Associated Comorbidities in Children under 5 Years with Severe Acute Malnutrition Attending Magumeri General Hospital: Retrospective Hospital-Based Study

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Abstract

Malnutrition is a global health challenge essentially because of its role as a preventable cause of several morbidities and mortality around the globe, especially in children under 5 years. Associated comorbidities and types of morbidity common in children admitted with severe acute malnutrition in Magumeri General Hospital were investigated. This was a retrospective quantitative hospital-based study. Hospital records, ward admission and discharge registers, and patient cards were reviewed focusing on demographic, clinical, and mortality data extracted on all children under 5 years admitted to the Hospital. Data during the period of December 2018 to March 2020 was collected and analyzed using Microsoft Excel 2013 and SPSS version 17.0. 367 children under 5 years with complicated SAM were identified from the reviewed total hospital admissions of 537. 217 cases were male (59.1%) while 150 were female (40.9%). Marasmus was the most common type of severe acute malnutrition (75.2%) while diarrhea, respiratory tract infection, and malaria were the top three comorbidities, majority of the cases were managed successfully with 79.6 % reported to have fully recovered and were discharged, while 17 (4.1%) died. Magumeri is a locality disproportional affected by various insecurities due to the Boko Haram insurgency, resulting in the high prevalence of severe acute malnutrition among children under 5 years, representing 68.3% of total hospital admissions in the same age group, while 81.2 % had at least more than one comorbidity with a significant association between prolonged hospital stay and treatment (p < 0.001).

Keywords: Admission, Magumeri, Morbidity, Severe acute malnutrition, and Under 5 children.

Introduction

The world health organization (WHO) defines severe acute malnutrition (SAM) as a condition of very low weight for height (below - 3z scores of the median growth standards), of visible severe wasting, or of nutritional oedema. Severe acute malnutrition (SAM) is one of the leading causes of morbidity and mortality among children aged under 5 years worldwide [1]. SAM in children can be classified as either

complicated or uncomplicated. SAM in children is said to be complicated if they have clinical features indicating the presence of comorbidities like infection or metabolic disorders, severe oedema, or poor appetite, while children with uncomplicated SAM are clinically well, alert, and have retained their appetite [2].

Children with complicated SAM are managed as inpatients in stabilization centers or special units in tertiary hospitals, while uncomplicated SAM can be managed as outpatients where suitable services with access to ready-to-use therapeutic food (RUTF) exist [3].

Globally, the impact of malnutrition on infant morbidity and mortality has been recorded, with an estimated 45% of all child deaths linked to malnutrition [4]. The most severe form of malnutrition, namely severe acute malnutrition (SAM), is associated with negative outcomes for children, including increased susceptibility to infection and other morbid complications [5], increased muscle loss [6], impaired wound healing [7] and longer length of hospital.

In sub-Saharan Africa, most under 5 hospital admissions are related to conditions such as diarrhea, pneumonia, measles, malaria, tuberculosis, human immunodeficiency virus (HIV), acquired immune deficiency syndrome (AIDS), and malnutrition [8] leading to varying degrees of outcome in these age group. Studies have also linked the interrelationship that exists between these common comorbidities and malnutrition.

Malnutrition is a direct or underlying cause of 45 percent of all deaths of under-five children [1, 9]. Data from the nutrition and health situation reports of Nigeria conducted in 2018 show that each year about 1 million Nigerian children die before their 5th birthday with malnutrition contributing to nearly half of these deaths [10, 11]. Nigeria has the second highest burden of stunted children in the world, with a national prevalence rate of 32 percent of children under five. An estimated 2 million children in Nigeria suffer from severe acute malnutrition (SAM) [12].

In 2019, the conflict in Northeastern Nigeria entered its eleventh year. Borno state is one of the states of the northeast geopolitical zone, with an estimated amount of 4.7 million people needing emergency food assistance in Borno as reported by the Famine Early Warning Systems Network Food Security Outlook (October 2020). Magumeri is a local government area of Borno State, Nigeria. Its headquarters are in the town of Magumeri where the general hospital is located. It has an area of 4,856 km2 and a recently estimated population of 213,975 of which 42,795 are children under the age of five years [13].

Across the globe, an estimated 16 million children under the age of 5 are affected by severe malnutrition resulting acute in several morbidities and mortalities. These outcomes are the direct result of malnutrition as well as the indirect result of childhood illnesses like diarrhea and pneumonia in that malnourished children are too weak to survive [14]. Reducing malnutrition and its consequences is a global development goal as stated by the Sustainable Development Goals (SDGs) and the Nigeria Nutrition in Emergency Working Group, it imposes significant costs on the social and economic development of the entire Northeast region, predisposing the children to different morbidities, psychosocial apathy, and cognitive deficiencies. This research hopes to provide relevant information backed by reliable data that may assist in improving currently available services aimed at providing care and treatment of complicated SAM, especially in low-resource countries like Nigeria and conflict-affected populations.

An understanding of how children with comorbidities present and initial management strategies are crucial for health workers dealing with new presentations of SAM. Therefore, this research aimed to:

- 1. Determine the associated comorbidities in children under 5 years with severe acute malnutrition admitted at Magumeri General Hospital (Stabilization unit).
- Determine the prevalence of common morbidities and presentations in children under 5 years with severe acute malnutrition attending Magumeri General Hospital.
- 3. Explain how the associated comorbidities affect inpatient care among children under 5 years admitted during the period of the study.
- 4. Determine vaccination status among children under 5 years admitted during the study period.

- 5. Investigate admission and treatment outcomes of complicated SAM among children under 5 years admitted at Magumeri General Hospital.
- **6.** Determine the distribution of severe acute malnutrition among children under 5 years by gender and month of admission during the study period.

Materials and Methods

Research Setting

Magumeri is a local government area of Borno State, Nigeria. It has an area of 4,856km2, 14 wards, and a population of 140,231 as per the 2006 census which has since increased to an estimated 213,975 (current population will be preferred to give inside of the targeted age group e.g., using displaced tracking matrix DTM). Magumeri

General Hospital currently runs comprehensive healthcare services as well as a stabilization center for the management of severe acute malnutrition with medical complications.

Source of Data

Identified cases and analyzed data were collected from hospital registers. Secondary data and all relevant information about the study population were collected and collated from hospital records during the period of the study.

Methods

This was a sixteen-month retrospective, quantitative, and hospital-based study. A wellstructured National Inpatient Therapeutic Program Admission Card for discharged patients who benefited from the management of severe acute malnutrition from December 2018 – March 2020 was used to retrieve the required information.

The admission card has the following components:

1. Biodata: Child's name, caregiver's name, age, sex, address, and ward.

- 2. Admission anthropometry: MUAC, weight, height, and oedema.
- 3. History associated with SAM: diarrhea, vomiting, cough, appetite, and fever.
- 4. Physical examination at admission: Respiratory rate, temperature, hydration status, state of consciousness, lymph nodes, and skin change.
- 5. Routine admission medication and immunization: Anti-malaria, antibiotics, vitamin A, and measles immunization.
- 6. Other treatments for Human Immunodeficiency Virus, Tuberculosis.

A weekly summary of anthropometry, medical history, and physical examination throughout the minimum period of eight weeks and the maximum period of twelve weeks in the program is captured. The sample collected comprised some records with incomplete information especially for some age groups with missing vaccination status, ward locations, and detailed discharge information due to continued disruption of services because of the ongoing conflict.

Research Instruments

Instruments and equipment necessary for the conduction of the research already provided for by the facility:

- 1. Weighing Machine: Weighing machine with a capacity of 100 kg and having the least count of 0.1 kg.
- 2. Height measuring scale (stadiometer).
- 3. MUAC Tape: For measuring mid-upper arm circumference.
- 4. Health management information system: a well-designed and pretested set of registers already in use.

Inclusion and Exclusion Criteria

All children aged under 5 years admitted to Magumeri General Hospital (Stabilization unit) with complicated severe acute malnutrition were included, admission to the unit is based on the presence of bilateral pitting oedema and /or weight for height Z-scores (WHZ) < -3 standard deviations (SD) using the WHO weight-forlength reference card (growth standards charts). Those with severe malnutrition complicated by chronic illness like cardiovascular disease, cerebral palsy, microcephaly, or sickle cell disease were excluded.

Ethical Considerations

Ethical approval was obtained from the hospital administration board to review patients' records at the hospital statistical office.

Statistical Analysis

Data collated during the study period were collected using Microsoft Excel 2013 with great attention to detail to minimize data entry errors. Descriptive statistics were employed in the analysis of the data and Statistical Package for Social Sciences (SPSS) version 17.0 software was used to analyze the data.

Limitations

The sample collected comprised some records with incomplete information especially for some age groups with missing vaccination status, ward locations, and detailed discharge information due to continued disruption of services because of the ongoing conflict.

Results

The period of the study was from December 2018 to March 2020. A total of 537 cases were reviewed from the hospital records. 367 children aged under 5 years with complicated SAM were identified based on the inclusion criteria and accepted for the study. This represented 68.3% of total hospital admissions, a fallout of the

ongoing crisis in the Northeast region of Nigeria where the study population was drafted. 217 of the cases were male (59.1%) while 150 were females (40.9%).

The prevalence of complicated SAM cases peaked among children within the combined age group 0 to 24 months: 306/367 (83.4%). Children in the combined age groups 25 to 59 months recorded 54/367 (14.7%) while the least occurrence of complicated SAM cases was seen among the age group of 48-59 months 7/367 (1.9%). The morbidity pattern indicated that marasmus was the most frequently recorded type of SAM accounting for 75.2% of the children. This was followed by kwashiorkor which accounted for 18.5% of the children while Marasmic–kwashiorkor had 6.3%.

The co-morbidities recorded (n = 367), showed that 161 of the children with SAM under 5 years admitted during the study period had diarrhea (43.9%), while 122 (33.2%) had respiratory tract infections, 143 (39.0%) had malaria and other comorbidities to include, pneumonia (13.9), measles (6.5%) and anemia at 3.8%, etc. (See Table 2). 81.2 % of the study population had more than one comorbidity. The average days of admission at the Hospital was 7 days. The vaccination status of the children during the study period showed that 20.7% were fully immunized based on the National Programme on Immunization, while 13.9% were partially vaccinated and 32.2% had no vaccination data (Table 1).

The age group 48-59 months had the least cases while age group 0-12 months were most affected.

Table 1. Background Distribution of Children under 5 Years with Complicated SAM Admitted to MagumeriGeneral Hospital During the Study Period According Age Groups of 0-59 Months

Age Group	Frequency	Percent
0-12	194	52.9
12-24	112	30.5
24-36	36	9.8
36-48	18	4.9
48-59	7	1.9
Ν	367	100

75.2 % of cases had Marasmus while 6.3 % had symptoms diagnosed as Marasmickwashiorkor. Data from the study showed that 161 of the children with SAM under 5 years admitted during the study period had diarrhea (43.9%), while 122 (33.2%) had respiratory tract infections, 143 (39.0%) had malaria and other comorbidities to include, pneumonia (13.9), measles (6.5) etc.

 Table 2. Background Characteristics of Children Aged under 5 Years Admitted at Magumeri General Hospital

 According to Sex, Morbidity and Comorbidity During the Study Period

Sec (n-367)	Ν	Percent	
Male	217	59.1	
Female	150	40.9	
Morbidity			
Marasmus	276	75.2	
Kwashiorkor	68	18.5	
Marasmic Kwashiorkor	23	6.3	
Comorbidity			
Diarrhea	161	43.9	
Respiratory Tract Infection	122	33.2	
Malaria	143	39.0	
Pneumonia	51	13.9	
Dehydration	45	12.2	
Conjunctivitis	19	5.2	
Dermatosis	28	7.6	
Measles	24	6.5	
Anaemia	14	3.8	
Otitis Media	12	3.2	

Tested using One-way analysis of variance, (p-value<0.05). Marasmus was more prevalent

in the male children when compared to the females (61.9% versus 38.1%).

Table 3. Morbidity Distribution and Demographic Presentation of Children Under 5 Years Admitted during the

 Study Period with Severe Acute Malnutrition

Characteristics	Marasmus	Morbidity	Marasmic-	P-value
		Kwashiorkor	Kwashiorkor	
Sex				
Male	171(61.9%)	40(58.8%)	8(34.7%)	0.023
Female	105(38.1%)	28(41.2%)	15(65.2%)	
Demography				
Mean Age	15.8 months	16.1 months	15.9 months	0.094
Mean Weight	5.1 kg	5.4 kg	5.1 kg	0.102
Mean Height	68.3 cm	67.0 cm	66.3 cm	0.113
Mean MUAC	9.6 cm	10.6 cm	10.1 cm	0.098

Bulamari ward had the least cases at 2.2% while Magumeri ward had the highest cases at

17.4 based on accessibility and proximity to the health facility.

N-367	Number	Percent
Male	217	59.1
Female	150	40.9
Morbidity		
Marasmus	276	75.2
Kwashiorkor	68	18.5
Marasmic Kwashiorkor	23	6.3
Local Government Wards		
Ajeri	17	4.6
Aduran	22	6.0
Atorom	18	4.9
Bulamari	8	2.2
Furam	26	7.1
Gajigana	35	9.5
Ноуо	24	6.5
Kajeri	19	5.2
Kareram	31	8.5
Kasula	14	3.8
Kazallari	11	3.0
Kupti	18	4.9
Magumeri	64	17.4
Maitari	9	2.5
Nngama	13	3.5
Titwa	18	4.9
No ward Identified	20	5.5

 Table 4. Background Distribution of Children Aged Under 5 Years Admitted at the Hospital During the Study

 Period by Local Government Wards in the Local Government Area

Fully vaccinated children during the study period were 20.7% while 13.9% were partially

vaccinated and 32.2% had no vaccination data (Table 5).

 Table 5. Vaccination Status of Children Aged Under 5 Years with Complicated Severe Acute Malnutrition

 Admitted to the Hospital During the Study Period

Vaccination Status	Frequency	Percent
Fully vaccinated	76	20.7
Partially Vaccinated	51	13.9
No Vaccination	122	33.2
No vaccination record	118	32.2
Ν	367	100

Many cases were managed successfully, with 79.6 % reported to have fully recovered and discharged from the hospital, and 8.7% of the cases were referred to other health facilities like

the University of Maiduguri Teaching Hospital, MSF, and ALIMA facilities for more specialized care and due to interrupted care because of the crisis.

N=367	Number	Percent
Males	217	59.1
Females	150	40.9
Outcome	122	33.2
Cured and discharged	292	79.6
Referred	32	8.7
Defaulted	26	7.1
Death	17	4.6

 Table 6. Background Description of Admission and Treatment Outcomes of Complicated SAM Among

 Children Under 5 Years Admitted to the Hospital during the Study Period

n=367. 217 were males while females were 150. With an average of 5 days of admission during the study period, the months of February

and August 2019 had the highest admission for both sexes with 40 (10.9%) and 43 (11.7%) admissions respectively.



Figure 1. Distribution of Children during the Study Period by Sex and Month of Admission

n=367.276(75.2%) had Marasmus during the study period, with the highest prevalence of Marasmus in the months of February, April, and August with 31 (11.2%), 28 (10.1%), and 34

(12.3%) respectively. While 68 (18.5%) had Kwashiorkor and 28 (7.6%) had Marasmic-kwashiorkor.



Figure 2. Morbidity Distribution by Months During the Study Period

Discussion

In this research, associated comorbidities in children under five years with severe acute malnutrition and how these morbidities affected inpatient care for the children attending Magumeri General Hospital (Stabilization unit) was studied, immunization status among under five with SAM was determined, admission and treatment outcomes of complicated SAM in under-five children was investigated, and the prevalence of associated comorbidities was also determined.

The mean age of the children in this study was 17.4 months, with most of the children with SAM being less than two years (83.4%), this was consistent with other studies conducted in Valgado Oua Drago Teaching Hospital, Burkino Faso [15] and some selected hospitals from Ethiopia [16].

217 of the cases were male (59.1%) while 150 were female (40.9%) which is like a study conducted in Ayder Referral Hospital, Tigray Ethiopia by [17], in 2015 and in Tamale Teaching Hospital Ghana [20].

The distribution of morbidity among the study population; marasmus 75.2%, kwashiorkor 18.5 %, and marasmic-kwashiorkor 6.3, this was consistent with a study by [17, 19], but differed from a study in Zambia [19] that reported kwashiorkor as the most common form of SAM.

Analysis of comorbidities showed that 59.4% had at least two comorbidities treated during the study period of which 61.9% were males compared with females at 38.1%, while 21.8% had three comorbidities with a male-to-female ratio of 75.7 to 24.3 (percent).

The distribution showed that 161 of the children had diarrhea (43.9%), 122 (33.2%) had respiratory tract infections, and 143 (39.0%) had malaria as the top three associated comorbidities with children under 5 years admitted at Magumeri General Hospital during the study period, this is consistent with the body of evidence that shows that the most significant comorbidities reported in children with SAM are infectious disease i.e. diarrhea, pneumonia, acute respiratory tract infections as well as malaria and measles [16, 17, 19, 20]. Concerning admission and treatment outcomes, many of the cases were managed successfully, with 79.6 % reported to have fully recovered and discharged from the hospital, 8.7% of the cases were referred, 7.1% defaulted and 17 (4.1%) died, this is similar to a study in Ethiopia [16]. The average hospital admission days were 7 days, with a

significant association between a prolonged hospital stay and treatment of comorbidities (p < p0.05). Fully vaccinated children during the study period were (76) 20.7% while (51) 13.9% were partially vaccinated, (118) 32.2% had no vaccination data and (122) 33.2% were not vaccinated, this is consistent with studies by [24, 25] that reported poor immunization coverage in Nigeria and especially the northeast region. The vaccination status in this study is linked to the ongoing crisis in the region resulting in population displacement, inaccessibility to healthcare, non-compliance to the insufficient vaccines as well as information of mothers and caregivers.

Conclusion and Recommendation

This research was conducted as a retrospective quantitative hospital-based study, while the data used in this study was collected amidst several strengths and limitations which could have biased the results, the level of data quality was assured and the missing information from the hospital records did not significantly affect the analysis of the results.

This study found diarrhea, respiratory tract infection, and malaria to be the top three comorbidities associated among children with severe acute malnutrition under 5 years admitted at Magumeri General Hospital, with 21.8% of the children presenting with more than three comorbidities on admission. prolonging treatment and hospital stay. This can be remedied by educating health workers both at the hospital and community level on early of detection and treatment severely malnourished children in the catchment areas and by creating strong community-based screening and timely referral of malnutrition cases.

Although the mortality rate of this study at 4.6% is below the WHO target of < 5% (WHO, 1999) for children with severe acute

malnutrition, there is still the need for improvement in the treatment and management outcomes of children admitted for SAM as most of the studies show that these comorbidities common among children with SAM are vaccinepreventable complications. This can be remedied by improving mother and caregiver counseling, improving access to vaccinations, offering combination vaccines, and using alert and mobile notification systems.

Ultimately Government has a role in stabilizing the region and ensuring the security and safety of the population as well as improving access to healthcare, education, water, sanitation, and hygiene in these communities as studies have shown a direct link with the overall improvement in the lifestyle and health outcomes of a population.

Conflict of Interest

The author and coauthors listed hereby declare no conflict of interest in the conduct of this research. Affiliated institutions included the Borno State Ministry of Health, INTERSOS Humanitarian Aid Organization, UNICEF, and OFDA.

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