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Pneumonia in Children Aged 6 to 59 Months with Severe Acute Malnutrition in the Department of Pediatrics of Gabriel Touré University Hospital

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Abstract

Introduction: Severe acute malnutrition (SAM) is associated with an increased risk of morbidity and mortality from infectious diseases, particularly pneumonia. The interaction between infection and malnutrition is bidirectional: malnutrition impairs immune defenses, while infection can worsen nutritional status. **Objective:** To study pneumonia in children aged 6 to 59 months with severe acute malnutrition hospitalized in the Department of Pediatrics at Gabriel Touré University Hospital. **Patients and Methods:** This was a descriptive prospective study of pneumonia cases occurring in children with severe acute malnutrition over a 12-month period, from January 1 to December 31, 2020. **Results:** Among 6024 hospital admissions, 216 cases of severe acute malnutrition were identified, of which 50 were associated with pneumonia, representing 23.15% of children with severe acute malnutrition. The mean age was 16.2 ± 2.3 months, with a range of 6 to 48 months. Children aged 6 to 23 months accounted for 80% of the study population, and females represented 56%. Complementary feeding was inadequate in 64% of the children. Marasmus accounted for 88% of the forms of malnutrition, while kwashiorkor accounted for 10%. All children presented with cough and fever; crackles were found in 72%, and tachypnea in 64%. Radiological opacity was reported in 66% of children who underwent chest radiography. The case fatality rate was 4%. **Conclusion:** Pneumonia is a frequent complication among children hospitalized with severe acute malnutrition in our setting. Young age, difficulties related to complementary feeding, and the high frequency of respiratory signs highlight the importance of integrated nutritional and infectious disease man-

agement.

Keywords

Pneumonia, Severe Acute Malnutrition, Child, Gabriel Touré University Hospital

1. Introduction

Worldwide, many children under 5 years of age suffer from malnutrition, including a proportion with severe acute malnutrition. In Mali, the prevalence of global acute malnutrition was estimated at 9.4%, while severe acute malnutrition was estimated at 2.0%, according to the data cited in the article [1] [2].

Severe acute malnutrition is associated with an increased risk of infectious complications and death. It frequently occurs in association with diseases such as diarrhea, malaria, and pneumonia [3] [4]. Pneumonia is an important cause of morbidity and mortality in children, particularly in the presence of malnutrition and when access to healthcare is inadequate [5] [6].

Pneumonia is an acute infection of the lower respiratory tract and lung parenchyma that may be caused by viral, bacterial, or, less commonly, fungal pathogens. Its prevention relies, among other measures, on vaccination, improving nutritional status, and reducing environmental risk factors [7].

The interactions between infection and malnutrition have long been recognized. They are bidirectional: malnutrition impairs the body's defense mechanisms, while infection increases metabolic requirements and may further worsen nutritional status [8] [9].

In our setting, data on pneumonia in children with severe acute malnutrition remain limited. Therefore, the objective of this study was to investigate the epidemiological, clinical, laboratory, and therapeutic characteristics of pneumonia in children aged 6 to 59 months with severe acute malnutrition who were hospitalized in the Department of Pediatrics at Gabriel Touré University Hospital.

2. Specific Objectives

- To assess the frequency of pneumonia among children aged 6 to 59 months with severe acute malnutrition;
- To describe the clinical and laboratory characteristics of pneumonia in these children;
- To describe the therapeutic management and outcomes of children with pneumonia associated with severe acute malnutrition.

3. Patients and Methods

Study setting: The study was conducted in the Department of Pediatrics at Gabriel Touré University Hospital, a tertiary referral hospital located in Commune

III of the District of Bamako. The department includes an Intensive Nutritional Recovery and Education Unit (URENI), which served as the patient recruitment setting.

Study design and period: This was a descriptive prospective study of pneumonia cases occurring in children with severe acute malnutrition, conducted over a 12-month period from January 1 to December 31, 2020.

Study population and inclusion criteria: Children aged 6 to 59 months hospitalized in the Department of Pediatrics at Gabriel Touré University Hospital with severe acute malnutrition complicated by pneumonia at admission were included. Patients whose medical records were unusable and those whose parents or legal guardians did not provide consent were excluded.

Data collection and analysis: The variables collected included sociodemographic characteristics, clinical assessment findings, laboratory and other ancillary investigations, treatments administered, and clinical outcomes. Data were entered and analyzed using Microsoft Office 2016 and SPSS statistical software.

Operational definition

- **Severe acute malnutrition**: a weight-for-height ratio below −3 Z-scores relative to the median of the WHO growth standards, or a mid-upper arm circumference (MUAC) of less than 115 mm, and/or the presence of clinical signs of bilateral nutritional edema.
- **Pneumonia:** the presence of cough or difficulty breathing associated with tachypnea, fever, and rales upon auscultation.

Ethical considerations: All patients were included after obtaining informed consent from their parents or legal guardians. Data were collected while ensuring anonymity and confidentiality. The principles of good medical practice were respected.

4. Results

During the study period, 216 cases of severe acute malnutrition were admitted out of 6024 hospitalizations, representing a hospital prevalence of 3.6%. Among the 216 children with severe acute malnutrition, 50 had pneumonia upon admission, a prevalence of 23.2%.

The mean age was 16.2 ± 2.3 months, with a range of 6 to 48 months. Children aged 6 to 23 months accounted for 80% of the study population. Females were predominant (56%). More than half of the mothers had no formal education (54%), 30% were aged 15 to 20 years, and 82% were housewives. Fathers were manual workers in 36% of cases. Socioeconomic conditions were considered unfavorable in 70% of cases.

The majority of children weighed between 5 and 10 kg (68%) and had a height between 65 and 75 cm (54%). Complementary feeding was inadequate in 64% of cases. Signs of wasting were observed in 66.7% of patients, signs of dehydration in 44%, and oral thrush in 40%. Edema was found in 12% of children.

Marasmus accounted for 88% of the forms of malnutrition, kwashiorkor for

10%, and the mixed form for 2%. All children presented with cough and fever. Crackles were found in 72% of patients, while tachypnea associated with signs of respiratory distress was observed in 64%.

Chest radiography showed pulmonary opacity in 66% of patients who underwent the examination; the opacities were bilateral in 42% of cases. Half of the patients had a hemoglobin level below 8 g/dL. Leukocytosis was found in 76% of patients. HIV serology was positive in two patients.

Table 1. Sociodemographic characteristics and age at introduction of complementary feeding.

Characteristics	Number	Percentage (%)
Age group		
6 - 23 months	40	80
24 - 48 months	10	20
Sex		
Male	22	44
Female	28	56
Mother's level of education		
Primary	13	26
Secondary	4	8
Higher education	2	4
Quranic school	4	8
No formal education	27	54
Mother's age (years)		
15 - 20	15	30
21 - 25	9	18
26 - 30	13	26
31 - 35	11	22
36 - 40	2	4
Socioeconomic conditions		
Favorable	15	30
Unfavorable	35	70
Age at introduction of complementary feeding		
Before 6 months	21	42
At 6 months	19	38
After 6 months	10	20
Complementary feeding practices		
Appropriate	18	36
Inappropriate	32	64

Ceftriaxone and the combination of amoxicillin-clavulanic acid were the most frequently used antibiotics, administered in 44% and 30% of patients, respectively. Nutritional management, including therapeutic milk and Plumpy'Nut, was provided to 92% of the children. Half of the patients had a hospital stay ranging from 10 to 15 days. According to the data, 84% met the discharge criteria, 12% dropped out, and the case fatality rate was 4% (Tables 1-4).

Table 2. Weight-for-height ratio and type of malnutrition.

Characteristics	Number	Percentage (%)
Weight-for-height < −3 z-scores	45	90
Weight-for-height ≥ −3 and <−2 z-scores	5	10
Marasmus	44	88
Kwashiorkor	5	10
Mixed form	1	2

Table 3. Distribution of children according to clinical signs.

Clinical sign	Number	Percentage (%)
Signs of dehydration	22	44
Skin lesions	12	24
Skinfolds due to malnutrition	30	60
Edema	6	12
Oral thrush	20	40
Nasal flaring	13	26
Chest retractions	20	40
Expiratory grunting	2	4
Thoracoabdominal asynchrony	3	6
Tachypnea	32	64
Crackles	36	72
Rhonchi	3	6
Shock	2	4

Table 4. Distribution of children according to biological and radiological findings.

Characteristic	Number	Percentage (%)
Hemoglobin 4 - 8 g/dL	25	50
Hemoglobin 8 - 12 g/dL	19	38
Hemoglobin >12 g/dL	6	12
Leukocytosis	38	76
Hypoglycemia	4	8
Positive malaria RDT	20	40
Positive HIV serology	2	4
Chest X-ray: opacity involving 2 lung fields	21	42
Right-sided opacity	10	20
Left-sided opacity	2	4

5. Discussion

This descriptive prospective study found a hospital prevalence of severe acute malnutrition (SAM) of 3.58% among hospitalized children and pneumonia in 23.2% of children with SAM. This proportion is within the range reported in some studies cited by the authors, which found pneumonia rates of 68% and 21%, respectively, among children hospitalized for SAM [10] [11]. These differences may be explained by variations in the characteristics of the study populations, diagnostic criteria, and healthcare settings.

The mean age was 16.2 ± 2.3 months, and children aged 6 to 23 months accounted for 80% of the study population. This predominance of younger children is consistent with the complementary feeding period, which represents a period of nutritional vulnerability when complementary feeding practices are inadequate. In our series, complementary feeding practices were considered inadequate in 64% of the children.

More than half of the mothers had no formal education, and socioeconomic conditions were unfavorable in 70% of the families. These characteristics reflect a context of social and nutritional vulnerability; however, they do not, by themselves, establish a causal relationship with the occurrence of pneumonia.

Marasmus accounted for 88% of the forms of malnutrition, kwashiorkor for 10%, and the mixed form for 2%. This distribution is similar to that reported by Maiga *et al.* [12], who also found a predominance of marasmus. HIV serology was positive in 4% of patients. HIV infection may be associated with growth retardation and increased susceptibility to infections; however, the small number of HIV-positive patients in our series does not allow a specific analysis of this association. The inhibitory effect of HIV infection on child growth, as well as the reversal of this effect following antiretroviral therapy, has been demonstrated by Sutcliffe *et al.* [13].

Clinically, all children presented with cough and fever. Crackles were present in 72% of patients, and tachypnea was observed in 64%. These findings are consistent with the clinical signs classically used to support the diagnosis of pneumonia in children [14]. Chest radiography showed pulmonary opacity in 66% of patients who underwent the examination. In a study of complications of severe acute malnutrition conducted in the Department of Pediatrics at Yopougon University Hospital in Abidjan, EBOUA TKF reported a pneumonia rate of 35.3% [15].

Management combined anti-infective treatment with nutritional care. Ceftriaxone and amoxicillin-clavulanic acid were the most frequently used antibiotics. Nutritional management was provided to 92% of patients. The outcome was characterized by a case fatality rate of 4%.

Pneumonia was identified in 23.15% of children hospitalized for severe acute malnutrition in the Department of Pediatrics at Gabriel Touré University Hospital. It mainly affected young children, particularly those aged 6 to 23 months, and was frequently associated with respiratory signs and radiological abnormalities. These findings highlight the importance of systematic screening for respiratory

infections and the integrated management of malnutrition and pneumonia in young children. In a study conducted in Mali on the management of severe acute malnutrition in children in a secondary hospital in the Sahel, Traoré F reported pneumonia in 47% of children with severe acute malnutrition [16].

6. Conclusion

Pneumonia is a frequent complication among children hospitalized with severe acute malnutrition in our setting. The young age of the children, difficulties related to complementary feeding, and the frequency of respiratory signs underline the importance of integrated nutritional and infectious disease management.

Conflicts of Interest

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

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