

## Evolution of the Treatment of Malaria in Acute Malnourished Patients at Ureni in Mali: From Systematic to Etiological Treatment.

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### Abstract

#### Summary:

Both malaria and malnutrition have been implicated in impairing children's cognitive abilities, making it difficult for them to learn, and decreasing their school performance. Two previous versions of the national protocol for the management of acute malnutrition provide different guidelines. Our study aims to assess the extent of the association of malaria with acute malnutrition and the most appropriate version of the protocol. It is a retrospective study based on the records of children 6-59 months hospitalized at the URENI of the CSRéf of Kayes in 2019. The results show that on the basis of positive RDT, 0.9% of those admitted had malaria on acute malnutrition. The acute malnutrition patient is defined as a child from 24 to 59 months, referred to the URENI, treated with injectable Artesun, generally lasting 5 days in the program with a successful treatment rate of 75%. They have little diarrhea compared to other non-malarial patients. The 2017 version of the national protocol for the management of acute malnutrition is the most appropriate. Further studies are needed to support our findings.

**Keywords:** Malaria and acute malnutrition, URENI, Kayes/Mali.

#### • Introduction:

Malaria remains a priority public health problem, with a very high morbidity, especially in sub-Saharan Africa where children under 5 years of age pay the highest price [1].

According to a World Health Organization (WHO) report on malaria in the world in 2020; the number of malaria cases was estimated at 241 million and deaths accounted for 627,000; 95% of which were in Africa. Children under the age of five were the most vulnerable group with 80% of all deaths [2].

In Mali, malaria is the leading cause of consultation in health facilities, accounting for 40% [3]. The prevalence of malaria in children varies from one region to another. The highest prevalence is observed in the regions of Mopti (27%), Segou (26%), Sikasso (26%) and Koulikoro (23%). Conversely, the prevalence of malaria is low in the District of Bamako (2%) and the region of Kidal (2%), followed by Timbuktu (7%) [4].

In the world, there are 6 species of plasmodium that can infect humans, while in Mali there are only 4, the most dominant of which is plasmodium falciparum, which causes severe malaria. The national malaria control program of Mali recommends the malaria rapid diagnostic test (RDT) for the biological diagnosis of malaria. [5]

Malnutrition is a pathological condition resulting from an imbalance between the body's intake and requirements of nutrients [6]. It is responsible for 45% of child mortality, especially in countries with poor health systems [7].

In Mali, as well as malaria, malnutrition is a major public health problem, as it is in most countries of sub-Saharan Africa. It is one of the major causes of morbidity and mortality in children under five. According to the SMART 2022 report, in Mali, the prevalence of global acute malnutrition was 10.8%, moderate acute malnutrition 8.7%, severe acute malnutrition 2.1%; that of chronic malnutrition (stunting) was 21.9% and underweight 18.6%. [8].

Good nutritional health plays an important role in protecting against the effects of malaria (morbidity and mortality), conversely data indicate that protein-energy malnutrition is associated with significant malaria morbidity and mortality in humans [9].

Indeed, both malaria and malnutrition are implicated in the impairment of children's cognitive abilities, their learning difficulties and the decrease in their school performance (Branca *et al.*, 2002; Fernando *et al.*, 2003). In addition, individuals who suffered from malaria and malnutrition as children have lower physical resistance to work (Martorell *et al.* 1992). These consequences, combined with human losses, considerably hinder the development of societies, hence the interest of our study at the URENI of the Kayes Health Reference Center, which focuses on the association of these pathologies as well as the approach used to treat malaria against the backdrop of the contradictory guidelines given by the 2011 and 2017 versions of the national protocol for the integrated management of acute malnutrition in Mali.

- **Objectives:**

- **General objective**

Study the management of severe acute malnutrition patients with malaria at the URENI of the CSRéf of Kayes in 2019.

2.2 Specific objectives

- To determine the prevalence of malaria among acute malnourished patients hospitalized at the URENI of the CSRéf of Kayes in 2019;
- Determine the rate of "successfully treated" acute malnourished patients hospitalized at the URENI of the CSRéf of Kayes in 2019;
- Comparing the malaria treatment regimen in acutely malnourished patients of the 2011 and 2017 versions of the National Integrated Malaria Management Protocol;
- Establish a profile of acutely malnourished patients hospitalized at the URENI of the CSRéf in 2019 with malaria.

3. Methodology

3.1. Location of the study

The study took place at the URENI of the Kayes reference health center.

3.2. Type of study

This was a retrospective cross-sectional study with exhaustive sampling of all children hospitalized at the URENI of the Kayes reference health center in 2019 except those less than 6 months old.

3.3. Study period

The study took place in 2019 with a data collection period extending from 3 months.

3.4. Study population and sampling

The study population was children aged 6-59 months, regardless of sex, hospitalized for acute malnutrition at the URENI of the Kayes health center during the study period. Patients who did not have hospitalization records or who had unusable records were not included in the study.

3.5. Data collection

A database was developed using SPSS software and filled in through the medical records.

3.6. Data processing and analysis

Data were analyzed through SPSS and data entry was done with Word 2013 software.

3.7. Limitations of the study:

The limitation of our study was the absence of some information in the records.

4. Results:

- Distribution of patients according to the performance and the result of the RDT

Table 1: Distribution of patients according to the performance and the result of the RDT

The results of the TDR	Realization of the TDR			Total
	Yes	No	File not filled in	
Positive	4	0	0	4
Negative	409	0	0	409
Not applicable	0	5	4	9
<b>Total</b>	<b>413</b>	<b>5</b>	<b>4</b>	<b>422</b>

The results show that 97.8% of the patients admitted did the rapid diagnostic test, of which 99% were negative and 0.9% were positive (4 patients).

Among the patients admitted to the URENI, only 5 had not received an RDT and 4 had records that did not include the RDT. We also note that the patients for whom the RDT was not performed or not mentioned on the file or the results of the RDT were not mentioned did not receive antimalarial treatment and were all discharged from the program.

**• Distribution of patients according to RDT results and administration of antimalarial treatment**

Table 2: Distribution of patients according to RDT results and administration of antimalarial treatment

The result of the TDR	Malaria treatment performed		Total
	Yes	No	
Positive	4	0	4
Negative	0	409	409
Not applicable	0	9	9
Total	4	418	422

Only patients with a positive RDT received antimalarial treatment.

**• Distribution of patients by function according to the guidelines of the 2011 and 2017 versions of the national protocol for integrated management of acute malnutrition**

According to the 2011 version of the national protocol, any patient admitted to URENI should receive the combination of Artemether-Lumefantrine (Co-artem<sup>®</sup>). Severe malaria cases should receive intramuscular Artemether injection with Co-artem as a relay injection. Quinine was prohibited for the first two weeks of treatment because of its side effects. The same was true for combinations containing Amodiaquine.

According to the 2017 version of the protocol, patients admitted to the URENI receive antimalarial treatment only when the RDT or the thick drop is positive on the basis of oral Co-artem. In case of severe malaria, treatment is based on Artesun 60 mg IM or IV and Artemether injection has become the second-line treatment. Combinations containing Amodiaquine and Quinine are not recommended because of their side effects.

The treatment of malaria in the present study followed the 2017 guidelines which led to the administration of antimalarial drugs only in those with a positive RDT (4 patients) and 3 were successfully treated and lasted only 5 days at the URENI. The study shows us that 418 patients with no RDT, mentioned or negative did not receive antimalarial treatment. Of these, 95.93% were successfully treated; 0.7% discontinued treatment, 0.2% died, and 3.5% were referred to the pediatric ward of the regional hospital.

The systematic administration of antimalarial drugs without regard to the results of biological examinations in a management unit raises certain concerns: the risk of overwhelming the body's metabolic and elimination capacities, which is debilitated by malnutrition. With 4 out of 422

RDT positive patients, the 2011 guidelines seem to be inefficient in terms of economic cost. However, it can be estimated that this will not be the same case in an area with high malaria prevalence. Based on the 2019 management data, the 2017 version seems more appropriate and efficient.

- **Profile of severely malnourished patients with malaria**
- **Age range:** the majority of patients (3/4) were in the 24-59 month age range while one was in the 6-23 month age range.
- **Type of admission:** all patients admitted were referred from a URENAS and represented 0.02% of referred patients (249 cases or 59% of admissions);
- **Discharge type:** three of the four RDT-positive patients were successfully treated and one dropped out;
- **Length of stay:** the majority (3/4) had 5 days as individual length of stay, while one stayed for 6 days in the unit. This duration is identical to that of all admitted patients who had a length of stay at 5 and 6 days to the same proportion of patients ;
- **Duration of the acute phase:** for three patients, the acute phase lasted 2 days. For one patient with malaria, the information was omitted in the data entry mask. For all children admitted to the URENI, the duration of the acute phase ranged from 0 to 16 days. However, the majority had only two days in the acute phase;
- **Transition phase:** The duration of the transition phase is not uniform among malnourished patients. One patient is at 1 day, another is at 3 days and the last one is at 4 days. Information on one malnourished malaria patient was not available in the database. For all patients, the length of stay in the transition phase was mostly 1 day.
- **Weight/height index:** all malnourished patients had a weight/height ratio of less than -3 Z-score, and were therefore severely malnourished. For all non-DRT positive patients, 96% had a Z-score below -3; and 4% had a Z-score between -3 and -2.
- **Presence of edema:** No malnourished patients with malaria had edema, whereas the prevalence of edema was 6% in non-malnourished patients;
- **Nasogastric tube placement:** No malaria patient wore a nasogastric tube during their entire stay. For non-malarial patients, the prevalence of nasogastric tube placement was 22%.
- **Pathologies or signs/symptoms associated with the malaria picture on malnutrition:**
- Fever was found in one out of four patients with malaria (25%), whereas for all non-malarial admissions, it was found in 28%.
- Diarrhoea was observed in one out of four (25%) malaria patients, whereas in the total number of non-malaria patients admitted, it was present in 35%;
- Cough/IRA was present in 3 malarial children (75%) with low intensity. Only one patient had a cough of moderate intensity (25%). For all non-malarial admissions, the majority had a mild cough/IRA (26%);
- Pallor: it was observed in one out of 4 malaria patients (25%) against 7% in non-malaria patients;
- Anemia on the basis of hemoglobin level: in two malaria patients, hemoglobin levels were not measured, while in the others the hemoglobin levels were in favor of severe anemia. Of all the

- children admitted, a large majority (357) did not have hemoglobin testing. Of those who did, the majority had moderate anemia (29 cases), 17 had severe anemia and 10 had mild anemia;
- Hepatomegaly: No malaria patient had hepatomegaly. It was found in 7 out of 422 cases in non-malarial patients.

**Discussions:**

Our work is a retrospective study that analyzed the 2019 admissions to the URENI of the CSRéf of Kayes involving 422. The aim was to study the management of severe acute malnourished patients with malaria confirmed by the RDT of malaria. Our objective was achieved, however, one of the limitations of the study may be the low number of malaria cases in the sample (4 cases).

**Prevalence of RDT positive malaria**

In our study, RDT was performed in 413 patients. In 5 cases, the RDT was not performed and in 4 cases the records did not contain the results of the RDT. The prevalence of malaria in the acute malnourished patients (who had the RDT) was 0.9%. This rate is significantly lower than that of all the other studies we referred to.

- TOURE F. in Dioila (Koulikoro region) in 2015[17] found a prevalence of 80% ;
- DIARRA N. et all in commune I of Mali in 2013 reported a prevalence of 56.8% [10] ;
- SAWADOGO found in Segou in 2009; a rate of 49% [11];
- TRAORE D-B reported a prevalence of 25.5% [12].

This difference could be explained by the low prevalence of malaria in children under 59 months of age in the Kayes region (12.2%) [13]; on the other hand, there is an URENI at the Kayes regional hospital that could absorb a significant number of malnourished patients with malaria. This low prevalence may reflect the effectiveness of the seasonal malaria prevention campaign, which manages to reduce the frequency of the disease during peak malaria periods.

**Fever:** None of the malaria cases in our study had fever at any time during the management. This may be due to the average quality of temperature taking by URENI providers and the physiological disorder in severe acute malnourished patients which may mask a fever. However, the assessment of fever in the sample showed it in 28.4% of the patients. This rate of fever is close to that observed at the URENI in Yirimadio (28.8%) [12] and to that found in Gao in 2009 by SAWADOGO.AS, i.e. 25.5% [11]. These results clearly show that a quarter or more of the acute malnourished at the URENI have fever.

**Length of stay:** in our study, RDT positive cases had an individual length of stay between 5 and 6 days while malnourished patients with negative RDTs had a length of stay varying between 2 and 19 days and also the majority of them had a length of stay of 5 and 6 days (75 patients). This could mean that malaria does not have an impact on the length of stay of acutely malnourished patients at the URENI of the CSRéf of Kayes. A study conducted by **Guindo SO** [17] found in 2016 in the pediatric department of the CSRéf of commune V an average length of stay of 7.14+ or - 3.15 days and states that pulmonary infections, diarrhea, and digestive candidiasis are

associated with long hospitalization times. Although we worked on the average length of stay and we worked on the individual length of stay, our findings seem to converge in noting the low impact of malaria among the acutely malnourished. We note that Guindo S.O. does not mention malaria among the causes likely to prolong the average length of stay.

### **The treatment regimens of the 2011 and 2017 versions of the integrated management protocol for acute malnutrition**

The 2011 version recommends routine administration of antimalarial drugs (Artemether-Lumefantrine: Co-Artem®) in any patient admitted to URENI. From 2012 to 2017, all patients admitted to the program received their doses of Co-Artem®.

This type of strategy may be useful in areas with a very high prevalence of malaria, where there are problems of reliability of test results due to deficiencies in the storage or the techniques for performing the test. However, compared to the second version, which emphasizes the positivity of the test before treatment with an antimalarial drug, it seems to respond to a logic of etiological treatment, with other benefits such as the avoidance of flooding the body of the malnourished person with drugs, and savings for the country on the cost of malaria drugs.

In light of the management of malaria in acute malnutrition at the URENI of the CSRéf, we believe that there is no need to systematically treat all children admitted; the said constants are in favor of the 2017 version of the national protocol of PCIMA.

### **Malaria on malnutrition and diarrhea**

Only one in four malnourished patients had diarrhea (25%). Among the other RDT-negative patients, 36% had diarrhea. Diarrhea seems to be more frequent in acute malnourished patients without malaria than in those with malaria.

Of the 422 malnourished patients admitted, 151 had diarrhea (35.78%). This result is lower than that of Ouédraogo SO et al in Burkina Faso [14] who found diarrhea in 60.9% of cases.

### **Conclusion:**

In our study, it appears that the prevalence of malaria is low at the URENI of the CSRéf of Kayes. All patients with positive RDT were treated with Artesun 60 mg injectable. The 2017 version of the national IMCI protocol would be more appropriate than the 2011 version. We did not find an impact between malaria and length of stay, nor did we find a rate of successfully treated, death. The pathologies frequently associated with acute malnutrition were diarrhea and acute respiratory infections.

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