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# Study of Malaria in Patients Operated on at the Reference Health Center of Commune I Bamako

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## Abstract

Malaria is a febrile and hemolyzing erythrocytopathy due to the development and multiplication of one or more of the five plasmodial species dependent on humans: *Plasmodium falciparum*, *P. malariae*, *P. ovale*, *P. vivax* and *P. knowlesi*. These parasites are inoculated into humans by the infective bite of a female mosquito, female anopheles of the genus Anopheles, during a blood meal. The study aimed to: determine the frequency of fever due to malaria after surgery; describe malaria symptomatology and clinical evolution after surgical intervention; determine the average length of hospital stay for operated patients with malaria; evaluate the average cost of malaria treatment. This was a prospective study which involved 110 operated patients, which took place over a period of 12 months from March 2017 to February 2018 in the general surgery department at the Reference Health Center of commune I of the Bamako district. The frequency of malaria was 11.82% before the intervention and 3.64% after the intervention, with an average age of 29.80 years; extremes of 2 years and 76 years and a sex ratio of 1.5 in favor of the male sex. The main clinical signs were fever (38.18%), headache (20.91%) and vomiting (36.36%) and physical asthenia (18.18%). Diagnosed and treated early, malaria progressed favorably. The outcome was simple for all our patients and we did not record any deaths. The cost of treatment was borne by the patients and/or their families. The average cost of treatment was 7915 CFA francs, significantly below the Malian minimum wage which is around 30,000 FCFA. The implementation of preventive measures is necessary to reduce the importance of malaria in hospitals: staff awareness, indoor spraying, use of impregnated mosquito nets.

## Keywords

Malaria, Plasmodium, Surgery, Fever, Thick Gout, Rapid Diagnostic Test

## 1. Introduction

Malaria or malaria is a febrile and hemolyzing erythrocytopathy due to the development and multiplication of one or more of the five plasmodial species dependent on humans: *Plasmodium falciparum*, *P. malariae*, *P. ovale*, *P. vivax* and *P. knowlesi* by a female Anopheles mosquito during a blood meal [1].

According to the WHO in 2017, 219 million cases of malaria in 87 countries, or 3 million more cases than in 2016 (443,000 deaths in 2017). In 2019, the number of malaria cases is estimated at 229 million in 87 malaria-endemic countries and that of deaths at 409,000, 67% of which concern children under 5 years old [2].

In Europe: Imported pathology due to immigration and tourism [3].

In Africa: In Dakar, Senegal, the prevalence rate in 2013; 2.8% compared to 1.2% from 2014 to 2015 [4].

In Mali in 2007, 2 cases of post-operative malaria attack out of 120 patients [5]. KEITA K recorded 2.3% cases of postoperative malaria in 1996 [6]. Malaria is rampant throughout Mali, responsible for 34% to 39% of reasons for consultation in health services. It is the leading cause of morbidity (15.6%) and mortality (13%); severe anemia observed in pregnant women and children under 5 years of age in tropical areas [7].

In a surgical setting, the diagnosis of malaria arises from a post-operative fever for which no cause has been found on clinical examination and bacteriological examinations according to Vitris *et al.* in 1991 [8]. Classically, the occurrence of an attack of malaria complicating a surgical procedure is feared by many surgeons. The diagnosis is confirmed by biological examination [5].

Treatment is based on the strategy of the national malaria control program [9].

Specialists in current practice have the choice between systematic chemoprophylaxis or waiting for symptoms suggestive of an attack before treating it.

To better understand the problem, we are considering this study which aims to:

—determine the frequency of cases of fever due to malaria after surgery;

—describe the malaria symptomatology and the clinical course after the surgical procedure;

—determine the average length of hospital stay for patients;

—determine the cost of care.

## 2. Materials and Method

This work was carried out in the Reference Health Center of commune I of the District of Bamako which has a surgery department.

This was a prospective cohort study which consisted of monitoring the occurrence of malaria attacks after surgical intervention. This study took place over a period of 12 months from March 2017 to February 2018 in the general surgery department at the Reference Health Center of commune I (CS Ref CI).

We carried out an exhaustive recruitment of all patients meeting our inclusion criteria: any patient and of any age who gave their verbal consent to participate

in the study and who had undergone surgery under general anesthesia, local regional or local anesthesia in the service; patients with no history of taking antimalarial medication.

Malaria attack is defined as any case of thick blood positive for *Plasmodium falciparum* and or any other species of plasmodium in an operated patient associated with at least one of the following clinical signs: Fever (uncorrected temperature ≥ 37.5˚C), chills, sweat, asthenia, body aches, headache, nausea and vomiting, abdominal pain, diarrhea, conjunctival pallor, jaundice, convulsion, coma.

The data were collected on a survey form including sociodemographic data variables (age, sex, nationality, address, ethnicity and length of hospitalization); clinical and para-clinical parameters (functional signs, general signs, physical signs, additional examinations) and the cost of malaria treatment. The patients were followed over a period of 7 days after the initiation of treatment with a check on D7 by doing the thick smear (GE) and the rapid diagnostic test (RDT).

All patients recruited received a paraclinical examination: a rapid diagnostic test, a thick film taken on each patient on days D0, D3 and D7, grouping/rhesus and hemoglobin level. [7]

The data were entered and analyzed using the EPI INFOS version 7.2.1.0 software and the Chi2 test was used with a significance threshold of $p < 0.05$.

Verbal consent was obtained from each patient before blood samples were taken for diagnosis. The reasons for the samples were clearly explained to the volunteers.

The information collected for each patient was entered in a file bearing an identification number guaranteeing anonymity. For safety reasons in relation to certain communicable diseases, in particular HIV and hepatitis B, when handling blood samples, certain safety provisions have been implemented.

Taken: wearing gowns and gloves; decontamination of contaminated products and equipment used; the use of safety boxes and waste incineration.

## 3. Results

The study involved 110 patients screened from 509 surgical procedures, of which 13 patients had a positive thick smear, *i.e.* 11.82%. The age group of 16 - 30 years (44.55%) was the most represented, followed by 0 - 15 years (30%). The average age was 29.8 years and extremes of 2 years and 76 years. (**Table 1**)

The sex ratio was 1.5 in favor of the male sex. 36.36% of our patients were operated on between November and February, which corresponds to the period when malaria transmission ends (**Table 2**). Vomiting and fever were the most common manifestations.

Malaria represents 30.95% of fevers. (**Table 3** & **Table 4**)

Laparotomy (peritonitis and occlusion) was the most frequent type of intervention; others: anal fistula, anal fissure, back and breast tumors, Cystocele, goiter. (**Table 5**)

**Table 1.** Distribution of patients by age and sex.

| Sociodemographic data | | Number | Percentage |
|---|---|---|---|
| Age | 0 - 15 | 33 | 30 |
| | **16 - 30** | **49** | **44.55** |
| | 31 - 45 | 8 | 7.27 |
| | 46 - 60 | 7 | 6.36 |
| | >60 | 13 | 11.82 |
| Sex | Male | 67 | 61 |
| | Feminine | 43 | 39 |
| Total | | 110 | 100 |

**Table 2.** Distribution of patients according to the intervention period.

| Period | Effective | Percentage |
|---|---|---|
| March-June | 36 | 32.73 |
| July-October | 34 | 30.91 |
| November-February | **40** | **36.36** |
| Total | 110 | 100 |

**Table 3.** Répartition des malades en fonction des manifestations cliniques du paludisme.

| Clinical manifestations | Effective | Frequency |
|---|---|---|
| Headache | 23 | 20.91 |
| Vomiting | **40** | **36.36** |
| Anorexia | 20 | 18.18 |
| Fever | **42** | **38.18** |
| Dehydration | 25 | 22.73 |

**Table 4.** Distribution of patients with fever according to etiology.

| Etiologies | **Jo** | **J3** | **J4** | **>J8** | Number | Frequency |
|---|---|---|---|---|---|---|
| parietal suppuration | 0 | 0 | 1 | 4 | 5 | 11.9 |
| Urinary tract infection | 0 | 0 | 0 | 2 | 2 | 4.76 |
| Respiratory infection | 0 | 2 | 0 | 0 | 2 | 4.76 |
| Malaria | **9** | **0** | **0** | **4** | **13** | **30.95** |
| Indeterminate | 0 | 20 | 0 | 0 | 20 | 47.62 |

**Table 5.** Distribution of patients according to the type of intervention.

| Type of intervention | Effective | Percentage |
|---|---|---|
| Peritonitis | **16** | **14.55** |
| Occlusion | **16** | **14.55** |
| Appendiceal abscess | 13 | 11.82 |

**Continued**

| | | |
|---|---|---|
| Umbilical hernia | 10 | 9.09 |
| Scrotal inguinal hernia | 8 | 7.27 |
| Pelviperitonitis | 5 | 4.55 |
| Pyo ovary | 5 | 4.55 |
| Hydrocele | 5 | 4.55 |
| Acute appendicitis | 4 | 3.63 |
| Parietal abscess | 4 | 3.63 |
| Prostate adenoma | 4 | 3.63 |
| Hemorrhoid | 3 | 2.72 |
| Fibroma | 2 | 1.82 |
| Digestive tumors | 2 | 1.82 |
| Ovarian Cyst | 2 | 1.82 |
| Others | 11 | 9.99 |
| Total | 110 | 100 |

The majority of thick films came back positive during the July-October period. We recorded 8.18% malaria before the intervention and 3.64% on D7, for an overall frequency of 11.82%. (Table 6 & Table 7)

Hospital stay: Among the 13 cases of malaria, 69.23% (9/13) had a hospital stay of 1 to 3 days and 30.44% (4/13) had a hospital stay of ≥8 days.

The average cost of malaria treatment was 7915 FCFA with extremes of 6600 and 30,600 FCFA. (Table 8)

## 4. Discussion

Methodological aspect: This was a prospective cohort study from March 2017 to February 2018 in the general surgery department of Cs Ref C I. Our prospective study made it possible to evaluate, follow all patients and collect data with very little bias. Malaria diagnostic tests were available every working day.

The difficulties encountered were the unavailability of the thick smear during the weekend in the CS Ref, the refusal of patients to participate in the study and certain incomplete files being rejected.

Epidemiological aspects: The frequency of malaria before and after the intervention was 11.82% (N = 110). This frequency was different from that of Tembiné in Mali in 2007 [5] and Fadl Alla Al *et al.*, 1996 in Cameroon [10] who found respectively 1.67% (N = 120), 3.46%. This difference may be linked to the health pyramid of Mali, the Reference Health Center which constitutes the health structure of first contact for surgical cases in Mali. Malaria cases were more frequent from October to December (9.7%) which corresponds to the period of end of malaria transmission in Bamako where cases of malaria in general are very frequent. This result was higher than that of Tembiné I., 4.7% (2/43) in the October-December period [5].

**Table 6.** Results of the thick blood smear and the rapid diagnostic test before the intervention and on day 7.

| GE and TDR results | | Period | | | |
|---|---|---|---|---|---|
| | | Before intervention | | J7 | |
| Research techniques | | Effective | Percentage | Effective | Percentage |
| GE | Negative | 101 | 91.82 | 101 | 96.36 |
| | Positive | **9** | **8.18** | **4** | **3.64** |
| TDR | Negative | 101 | 91.82 | 108 | 98.18 |
| | Positive | **9** | **8.18** | **2** | **1.82** |

**Table 7.** Distribution of patients according to the period of intervention and the result of the thick smear.

| Intervention period | Tick drop Positive Number Percentage | | Negative Workforce Percentage | |
|---|---|---|---|---|
| March-June | **4** | **30.77** | 32 | 32.99 |
| July-October | **9** | **69.23** | 25 | 25.77 |
| November-February | 0 | 0 | 40 | 41.24 |
| Total | 13 | 100 | 97 | 100 |

**Table 8.** Estimated cost of care.

| Drugs | estimated cost | Effective | Total |
|---|---|---|---|
| Quinine + serum glucose 10% | 6000 | 8 | 48,000 |
| Artesunate protocol | 30,000 | 5 | 150,000 |
| Artemether + lumefantrine in relay | 600 | 13 | 7800 |
| Total | 36,600 | 26 | 205,800 |

Clinical characteristics of patients: Vomiting was the most frequent functional sign with 36.36%. This high frequency could be explained by the surgical attack and the effect of the anesthetic product (Alfonsi, 2003) [11]. Headaches were also common at 20.91%. This frequency could be explained by spinal anesthesia or epidural, linked to a leak of cerebrospinal fluid into which the drugs are injected, which induces a drop in intracranial pressure (Alfonsi, 2003) [11].

Fever is one of the most common general signs of malaria. In our study, 42 patients had a fever, *i.e.* 38.1%, including 13 cases of positive thick drop (30.9%). Among the 120 patients sampled by Tembiné I. in Bamako in 2007, 25 had a fever or 20.8% of which one person had a positive thick film or 4% [5] [12]. This difference could be explained by the type of surgical intervention and the location of the study.

Our result is comparable to that of Fadl Alla Al *et al.* in Cameroon in 1996 [10], which found 94 cases of fever or 36.1% including 9 cases of positive thick drop or 9.6%. The undetermined causes of fever were the most frequent 47.62%

(20/42) and they mainly occurred within 72 hours following the surgical procedure. We have not carried out bacteriological research in these cases of fever. We believe that this is due to the prerogative of underlying pathologies given the emergency context of the care of many of our patients. The other causes were dominated by parietal infections 11.9% (5/42), urinary 4.76% (2/42), 4.76% (2/42) respiratory. This shows that malaria should not be systematically considered as the cause of postoperative fever without parasitological proof even though we are in a malaria endemic area. These observations are consistent with those of Vitris *et al.* in 1991 in Cameroon [8] and Tembiné in 2007 in Mali [5] who respectively observed 90% and 96% of postoperative fevers not linked to malaria.

Alteimeier classification: 43.6% (48/110) of patients were Alteimeier I. This result does not differ from those of Tembiné I., 52.5% (63/120) (P = 0.1790) [5] and Keïta K., 40.5% (88/215) (P = 0.5830) [6]. In our series 40.9% (45/110) were Alteimeier IV, explained by the high number of surgical emergencies.

ASA classification: The majority of our patients (75/110) were operated on under general anesthesia, *i.e.* 68.18% of the sample studied. This result does not differ from that of Keïta, 78.1% (168/215) with P = 0.0504. On the other hand, Tembiné I. in Mali found 88.3% (106/120) [5] of which there is a statistically significant difference with P = 0.001, thanks to the systematic indication of general anesthesia in goiter surgery. (most frequent reason for intervention) in his series.

Laboratory tests: Antigenic RDT was systematic in our study before and after the operation [13] [14] [15] [16]. Its use is simple and fast and a valuable contribution in isolated post. The frequencies were 8.2% before the intervention and 1.8% after the intervention. The 8.2% had received anti-malarial treatment immediately postoperatively. The presence of 1.8% of positive RDTs in patients without malaria on admission could be explained by the long period of hospitalization of these patients with a possibility of hospital infection and the lack of use of mosquito net impregnated with malaria. In endemic areas, the strategy for using RDTs in the diagnosis of malaria makes it possible to avoid the systematic use of presumptive treatment, which contributes to the selection of resistant strains of P. falciparum.

Thick smear: The frequency of positive thick smear in our study before the intervention was 8.18% (9/110). This result does not differ from that of Takongmo S. et al, in 1993 [13] who found 8%, but higher than that of Tembiné I. who found 0.8% (1/120) [5]. This difference could be explained by the fact that our study was carried out in a first contact surgical center.

The frequency of thick smear results in our study after the intervention was 3.64%. This result does not differ from that of Tembiné I. [5] who found 0.8%, but lower than that of Takongmo S. *et al.* [13] who found 15% (12/80) (p = 0.0053). This difference is explained by the fact that their study aimed to assess the importance of surgery as a triggering factor for malaria. It compares the prevalence rates of malaria in a group of patients preoperatively and postopera-

tively.

Thick smear, a WHO reference test, was widely used for routine diagnosis [2] [17] [18] [19] [20] [21].

Treatment: We noted 13 cases of malaria attack (9 cases on the day of the operation and 4 cases after postoperative day 7), managed as a serious and complicated form of malaria with quinine salts. In our study, we used the dosage of 24 mg/kg/day for 3 days by intravenous infusion then oral relay based on CTA (artemether + lumefantrine) for 3 days. Diagnosed and treated early, malaria always evolves favorably. We did not record any cases of treatment failure or death linked to postoperative malaria, as did Tembiné I. and Keita K. [5] [6].

Classically, the occurrence of an attack of malaria complicating a surgical procedure is feared by many surgeons. Specialists in current practice have the choice between systematic chemoprophylaxis or waiting for symptoms suggestive of an attack before treating it. In France, clinical cases of severe postoperative malaria have been described: a pernicious attack in a subject originating from an endemic area by Marsepoil *et al.* in 1984 [3], another case of transfusional malaria by Gaillard *et al.* in 1988 [14].

In countries with high malaria endemicity, few studies have been carried out to assess the real role of malaria in the etiology of postoperative febrile syndrome. Some African authors report that malaria is a permanent and significant risk in the event of surgery in a tropical environment and recommend chemoprophylaxis during major interventions: Takongmo *et al.* in 1993 in Cameroon [13]; Longombe *et al.* in 1989 in Zaire; Djibo *et al.* in 2001 in Niger [22] and Anteyi *et al.* in 2003 in Nigeria [23].

However, other authors minimize this risk Diako *et al.* in 1994 in Bobo- Dioulasso [24], in Burkina Faso, Keita K. in Bamako in Mali in 1996. In Mali, very few studies have been carried out in a surgical environment: according to Keita K. (1996), the frequency of malaria in a surgical setting was 2.3% and Tembiné I. in 2003 [5] [6].

The cost of post-operative malaria management is comparable to that of malaria treatment in Mali.

At the end of this study, we note the low frequency of malaria in surgical settings and the possibility of hospital infection of malaria. It is a serious pathology that can lead to postoperative complications when diagnosis is late. Treatment is based on quinine salts, artesunate and CTA after a biological diagnosis by thick blood smear or rapid diagnostic test. Preventive measures must be taken: raising staff awareness of the existence of the occurrence of malaria following surgery; regular spraying of healthcare facilities against mosquitoes during the transmission season; use of impregnated mosquito nets.

## 5. Conclusions

Malaria is an endemic disease in Mali, especially in the Sudano-Sahelian zone, a public health problem. The main signs identified were fever, headache, vomiting

and physical asthenia. Hospital infection of malaria is possible but the frequency was low in our series. Seriously, malaria can lead to postoperative complications when the diagnosis is late.

Diagnosis was based on positive thick blood and TDR justifying treatment with quinine salts, artesunate and CTA.

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## Conflicts of Interest

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

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