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Clinical and Evolutive Aspects of Severe Acute Malnutrition in Children Aged 0 - 59 Months at Maroua Regional Hospital in Cameroon's Far North Region

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Abstract

Introduction: Severe acute malnutrition remains one of the most important causes of under-five mortality. In Cameroon, the northern regions have the highest prevalence, with 1.4% in the Far North in 2021. These children are managed at the Internal therapeutic and Nutrional Centre, one of which is located at Maroua Regional Hospital, the third level referral Hospital. We therefore proposed to carry out a study on the clinical and evolutive aspects of these children. **Materials and Methods:** it was a descriptive, cross-sectional study from January 2020 to December 2022, at the ITNC (CNTI) of Maroua Regional Hospital. The sample size was obtained from the Lorentz formula. Patient records were used for data collection. We excluded all incomplete records and patients with less than 24 hours of admission. **Results:** Out of the 873 patients we recruited, the prevalence of severe malnutrition was estimated at 18 %. The average age was 14 months, with a male predominance. The main reasons for consultation were fever (42%) and diarrhoea (35%). Marasmus was the predominant clinical form. The major medical complications were sepsis (32.9%) and malaria (16.8%). HIV prevalence was 2.5% and

tuberculosis was 4.9%. Most patients had haemoglobin levels between 7 and 10g/dl. 79.3% were cured and 6.5% died. The main causes of death were sepsis and malaria. **Conclusion:** Severe acute malnutrition remains a major problem in the Far North region. Several joint actions are needed to break this cycle.

Keywords

Severe Acute Malnutrition, Children, Far North Cameroon

1. Introduction

Severe acute malnutrition remains a major cause of under-five mortality worldwide [1]. According to the World Health Organization (WHO), 45 million children under the age of 5 suffered from wasting syndrome worldwide in 2021 which is the deadliest form of malnutrition in children. In Sub-Saharan Africa, 7.3 million children suffered from wasting in 2019. The Greater Horn of Africa and Sahelian countries are hard hit by food insecurity exacerbated by climate change [2]. In Cameroon, as in most developing countries, the double burden of malnutrition remains a public health problem. It particularly affects vulnerable groups such as children under the age of 5 years [3]. Located in the heart of the Lake Chad Basin, the Far North is Cameroon's most populous region, with an estimated population of 4.3 million, or 18% of the national population, with Maroua as its capital. The region has been experiencing a security crisis since 2013, impacting the lives of local populations with a poverty rate estimated at 74.3% in 2014 [4]. Over the past ten years, the region has been affected by climate change, with a longer dry season and floods destroying crops, leading to numerous food crises [5]. According to the SMART survey carried out in 2021, the Far North region had a prevalence of 1.4% of severe acute malnutrition (SAM) in children under 5 [6], with extremes of up to 1.6% in the Mayo Tsanaga and Logone and Chari Division [7]. These children are managed in specialized units in several health facilities. Few studies have been carried out in hospitals on severe acute malnutrition in children under 5 years in Cameroon and even fewer in the Far North region. The Maroua Regional Hospital, which represents the third level of referral in the health system in the region, has a center for the care of children with SAM with medical complications, and receives patients from various health facilities. Our study will improve knowledge on the clinical and evolving aspects of malnourished children in hospitals in Cameroon in general and more specifically in the Far North region and at the Maroua regional hospital.

2. Materials and Methods

Our study took place at the CNTI of the Maroua Regional Hospital. This unit belongs to the General Pediatrics Department and specializes in the care of

children aged 0 - 59 months suffering from SAM with medical complications. It is a third-category referral hospital that receives all patients referred from the various health facilities in the city and region. Our study was descriptive and cross-sectional over a three-year period, from January 2020 to December 2022. The minimum sample size was calculated using Cochran's formula: ($n = (t^2 \times p \times (1 - p)/m^2)$) using a prevalence ($p$) at 0.5 of severe acute malnutrition, given that hospital prevalence remains unknown in the region, t = confidence level according to the normal distribution centered reduced at 95%, equivalent to 1.96. m, the tolerated margin of error of 5% [8]. We chose to conduct our study over a three-year period to achieve a larger sample size, to reduce bias and increase the power of the study. The sampling was exhaustive (all individuals admitted to the CNTI from January 1, 2020, to December 31, 2022 and who met the inclusion criteria). After data purification, we retained a total of 873 files. Patients aged 0 - 59 months admitted to the CNTI were included. Exclusion criteria were incomplete records and patients who stayed less than 24 hours in the unit. We used WHO growth curves with different weight-for-height ratios and/or brachial circumference measurements to classify patient's' nutritional status. Severely acutely malnourished infants aged 0 - 59 months with a weight-for-height ratio of less than −3 Z score and/or a brachial circumference of less than 115 cm in the 6 - 59 months age group, with or without the presence of nutritional oedema [9]. The epidemiological profile was described in terms of age, sex, and patient origin. Clinical variables included reason for admission, anthropometric parameters, clinical forms, medical complications, and comorbidities. Patient outcome was defined as recovery, discharge against medical advice (DAMA) and death. Gastroenteritis was defined by the presence of diarrhoea and/or vomiting; malaria was defined by a positive thick blood drop or a positive rapid diagnostic test (RDT); respiratory diseases included bronchitis, bronchiolitis, pneumonia, bronchopneumonia, and pleuropneumonia. Sepsis was defined by the presence of an inflammatory syndrome with a systemic response, with signs of clinical or biological damage to organ (s). Pediatric Acquired Immunodeficiency Syndrome (AIDS) was considered in children presenting clinical signs of AIDS according to WHO classification, with positive HIV (Human Immunodeficiency Virus) serology or positive HIV PCR. Tuberculosis was considered in patients presenting clinical, radiological or anatomopathological signs of tuberculosis associated with positive Gene expert or urine LAM results. Discharges against medical advice (DAMA) were considered for patients who abandoned treatment during hospitalization without medical consent. We submitted the study protocol to the hospital management and began data collection after authorization. Informed consent was difficult to obtain, given the retrospective nature of the study. The confidentiality and anonymity of patients were respected. Data were collected on a pre-established questionnaire from patient's files. Data analysis was carried out using SPSS 27.0 software. It was univariate and made it possible to bring out for each of the variables analyzed, the numbers, frequencies, and some averages. The document was written using Microsoft Word 2019.

Study bias: bias may have been introduced into our study.

Confusion bias: a review, validation, and data purification committee before data analysis. Information bias: in addition to patient records, department registers were used for data verification.

3. Results

3.1. Socio-Demographic Data (Table 1)

From January 2020 to December 2022, 6185 patients were hospitalized in the general pediatrics department, including 1115 at the CNTI; 241 files did not meet the inclusion criteria. We retained a total of 873 files, giving a hospital prevalence of SAM of 18%. The average age was 14 months of age, with a sex ratio of 1.2. The predominant age group was 6 to 24 months (79.2%). Most patients (56%) came from the urban area of Maroua.

3.2. Clinical Data

Of the 873 patients, the main reasons for consultation were fever in 367 patients (42.0), then diarrhea in 324 patients (37.1) and weight loss in 58 patients (6.6). Among these patients, 54 or 6.2% presented edema on admission (Table 2). Marasmus was the predominant clinical form, with a percentage of 94% (Figure 1). Sepsis was the most common diagnosis (33.9%), followed by malaria (16.8%). Pediatric AIDS accounted for 2.7% of patients, and 4.5% had tuberculosis in all clinical forms (Table 3). Regarding HIV serology, 96.6% of patients were tested, with 23 cases of positivity. Of these, 07 patients were known and followed-up, and 16 patients were detected during hospitalization. HIV PCR came back positive in one of the 3 patients tested. For the detection of tuberculosis by sputum, the Gene expert was carried out in 11.5% of patients, with 6 positive cases (5.9%).

Table 1. Socio-demographic data of patients.

Socio-demographic variables		Frequency (%)
Ages	6 - 12 months	398 (45.6)
	12 - 24 months	294 (33.6)
	Less than 6 months	118 (13.5)
	24 - 59	63 (7.3)
	Total	873 (100)
Gender	Males	506 (57.9)
	Females	397 (42.1)
	Total	873 (100)
Origin	Urban zone	489 (56.0)
	Rural area	384 (43.9)
	Total	873 (100)

Table 2. Patients presenting complains.

Presenting complains	Frequency	Percentages (%)
Fever	367	42.0
Diarrhea	324	37.1
Weight loss	58	6.6
Convulsion	43	4.9
Respiratory distress	24	2.7
Edema	15	1.7
Vomiting	15	1.7
Coughing	14	1.6
Others*	8	0.9
Abdominal pain	5	0.5
Total	873	100
Presence of edema		
No	819	9.8
Yes	54	6.2
Total	**873**	**100**

*Anorexia, dysuria, dysphagia, macrocrania, hematuria, rash.

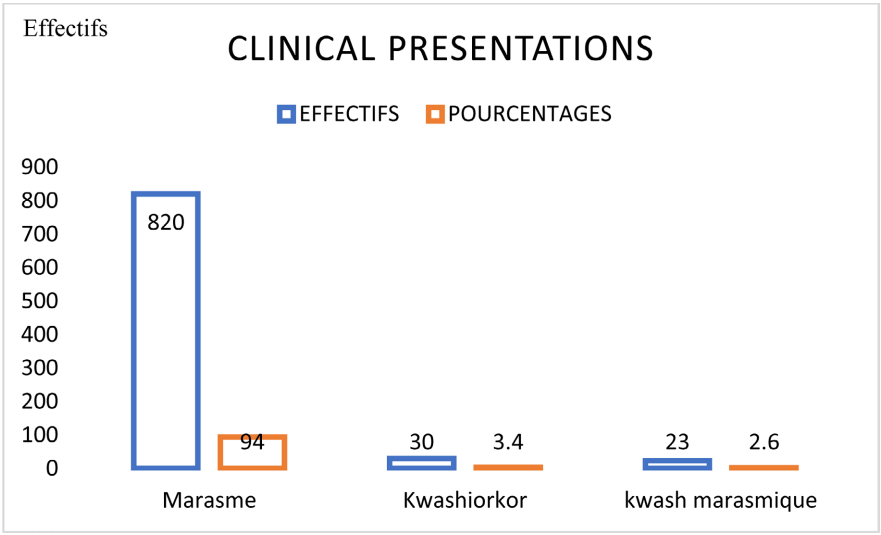

Figure 1. Clinical presentation of patients.

Detection of tuberculosis by urine Lam, 11.9% of patients performed the test, with 33 positive cases (31.7%) of patients (Table 4). Most patients (81.6%) had a blood count. Of these patients, 46.8% had a haemoglobin level of between 7 and 10 g/dl, and 9.9% of patients had a haemoglobin level of less than 5 g/dl (Figure 2).

Table 3. Patient's medical complications.

Medical complications	Frequency	Percentages (%)
Sepsis	296	33.9
Malaria	147	16.8
Respiratory diseases	140	16.0
Malaria and sepsis	81	9.4
Kwashiorkor	53	6.0
Tuberculosis	39	4.5
Late neonatal infection	23	2.7
Pediatric AIDS	23	2.7
Meningitis	21	2.4
Urinary tract infection	17	1.9
Surgical pathologies	10	1.3
Congenital heart disease	6	0.7
Ear, nose and throat (ENT) diseases	6	0.7
Malignant hemopathies	3	0.3
Cleft lip and palate	3	0.3
Cerebral tumor	1	0.1
Measles	1	0.1
Other***	3	0.3
Total	**873**	**100**

*Human immunodeficiency syndrome; **Otho rhino laryngology; ***Cerebral palsy, nephropathy, osteomyelitis.

Table 4. Prevalence of HIV* and tuberculosis.

Tests	Results	frequency	percentages (%)
Serologies HIV*	Realized	844	96.6
	Negative	816	93.4
	Positive	23	2.7
HIV PCR	Realized	3	0.3
	Negative	2	66.6
	Positive	1	33.4
Gene expert	Realized	101	11.5
	Negative	95	94.1
	Positive	6	5.9
Urine Lam	Realized	104	11.9
	Negative	71	68.2
	Positive	33	31.7

* Human immunodeficiency virus.

3.3. Patient's Treatment

Table 5 below shows that of the 873 patients, 870 patients received antibiotic treatment, or 99.6%; Anti-malarial treatment was administered to 490 patients (56.1%). Blood transfusion was carried out in 73 patients who presented with severe anemia, *i.e.* 8.3%. Anti-tuberculosis drugs were instituted in 43 patients (4.9%) and 18 patients also received antiretroviral treatment (2%). Abdominal surgery was performed in 1% of patients, and one patient was referred for neurosurgery.

3.4. Patient's Outcome

Recovery from medical complications was observed in 79.3% of patients. These patients were then transferred to the Ambulatory care center (ACC) for further nutritional rehabilitation. We recorded 60 discharges against medical advice (6.8%) and 6.5% deaths. 3 patients suffering from pathologies that could not be

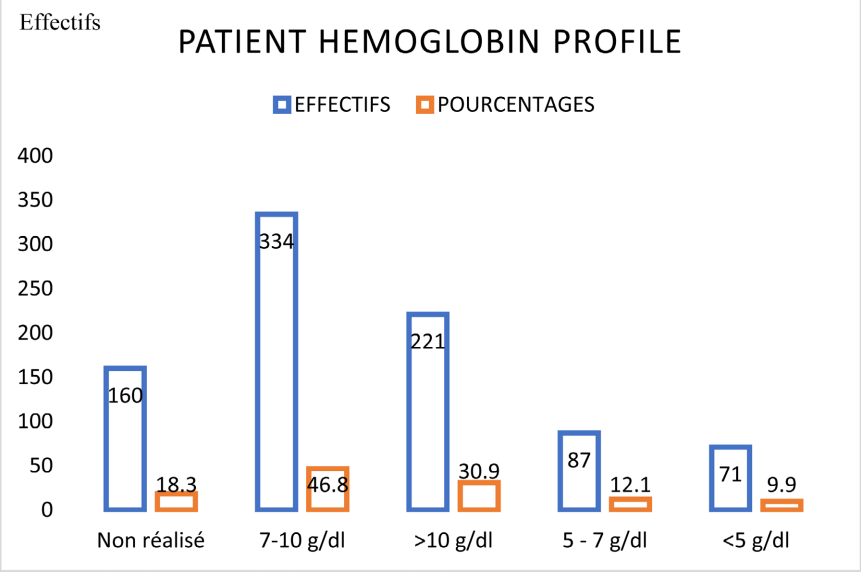

Figure 2. Patient's hemoglobin levels on admission.

Table 5. Patient's treatments.

Patient's treatment		frequency (%)
Medical treatment	Antibiotics	870 (99.6)
	Anti-malarials	490 (56.1)
	Blood transfusion	73 (8.3)
	Antifungals	52 (5.9)
	Antituberculosis	43 (4.9)
	Antiretroviral	18 (2.0)
Surgical treatment	Abdominal surgery	9 (1)
	Neurosurgery	1(0,1)

Table 6. Patient's outcome.

Patient's outcomes	frequency (s)	percentages (s)
Cured	690	79.3
(DAMA)	60	6.8
Deceased	59	6.7
Ongoing follow-up	53	6.0
Surgery	9	1.0
Referred	3	0.3
Total	**873**	**100**
Causes of death		
Sepsis	**22**	**37.3**
Malaria	18	30.6
Respiratory diseases	9	15.3
Meningitis	5	8.4
Congenital heart disease	2	3.4
Tuberculosis	2	3.4
Late neonatal infection	1	1.6
Total	**59**	**100**

managed in our hospital were referred (**Table 6**).

4. Discussion

We found a hospital prevalence of 18% for SAM, like those of Keita *et al.* (18.8%) [10] and Camara *et al.* (17.62%) [11]; Toure *et al.* in Dakar in 2021 had a lower prevalence of 14.4% [12]. In contrast, Chiabi *et al.* in Yaoundé and Koum *et al.* in Douala had a hospital prevalence of 2.72% and 8.75% respectively [13] [14]. These differences may be explained by the high prevalence of SAM in Sahelian zones and the variable attendance rates at the various hospital structures. The average age of the patients was 14 months. In Chiabi *et al.* study, it was 9 months [13].

Nguefack *et al.* had an average age of 17 months [15] and Keita *et al.* was 26 months, [10] while Toure *et al.* had an average of was 20.8 months [12]. These differences may be explained by the inclusion criteria, that which differed in each study. The most represented age group was that of 6 to 12 months, (45.6%) Nguefack *et al.*, Keita *et al.* as well as Chiabi *et al.* found similar results [10] [13] [15]. On the other hand, in Conakry, the majority age group was 6 to 23 months (59.78%) [11]. This difference could be due to the age splitting which is different in Camara *et al.* study [11]. Most patients (56%) came from urban areas, unlike Keita *et al.* and Toure *et al.*, where the majority came from rural areas [10]. The different location of hospital facilities could influence the attendance rate of

surrounding populations. Edema was present in 6.2% of patients. Chabi *et al.*, Keita *et al.* and Toure *et al.* had higher proportions, respectively 10.8%; 22.5% and 15.6% [10] [12] [13]. Marasmus was the major clinical presentation, *i.e.* 94% of patients. Chiabi *et al.*, Camara *et al.*; Koum *et al.* had the same findings with 88.8% respectively; 77.9%; 89%. [11] [13] [14]. On the other hand, Nguefack *et al.* found kwashiorkor as the dominant clinical form [15] like Kambale *et al.* in Congo in 2016. In this study, malnutrition with edema was the predominant form of severe acute malnutrition (58%) [16].

The main reason for consultation was fever (42.0%), followed by diarrhea (37.1%). Our results are like those of Camara *et al.*, where fever was the main reason for consultation (78.26%) [17]. Chiabi *et al.*, in their study, found weight loss (58.1%) followed by fever (53.6%) as their main presenting complain [13]. Keita *et al.* reported diarrhea followed by vomiting [10], and Toure *et al.* found digestive signs in 40.8% of patients [12]. Marasmus was the predominant clinical presentation, in 94% of patients. Chiabi *et al.*, Camara *et al.*; Koum *et al.* had the same findings with 88.8%; 77.9%; 89% respectively [13] [14] [16]. On the other hand, Nguefack *et al.* and Kambale *et al.* in Congo found kwashiorkor to be the dominant clinical form [15] [17]. Sepsis was the most common medical complication, followed by malaria.

In Toure's study in Dakar, only 23 patients had malaria [12], in contrast to all other studies in Niger, Guinea, Cameroon and Senegal [12] [13] [18]. HIV serology was performed in 96.6% of patients, with 23 positive cases. 7 patients were known to be HIV-positive and 16 were detected during hospitalization. PCR was positive in one out of 3 patients who underwent the test. In Chiabi *et al.*'s study out of 32 HIV-immunocompromised patients, 14 were tested positive [13]. Toure *et al.* found that 9.9% of patients tested positive for HIV [12]. In these two hospitals, there are units for monitoring and caring for patients living with HIV, and according to WHO recommendations, HIV detection should be carried out in all malnourished patients because of the increased risk of HIV co-infection in SAM patients [19]. The overall prevalence of tuberculosis was 4.5%, with the Gene expert and Lam urine detection methods used for the diagnosis. Toure *et al.* found 3 cases of tuberculosis [12]. In sub-Saharan Africa, the co-infection of HIV, tuberculosis and severe acute malnutrition remains high [20], and the detection of tuberculosis in malnourished patients should be systematic and should warrant the assessment of nutritional status in anyone presenting with tuberculosis [19]. In our study, 81.6% of patients had a full blood count. Of these patients, 46.8% had a haemoglobin level between 7 and 10 g/dl, and 9.9% had a haemoglobin level less than 5 g/dl. Toure *et al.* in Dakar found that 6.47% of patients had haemoglobin levels below 4 g/dl [12]. According to the WHO, 42% of children under the age of five suffer from anemia in Africa, particularly infants under the age of two [21]. The recovery/cure rate was 79%; Nguefack and Chiabi in Cameroon had recovery rates of 75.6% and 58.7% respectively [13] [15]. Keita *et al.* had a rate of 73% [10]. The death rate was 6.7%, with similar results for Keita *et al.* (6.9%) [10]. On the other hand, Chaibi *et al.*,

Nguefack *et al.*, and Koum *et al.* had a higher death rate: 15%, 21.9% and 20% respectively. [13] [14] [15] The main causes of death were sepsis and malaria, as in Niger, where the main cause of death was sepsis [18]; Keita *et al.* found malaria to be the main cause of death [10]. Malaria is responsible for the majority of deaths in sub-Saharan Africa. Undernutrition plays a role in about 45% of deaths in children under the age of 5 years. These deaths occur mainly in low- and middle-income countries, with pneumonia, malaria, and diarrhoea as the main causes [22]. We found that 6.7% of patients were discharged against medical advice. All studies found a drop-out rate of around 2%. [7] [9] [16]. The drop-out rate may be explained by financial constraints and the length of hospital stay, which varies according to the medical complications presented by the patient.

5. Conclusion

Severe acute malnutrition remains a public health problem in our context. The Far North region is one of the areas where the prevalence of malnutrition remains high. Despite all measures taken by the government to alleviate the problem, it still accounts for a high mortality rate among children less than 5 years.

Limitations of the Study

Patients hospitalized in other specialized departments although meeting the criteria for severe acute malnutrition could not be included in this study. Patients over 5 years old presenting signs of acute malnutrition are not admitted to the CNTI for treatment, hence the age limitation of 0 to 59 months.

Authors' Contributions

Abouame Palma Haoua, Kamo Selangai Hélène, Sime Tchouamo Arielle Annick, Fernando Lepka, Nemsi Daniel, Salihou Aminou Sadjo, Soureya Haman, Feudjo Yolande, Dama Ulrich, Nguefack Félicitée designed the study, Abouame Palma Haoua, Nemsi Daniel, Fernando Lepka, Kamo Selangai Hélène, Dama Ulrich, Nguefack Félicitée analyzed the data and produced the first draft of the study. All authors extracted the manuscript and approved the final draft.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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