Scientific Research Publishing

Open Journal of Pediatrics, 2025, 15(2), 217-223
https://www.scirp.org/journal/ojped
ISSN Online: 2160-8776
ISSN Print: 2160-8741

Renal Complications of Malaria in Children in the Pediatrics Department of the Chu Gabriel Toure in Bamako

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How to cite this paper: Belco, M., Bory, T., Kalirou, T., Karamoko, S., Adama, D., Amadou, T., Elmouloud, C.M., Djita, B., Aziz, D.A., Hawa, D., Pièrre, T., Aminata, D., Oumar, C., Yacouba, C.A., Djéneba, K., Issiaka, K., Mariam, S., Boubacar, T., Traoré, F. and Tounkara, K. (2025) Renal Complications of Malaria in Children in the Pediatrics Department of the Chu Gabriel Toure in Bamako. *Open Journal of Pediatrics*, **15**, 217-223.
https://doi.org/10.4236/ojped.2025.152020

Received: January 4, 2025
Accepted: March 9, 2025
Published: March 12, 2025

Abstract

Introduction: The mechanism of this malaria-associated renal complication appears to be acute tubular necrosis related to hemoglobinuria. The aim of our study was to investigate the prevalence of renal complications of severe malaria in children aged 1 month to 15 years. **Materials and Methods**: This was a retrospective study of the records of children aged 0 to 15 years admitted to the Department of Pediatrics between January 1, 2017 and December 31, 2019 (36 months), for severe malaria with a biologically confirmed renal complication. **Results**: The frequency was 0.9%. The age group 6 - 12 years was the most represented (65.2%), with a mean age of 9.1 years and extremes of 08 months and 15 years. Severe malaria was the main reason for referral (43.5%). Malaria was confirmed by thick blood smear in 73.9% of cases, and by malaria rapid diagnostic test (RDT) in 56.5%. The majority of patients (71.7%) had creatinine values above 265 µmol/l. Furosemide was used in 87%, and 17.4% of patients received hemodialysis. The mortality rate was 50%. **Conclusion:** Acute renal failure in severe malaria is a rare complication in children. Its occurrence can be life-threatening, especially in the absence of emergency extra-renal purification.

Keywords

Malaria, Acute Renal Failure, Hospitalized Children

1. Introduction

Today, malaria is a major public health problem in developing countries, particularly in the intertropics [1].

In 2000, the World Health Organization (WHO) defined severe malaria as the presence of asexual forms of Plasmodium *Falciparum* in the blood associated with one or more so-called major severity criteria [1] [2]. According to the latest WHO report published on December 4, 2019: Worldwide, the number of malaria cases was estimated at 228 million in 2018, compared with 231 million in 2017. Ninety-three percent of cases were recorded in the African region. Children under 5 accounted for 67% of deaths.

In Mali, malaria remains a major public health problem due to its impact on mortality, morbidity and socio-economic repercussions on the general population [3].

According to the health information system, malaria constituted 66% of reasons for consultation in 2018 with a case-fatality rate of 1.33‰ [4]. According to the EDSM-VI the prevalence of malaria in children aged 6 - 59 months was 19% in 2018 [5]. In Bamako, at the CHU GT in the pediatrics department, it accounted for 40.4% of consultations, 22.48% of pediatric hospitalizations, and 10.33% of in-hospital deaths [6]. The renal involvement of malaria constitutes a serious form.

The worldwide prevalence of malaria-related renal complications is variously estimated at up to 60% [7]. This prevalence is not homogeneous in Africa, due to studies of different types and carried out in different departments.

The mechanism of this malaria-associated renal complication appears to be acute tubular necrosis associated with hemoglobinuria [8].

In Gabon, a 2017 study on the frequency of renal involvement during severe childhood malaria at the Service d'Accueil des Urgences Pédiatriques et en réanimation du Centre Hospitalier Universitaire de Libreville revealed a frequency of 0.7% [9].

In Mali, it represents 23.65% of the causes of admission to the nephrology department of the CHU du Point G [4].

No study has been carried out on the renal damage caused by severe malaria in our department, which is why we initiated this study, the aim of which is to investigate the prevalence of renal complications of severe malaria in children aged between 1 month and 15 years in the paediatrics department of the Gabriel Touré University Hospital in Bamako.

2. Materials and Methods

Our study was carried out in the pediatrics department of the Gabriel TOURE University Hospital in Bamako. Located in the center of the city, the pediatrics department receives patients from all the communes of Bamako and those referred by other localities in Mali. It comprises a neonatology service, a general paediatrics service and a paediatric emergency service. We conducted a retrospective study of the records of children aged 0 to 15 years admitted to the pediatrics department

between January 1st, 2017 and December 31st, 2019, i.e., (36 months), for severe malaria with a biologically confirmed renal complication.

Data were collected on a survey form after verbal consent from the parent and/or guardian. The variables studied were epidemiological: age, sex, time to consultation, clinical: reason for consultation, signs of examination, paraclinical: RDT, thick drop (GE), Uremia, creatinemia, ABO grouping, RH, haemogram, treatment and evolution. The data collected were entered and analyzed using SPSS version 22 software.

The Chi-square test was used to compare categorical variables. The value of $p < 0.05$ was considered statistically significant. Data confidentiality has been respected.

3. Result

3.1. Socio-Demographic Characteristics

During the study period, 46 cases of patients hospitalized for severe malaria with renal complications were recorded out of 4956 patients hospitalized for malaria, representing a frequency of 0.9%. The age group 06 to 12 years was the most represented (65.2%), with an average age of 109.2 ± 36 months and extremes of 08 months and 15 years. 78.3% were male, with a sex ratio of 3.6. Nearly half the patients were referred by a CSRéf (41.3%) (Table 1).

Table 1. Epidemiological characteristics.

Features		Workforce (n = 46)	%
Age (months)	Average	109.2 ± 36	
	1 - 11	01	2.2
	12 - 60	05	10.9
	61 - 72	30	65.2
	>72	10	21.7
Gender	Male	10	22
	Female	36	78
Reference	CSRéf	19	41.3
	Cscom	02	4.3
	Medical practice	07	15.2
	Hospital	04	8.3
	Brought by his parents	14	30.4

3.2. Clinical and Characteristics

Severe malaria was the main reference ground with 45.7% and the others were anuria 37%, renal failure 4.3% and anemia 4.3% (Table 2). The neurological phenotype accounted for 56.5%, anemia 34.8%. Confirmation by a positive thick drop accounted for 73.9% of patients, while the malaria rapid diagnostic test was positive in 56.5% (Table 3). The majority of patients (71.7%) had a creatinine value greater than 265 µmol/l (Table 4), mean creatinine was 760.64 µmol/l with extremes of 19 and 2177 µmol/l. Mean blood urea was 79.29 ± 19.19 mmol/l with extremes of 10 mmol/l and 125 mmol/l.

Table 2. Reference pattern.

Reference pattern	Workforce	%
Severe malaria	21	45.7
Dyspnea	02	4.3
Renal insufficiency	02	4.3
Anuria	17	37
Convulsion	01	2.2
Anemia	02	4.3
Other	01	2.2
Total	46	100

Table 3. Biological confirmation of malaria.

Biological test	Workforce	%
Positive RDT	26	56.5
Negative RDT	05	10.9
GE positive	**34**	**73.9**
GE negative	03	6.5

Table 4. Biological confirmation of renal failure.

Creatinine/µmol/L	Number	%
< 265	13	28.3
> **265**	**33**	**71.7**
Total	46	100

3.3. Features

Conventional treatment was used in 52.2% of cases prior to hospitalization. Inpatient medical treatment was artesunate in 100% of patients, furosemide in 87% and blood transfusion in 43.7%, while 17.4% of patients received dialysis (Table 5).

Table 5. Treatments received.

Treatment	Number n = 46	Percentage
Antipyretic (paracetamol)	18	39.1
Antibiotics	33	71.7
Transfusion	20	43.5
Dialysis	08	17.4
Furosemide	40	87
Artesunate	46	100

3.4. Evolving Features

The mortality rate was 50% (Figure 1). Patients who died or were transferred to nephrology ranged in age from 6 to 12 years. Patients referred for anuria accounted for 75% of deaths. More than half the patients who died (57.6%) had a creatinine level well above 265 µmol/l (***p* = 0.034**). Patients who died or were transferred to nephrology had blood urea values well above 60 mmol/l.

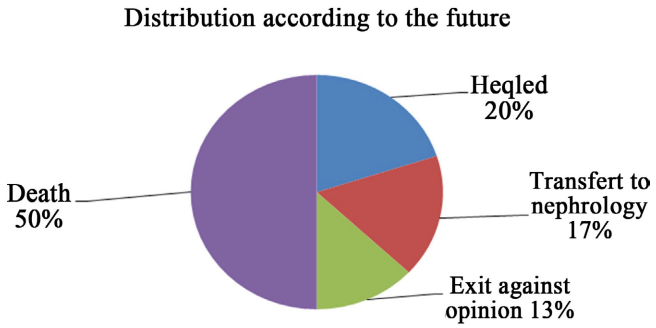

Figure 1. Patients by outcome.

4. Discussion

The incidence of renal complications of malaria in children was 0.9% (46/4956). Prevalences as low as ours have been found in other series, ranging from 0.56% to 0.7%, reported respectively by Essola L *et al.* in Gabon [9] and Lalya F *et al.* in Benin [10]. Higher rates were reported by N. Yannick *et al.* [11] in Burkina Faso (1.79%) and Kunuanunua *et al.* [12] in the Democratic Republic of Congo (11.4%). In our study, the sex ratio was 3.6. This value is higher than that of Yannick N *et al.* [11] in Burkina Faso and Lalya F *et al.* [10] in Benin, who found a sex ratio of 1.62 and 1.4 respectively. The mean age of patients was 109.2 ± 36 months, with extremes of 08 months and 15 years. This is comparable to that of Essola L *et al.* [9] in Gabon (102.7 ± 67.7 months). On the other hand, the mean age in our study is lower than that reported by Ibadin *et al.* [13] in Nigeria (134.4 ± 11.64 months). In our study, malaria was confirmed by thick drop (73.9%) and RDT (56.5%). Our results are superior to those of Yannick N *et al.* [11] and Keita Y *et al.* [14], who found confirmation by GE at 37.7% and 41.8% respectively. On the other handSamaké Z [15] in commune II of Bamako and Diallo Y in commune V of Bamako [16] found 79.35% and 94.3% respectively of positive RDT. Biological anemia was noted in all cases of renal failure. This result is comparable to that found by Yannick N *et al.* [11] in Burkina Faso in their study. In our study, the mean blood urea level was 79.29 ± 19.19 mmol/l, with extremes of 10 mmol/l and 125 mmol/l. This level is higher than that of Essola L *et al.* [9], who found a mean of 40.6 ± 10.4 mmol/l with extremes of 3.4 mmol/l and 72.8 mmol/l. The majority of patients who dialyzed or died had blood urea values well above 60 mmol/l. The mean creatinine level in patients with renal failure in our study was 760.64 µmol/l, with extremes of 19 and 2177 µmol/l. This result is higher than that of Essola L *et al.* [9], which was 572.4 µmol/l ± 434.5 µmol/l with extremes of 195 µmol/l and 1461 µmol/l. On the other hand, Yannick N *et al.* [11] found a mean creatinemia of 1153.7 ± 727.97 µmol/l higher than in our study.

As our department has no hemodialysis unit, parents must be referred to a third referral hospital located some ten kilometers away, and almost all parents had a low socioeconomic level, which is why only 17.4% of patients received hemodialysis. On the other hand, Maiga I *et al.* [17] Kunuanunua *et al.* [12] recorded higher hemodialysis rates, with 51% and 23.6% respectively, while Lalya *et al.* [10] ob-

tained 3.7%. In our study, the majority of patients who underwent dialysis or died had creatinine values well above 265 µmol/l. In our study, paracetamol was the most widely used antipyretic, accounting for 39.1% of cases, and 43.5% of our patients received a blood transfusion. This result is lower than that of Samaké Z [15], who found that 81.6% of patients benefited from antipyretics. The diuretic chosen was furosemide in 87% of cases. Furosemide administration is most common in poorly equipped environments [2] [10] [19]. Half of our patients (50%) died, and all were aged between 6 and 12 years. Our death rate is higher than those of Nyangui BM [20] in Point G and Keita Y *et al.* [14] in Senegal, who recorded 16.2% and 12.6% deaths respectively. This high case-fatality rate is thought to be due to delayed diagnosis, the low hemodialysis rate and the low availability of blood products in our mini blood bank to manage cases of anemia.

5. Conclusion

Renal complications of severe malaria are frequent in our department, with a high mortality rate. Acute renal failure in severe malaria is a rare complication in children. Its occurrence can be life-threatening, especially in the absence of emergency extra-renal purification.

Conflicts of Interest

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

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