1 - 48.0 months	5 (4.7)	5 (100)	0 (0)	
48.1- 60.0 months	2 (1.9)	2 (100)	0 (0)	
Socioeconomic status				
Middle	10 (9.3)	7 (70.0)	3 (30.0)	$\chi = 2.41$ $p = 0.12$
Lower	76 (71.0)	47 (61.8)	29 (38.2)	
No data	21 (19.6)	-	-

Figure 2: Pattern of mortality per month

The SAM patients were categorised as diagnosed in the case notes as oedematous and non-oedematous SAM. The degree of malnutrition according to the weight for height/length scores, weight and height for age, and mean weight and height were comparable among the oedematous and non-oedematous SAM patients.

However, the mean OFC was higher among the oedematous SAM while their PCV was lower ($p=0.03$). Oedematous had higher proportion with low PCV, while non-oedematous had a higher proportion with high PCV values. The mean values of their weight, height, OFC, MUAC and PCV are shown in Table 3.

Type of nutritional rehabilitation diet administered

Table 4 shows that during resuscitative phase, they were predominantly given the prepared nutritional diet kwashpap while the RTUTF was less available and when not tolerated, home-made pap was given. Most of the patients had a mix of the different type of feeds depending on availability, followed by predominant kwashpap, F75, then switched to kwashpap or F 100. The average duration of the resuscitative phase was 5.3 ± 3.8 days.

Complications and outcome

The commonest complication was diarrhoeal disease followed by respiratory tract infection. Multiple com-

Table 2: Anthropometric characteristics and packed cell volume of the patients with SAM

Variable	Total cases	Non-oedematous SAM	Oedematous SAM	
Weight for height z score (n= 79)				
<-3sd -> -4sd	37 (40.2%)	24 (58.8%)	19 (44.2%)	$\chi = 0.53$
<-4sd	42 (33.6%)	23 (63.9%)	13 (36.1%)	$p = 0.44$
Weight for age z score (n= 97)				
<-2sd -> -3sd	7 (6.5%)	4 (57.1%)	3 (42.9%)	$\chi = 0.02$
<-3sd	90 (84.1%)	54 (60.0%)	36 (40.0%)	$p = 0.88$
Height for age z score (n= 79)				
<-1sd -> -2sd	24 (22.4%)	14 (58.3%)	10 (41.7%)	$\chi = 3.71$
<-2sd -> -3sd	21 (19.6%)	16 (76.2%)	5 (23.8%)	$p = 0.15$
<-3sd	34 (31.8%)	17 (50.0%)	17 (50.0%)	
MAC classification (cm) (n= 65)				
< 11.5	47 (43.9%)	29 (61.7%)	18 (38.3%)	$\chi = 0.42$
11.5- 12.4	14 (13.1%)	8 (57.1%)	6 (42.9%)	$p = 0.81$
≥ 12.5	4 (3.7%)	3 (75.0%)	1 (25.0%)	
PCV on admission (%) (n= 87)				
<15	5 (4.7%)	1 (20.0%)	4 (80.0%)	$\chi = 5.03$
16 -24	9 (8.4%)	5 (55.6%)	4 (44.4%)	$p = 0.3$
25 - 34	31 (29.0%)	19 (61.3%)	12 (38.7%)	
35- 44	36 (33.6%)	23 (63.9%)	12 (36.1%)	
>45	6 (5.6%)	5 (83.3%)	1 (16.7%)	

MAC = Mid arm circumference; OFC = Occipito-frontal circumference; PCV = Packed cell volume

Table 3: Mean values of the nutritional status at admission, weight gain at discharge and length of illness

Variable	Total	Non-oedematous SAM	Oedematous SAM	Test of significance
Mean weight (cm) (n=107)	6.35 ± 1.26	6.28 ± 1.42	6.67 ± 0.94	t = 1.6 p = 0.10
Mean height (cm) (n=79)	74.7 ± 6.73	75.1 ± 9.5	75.6 ± 4.07	t = 0.32 p = 0.75
Mean MAC (cm) (n=65)	10.26 ± 1.51	10.65 ± 1.39	10.54 ± 1.40	t = -0.30 p = 0.76
Mean OFC (cm) (n=43)	44.1 ± 2.45	43.5 ± 2.8	45.0 ± 1.5	t = 2.32 p = 0.03
Mean PCV (%) (n=87)	32.4 ± 9.0	34.2 ± 8.4	29.9 ± 10.0	t = -2.15 p = 0.03
Mean weight gain (g/kg) (n=39)	15.10 ± 14.99	16.64 ± 16.21	13.1 ± 13.5	t = -0.72
Length of illness (days)	28 (IQR-40)	28 (IQR-46)	30 (IQR-61)	
Mean duration of admission (hrs)	169.3 ± 153.8	153 ± 101.6	196.8 ± 214.4	t = 1.4

MAC = Mid arm circumference; OFC = Occipito-frontal circumference; PCV = Packed cell volume

plications presented in individual patients. Mortality was high at 45.8% with no difference between both oedematous and non-oedematous SAM; although those with oedema had a longer duration of admission (Table 5).

Discharge criteria, weight at discharge and follow up

The only anthropometric index monitored throughout admission was the weight. In table 6 the mean weight gain per day was higher among the non-oedematous SAM while unavailable data or unwritten record of weight at discharge was found in 27.6% (16/58) of the discharged cases. The recovery rate in those who were discharged with available weight record was 17.1% (6/35). Five cases (17.1%) of the discharged cases left against medical advice.

Only 17 (29.3%) attended follow up and weight was monitored in only 9 patients. Among those who came for follow up, the predominant diagnosis was malaria.

DISCUSSION

Incidence of malnutrition was more in the rainy season as seen in other studies (11, 12) and this coincides with the onset of intense farming activities when grains and legumes become short in supply and persists throughout

till harvest period. Low socioeconomic status families with poor food security are predominantly affected. This can be prevented by proper planning for that period and food diversification. Other measures are community engagement, mass media education, training community health workers in identifying families at high risk for intervention. The predominant form of severe malnutrition seen in this study was non-oedematous severe malnutrition. A previous study done in the hospital, reported oedematous severe malnutrition as the commonest. However, that study also included other degrees of wasting among malnourished patients (from mild to moderate); hence, and this probably reduced the proportion of severely wasted patients reported (13). Other hospital-based studies showed varying proportions of oedematous vs non-oedematous malnourished patients. A lower proportion, 26.7%, had oedema from a study in Jos in Nigeria (14) while a higher proportion, 53.2% and 67%, were reported from studies in Uganda and India respectively (15, 16). Generally, males have been reported to be more affected by severe malnutrition and this has been adduced to probable preferential treatment of females such that they get better meal fractions from their mothers (17). Male children are also more active and more

affected by environmental stressors like infections. (17, 18) It has been postulated that oedematous children become malnourished over a shorter period, fail to adapt, develop oedema and therefore have a higher weight. Their height is also not as affected as the non-oedematous who are more chronically ill and have been exposed to a lot of infections resulting to more stunting (15, 16). The significantly lower PCV observed in the oedematous patients is similar to what was found in the literature (19, 20). This could also be attributed to the more rapid onset of nutritional deficits and mal-adaptation as opposed to non-oedematous SAM who have a longer time to adapt to chronic anaemia.

Most of the SAM in this report did not receive the recommended formulae milk being provided by the WHO/UNICEF (21). Information revealed that most of the supplies are given to stipulated state-owned stabilization treatment centres amongst which tertiary hospital are not captured. However, being the main referral centre in the region for managing complex cases of all kinds, this is a drawback to be attended to. The use of locally sourced alternatives is ideal, which

was utilized; however, the drawback here was a constant formulation for the resuscitative and rehabilitative phases of nutritional rehabilitation (21). This probably explains the finding that many on the kwashpap had worsening stools at onset of that feed. Diarrhoea was also the commonest complication associated with both types of SAM in these patients. Other complications like pneumonia, severe anaemia and sepsis were also predominant and are the common associated complications from other reports (22, 23). These infectious complications are prevalent in SAM patient because of reduction in innate immunity (skin and mucosal atrophy) and cell-mediated immunity (atrophy of their lymphoid organs leading to reduced production of lymphocytes and natural killer cells) (24). Mortality was high occurring in nearly half of the cases and similar to both groups, and this may be compounded by the long duration of symptoms before presentation to the hospital.

Table 4: Type of nutritional diet administered

Variable	Number %
Predominant Nutritional Rehabilitation diet	
Resuscitative phase	Rehabilitative phase
Kwashi pap	Kwashi pap 38 (35.5%)
F75/home-made pap	Kwashi pap or plumpy nut 35 (32.7%)
F 75	F 100 or plumpy nut 24 (22.4%)
Home-made pap	Kwashi pap 10 (9.3%)

Appropriate documentation of recovery parameters like day of resolution of oedema, rate of weight gain height, MUAC during admission was lacking. The only anthropometry available at discharge was the weight. Mean weight gain was higher in the non-oedematous patients as those with oedema usually lose weight initially as the oedema resolves (14). This also reflected in the rate of weight gain of >10g/kg/day that was more among the non-oedematous patients. Weight gain was less in the study by Dhanalakshmi because the patients were discharged early on request as symptoms resolved (25). Weight gain in this study was however comparable to that reported by Edrefm (26) in Ethiopia. However, the length of stay was much longer in this study. There was a recovery rate of 17% among the survivors whose weights were documented at discharge. This is quite low compared to other studies where rates of recovery of up to 81% was documented (27). It is instructive to note that MUAC which is easy to assess and use as a criterion for discharge, was not being measured (27). MUAC was said to have better discrimination in assessing SAM patients who are to be discharged than using the weight for height criteria (25).

About 70.6% did not turn up for follow up. Figures of up to 45.1% have been reported (8) Distance from the facility and care-givers loss of daily wages were

identified as risks for being lost to follow up. In addition, patients admitted with smaller MUAC were more often lost to follow up. Ideally, the post-SAM follow up period should last 6 to 24 months after treatment which none of the patients in this study fulfilled; therefore, the relapse rate after treatment could not be ascertained.

Table 5: Complications and outcome

Variable	Total cases	Non-oedematous SAM (n =66)	Oedematous SAM (n =41)	
Presenting complications *				
(n=96)				
Diarrhoeal disease	38 (35.5%)	25 (65.8%)	13 (34.2%)	$\chi^2 = 0.93$ $p = 0.43$
Pneumonia	34 (31.8%)	14 (41.2%)	20 (58.8%)	
Probable Sepsis	31 (28.9%)	18 (58.1%)	13 (41.9%)	
Measles	24 (22.4%)	10 (41.7%)	14 (58.3%)	
Tuberculosis	19 (17.8%)	9 (47.4%)	10 (52.6%)	
Neurological sequelae	4 (3.73%)	2 (50%)	2 (50%)	
Others	20 (18.6%)			
Outcome				
Alive	58 (54.2%)	36 (62.1%)	22 (37.9%)	$\chi^2 = 0.008$
Dead	49 (45.8%)	30 (61.2%)	19 (38.8%)	$p=0.93$

* multiple diagnoses included

In conclusion, there is a high burden of malnutrition among under-fives seen in the facility and their management can be challenging due to several complications encountered. Better documentation, provision of standard refeeding diet, improved monitoring of anthropometric indicators of recovery, innovative methods of follow up of these patients are some of the ways their care can be improved.

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Table 6: Weight gain before discharge and follow up of SAM patients

Variable	Total cases	Non-oedematous SAM	Oedematous SAM	Test of significance
Weight gain per/kg/day (n=39)				
< 10g/kg/day	20 (51.3%)	9 (40.9%)	11 (64.7%)	$\chi = 2.17$ p= 0.13
> 10g/kg/day	19 (48.7%)	13 (50.1%)	6 (35.3%)	
Weight z-score at discharge (n=91)				
Median	1 (0.93%)	1 (100%)	0 (0)	$\chi = 4.4$ p=0.35
<-1sd->-2sd	5 (4.67%)	2 (0.4%)	3 (0.6%)	
<-2sd ->-3sd	12 (11.2%)	6 (50.0%)	6 (50.0%)	
<-3sd ->-4sd	6 (5.60%)	3 (50.0%)	3 (50.0%)	
<-4sd	11 (10.3%)	9 (81.8%)	2 (0.18%)	
Attended follow up at least once (n =58)				
Yes	17 (29.3%)			
No	41 (70.6%)			
Weight monitored at follow up				
Yes	9 (15.5%)			
No	8 (13.8%)			
No follow up	41 (70.6%)			

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