

Original Research Article

Short Term Outcome of Malaria at Rwanda Level 2 Hospital Bria in Central African Republic: A Cross-sectional study

Abstract

Background: Malaria has been recognized as a disease affecting peacekeeping forces serving in malaria endemic countries. We wanted to determine the short term outcome of malaria at Rwanda Level 2 hospital.

Methods: Malaria cases were prospectively reviewed and followed at Rwanda Level 2 hospital Bria in Central African Republic for a period of three months. Clinical, laboratory, treatment and short outcome findings were analyzed.

Results: 102 patients with positive rapid diagnostic test and blood smear were reviewed, prevalence rate was 14.97 %, mean age of 37.77 ± 8.4 years and male presented with 91.2%, male sex ratio of 10,3:1. Headaches, body weakness, joint aches, muscle aches, chills and fever presented respectively 98%, 89.2%, 84.3%, 81.4%, 61.8% and 49%. Digestive symptoms were presente anorexia, nausea, abdominal discomfort and vomiting 41.2%, 37.2 %, 31.4% and 8.8% respectively. Plasmodium falciparum was found in 98%, associated with vivax in 1% and isolated vivax in 1%. High parasitemia of 1 to 10 parasites per thick field was found in 8.8%. Malaria recurrence rate was 13.7% with a duration period mean of 38.92 days (range 20-82 days). 35.71% had recurrent within thirty days. 82.4 % of patients received tablets Artemether-lumefantrine. This Hyparasitemia was associated respectively with nausea $p=0.013$, OR=5.9, 95% (1.3 - 26.93) and anorexia $p=0.003$ OR=11.43, 95% (1.43-87.99). Clinical and laboratory findings post treatment showed a strong statistical association.

Conclusion: Malaria is prevalent at Bria; multitudes of symptoms and sign have been documented. Post treatment clinical and laboratory findings showed efficacy of treatment.

Keywords: Malaria, Outcome, Rwanda Level 2 Hospital

1. Introduction

Malaria is a life-threatening disease caused by parasites that are transmitted to people through the bites of infected female *Anopheles* mosquitoes, the most deadly, and it predominates in Africa. It remains an important health threat to non-immune travelers with the explosive growth of global travel and affecting peacekeeping forces serving in malaria endemic countries [1-4].

The human-pathogenic *Plasmodium* species shows preponderance of *P. falciparum* in tropical Africa, while *P. vivax* prevails over *P. falciparum* in South America. Both *P.falciparum* and *P. ovale* are prevalent in South-Eastern Asia and Western Pacific. Although *P.malariae* may occur in all malarious areas, its prevalence is generally low. *P. ovale* is widespread principally in tropical Africa whereas *P. knowlesi* infection occurs in certain forested areas of South-Easter Asia [5].

Although severe malaria is more often seen in cases of *P. falciparum* infection, complications and even death have been reported in non-falciparum malaria as well [6].

It is manifesting as a multitude of symptoms, degrees of severity and indirect morbid consequence and accuracy of a clinical diagnosis varies with the level of endemicity, malaria season, and age group [7-9].

There were an estimated 219 million cases of malaria (154–289 million) and 660 000 deaths (range 610 000–971 000) in 2010 [1,5].

In 2015, the region was home to 88% of malaria cases and 90% of malaria deaths Sub-Saharan Africa continues to carry a disproportionately high share of the global malaria burden [1].

The Security Council established the United Nations Multidimensional Integrated Stabilization Mission in the Central African Republic (MINUSCA) by its resolution 2149 (2104) on 10 April 2014 [10]. Rwanda Level 2 hospital is the UN hospital, which serves UN personnel based in Eastern headquarter. It is staffed with surgeons, anesthetists, gynecologist, internist physician, pediatrician, general practitioners, nurses, dental therapists, psychologist and physiotherapist.

1. Materials and Methods

This was a cross-sectional prospective study on malaria cases received from outpatient department and admitted from April to July 2017. Were included all patients whom clinical and laboratory findings confirmed malaria infection among people having facility to this hospital. Post treatment, patients were followed for clinical and laboratory examinations.

Proposal was submitted and approved by Rwanda Level 2 ethical committee.

Data were entered in the computer programme Statistical Package for the Social Sciences (SPSS) software version 16.0 and were analyzed both with the aid of the computer programme SPSS and Microsoft Excel.

Descriptive statistics were used for frequencies, mean, and analytical statistics being used for cross tabulations, 95% confidence intervals applied as necessary. Comparison of means and proportions were done.

The statistical test Pearson's Chi-square was computed only for 2x2 tables with cells which had expected count more than 5 and those having expected count less than 5, Fisher's Exact Test was used. McNemar test was applied for qualitative variables and Paired Samples t-test used on quantitative ones for comparison and the limit of significance was established at $p < 0.05$.

1. Results and Discussion

3.1. Results

102 patients met our inclusion criteria with a prevalence rate of 12.22 %. Male sex ratio of 10.3:1 with a mean age of 37.77 ± 8.4 years. The median (middle) was 38 years and minimum age was 22 years, maximum being 60 years.

98% presented headaches, 89.2 % Body weakness, 84.3 % joint aches, 81.4 % myalgia, 61.8% chills, 41.2 % anorexia, 37.3% nausea, 31.4 % had abdominal discomfort and 8.8 % presented vomiting.

Plasmodium falciparum was found in 98 % of cases and 1% presented both falciparum associated with vivax, 1% was found to have isolated Vivax. 79.4 % of all patients had 1 to 10 parasites per 100 fields, 11.8 % had 11 to 100 parasites per 100 fields, 2.9 % presented 1 to 10 parasites per field and 5.9 % had more than 10 parasites per field.

13.7 % of this cohort had another malaria episode after recruitment due to *P. falciparum*. 82.4 % were treated with Artemether 20 mg and Lumefantrine 120 mg, four tablets bid for 72 hours and on fourth day analyze of blood smear was obtained. 12.7 % had IV artesunate for 24 hours; blood smear control was obtained then complete with Artemether 20 mg and Lumefantrine 120 mg four tablets bid for 72 hours. 3.9 % had IV quinine for 48 hours; blood smear control was obtained then complete with quinine per os for five days. The one with quinine per os had blood smear control on eighth day. After the completion of treatment, clinical examination was obtained.

A morbidity of three days counted for coartem, four days for artesunate and coartem and seven days for quinine was noted. The mean was 3.32 days which patient spent taking treatment for a total of 339 days.

After completing anti malaria drugs, patients followed had 67.6 % of headaches, 53.9% of body weakness, anorexia of 27.5%, abdominal discomfort of 4.9 %, nausea of 3.9 %. 100% of patients had no chills neither vomiting.

There was no association between male or female and presenting high or low parasitemia, $p=0.407$.

There was a strong association $p=0.013$ between presenting high parasitemia and nausea. And those presenting nausea had a risk of 5.9 times to be found having more than 11-100 per 100 thick fields malaria parasites. Anorexia had a strong association also with high parasitemia, $p=0.003$, $OR=11.43$

Fourteen patients had recurrent malaria where 35.71% had malaria before completing thirty days, 37.71% got it between 30-45 days. The mean days of recurrence were 38.92 days.

There was significance proportions and mean regression of symptoms and signs of malaria after a short term follow up, where some symptoms completely disappeared after immediate treatment. **Table 1**

125

Table 1

126

Variables		Group 1a		Group1b		Diff. of proportions		Chi-square		P-value	
Headaches		98%		67.60%		0.3		29.032		p<0.001	
Body Weakness		89.20%		53.90%		0.35		21.814		p<0.001	
Joint aches		84.30%		2.90%		0.81		81.012		p<0.001	
Muscles aches		81.40%		2%		0.79		79.012		p<0.001	
Chills		61.80%		0%		0.62		61.016		p<0.001	
Anorexia		41.20%		27.50%		0.14		4.024		0.045	
Nausea		37.30%		3.90%		0.33		32.029		p<0.001	
Abdominal discomfort		31.40%		4.90%		0.26		21.806		p<0.001	
Vomiting		8.80%		0%		0.09		Binominal distrib.		0.004	
Blood smear		Positive		Negative		1		100.01		p<0.001	
						95% CI of difference					
Variable	Mean 1	Mean 2	Diff. of Means		Lower		Upper		t	df	p-value
Fever1-Fever2	37.604	36.417	1.1873		1.0106		1.3639		13.332	101	p<0.001

127

128

129

130

131

132

133

134

135

136

137

138

139

140

141 5. DISCUSSIONS AND CONCLUSION

142 5.1. Discussion

143 In this study, hundred and two malaria cases have been diagnosed, treated and followed
144 at Rwanda Level 2 hospital Bria in Central African Republic for a short period.

145 Male sex ratio was 10,3:1 where males represented 91.2%.

146 In the different other studies found high prevalence in males. *Sumadhya D et al.* (2016)
147 [11], found 98.4%, *Barbara E et al.* (2011-2012) [12] found 84 %, *Muhammad I et*
148 *al.*(2014-2015) [13]. found 88.6%, *Fabien Sauvet et al.* (2006) found 97.39%[14]. This is
149 obviously due to the very small number of females deployed in peacekeeping missions
150 compared to males.

151 Our patients' age was between 22 and 60 years old with a mean of 37.77 ± 8.396 . These
152 results are similar to results found by below other authors: [13] found that peacekeepers
153 with skin diseases were aged form 20 to 60 years. Regarding our mean age of 37.77
154 years, [9] found that troops aged between 20-40 years constituted 96.3%.

155 In this study, symptoms and signs dominated by headaches, body weakness, joint aches,
156 muscles aches were quietly comparable to those found by L. Sanchez et al. [15]. The
157 difference being due to sample size. **Table 2**

158

	Our study =102		L Sanchez et al. =38	
	Number	%	Number	%
Headaches	100	98	30	79
Weakness	91	89.2	13	34
Fever (° C)	50	49	30	79
Joint aches	86	84.3	3	8
Muscle aches	83	81.4	2	5
Nausea/vomiting	47	46	5	13
Anorexia	42	41.2	1	3

Plasmodium falciparum was prevalent at 98% and associated or not with *P.vivax* in 2%. These results are similar to those found by [11] where descriptive statistics of the malaria attacks during deployment of military in endemic overseas territories found a rate of (n=44); where *P. falciparum* was found to be prevalent with 22.7% and *P. vivax* with 13.6%; they found also that not recorded of 63.7% in 44 malaria attacks.

In this study, patients had a minimum time of treatment of three days up to seven days. A morbidity of 3.22 days loss (out of work) was found during this study for a total of 339 days. These results are comparable to the result found by [3] in the last century, malaria historically caused greater loss of manpower than combat-related injuries during deployments to tropical regions. This study found that there is no association between sex and parasitemia neither age with parasitemia $p=0.407$ and $p=0.939$ respectively. These results are similar to those found by Hassan Ali et al. where they found that malaria parasite density was not related to age, gender and hepatosplenomegaly [16].

Our study found a malaria recurrence mean of 38.92 days (20-82 days), where 35.71% had malaria before 30 days, 37.71% got it between 30-45 days, 14.29% got it between 46 to 60 days and 14.29 % had it after 60 days. These results are superposable to those of Yehenew A. Ebstie et al (2015), where it is reported that only 1.5 % of participants were shown late parasitological failure between seventh and 14th day follow up and 1.3 % were free from anemia at the end of follow-up [17].

The study found an association between parasitemia of more than 2+ parasites, $p=0.013$, OR=5.9 95% CI (1.3 - 26.93). There is a relative risk of 5.9 to have parasitemia of more than 2+ when you presente nausea due to malaria. There was also association between presenting anorexia due to malaria with parasitemia of more than 2+ parasites $p=0.003$, OR= 11.43 95% CI (1.43-87.99).

Regarding comparison of clinical manifestations of malaria before and after the treatment, this study found that all presented symptoms and sign of our patients had significantly decreased with positive proportions, means and significant probabilities less than 0.05 as shown in the comparative table with free from parasitemia. These results are

similar to those found by [17] (2015), among 130 participant in the study, 60% were males and 96.1% participants were free from parasitemia at day 3. At the end of the study, 98.5% of participants showed adequate clinical and parasitological response of the drug.

Artemisinin derivatives were used in 95.1% in this study, and showed a good outcome from clinical and laboratory results. These findings are similar those of Houston S, Houston A (2015), where Artemisinin derivatives are currently the mainstay of antimalarial treatment throughout the world. Their implementation, along with expanded use of insecticide-treated bed nets, accounts for a large part of the reduction in malaria deaths in Africa over the past decade [18].

This study found that two patients had malaria while were on prophylaxis of Lariam and doxycycline. These findings are correlated to this statement where Prophylactic and clinical failures of doxycycline against *P. falciparum* have been associated with both inadequate doses and poor patient compliance. However, resistance can also explain failures of prophylaxis [19].

5.2. CONCLUSION

Malaria is still considered as global morbidity health problem and major killer. It is prevalent in Bria area; where multitude of symptoms and sign some associated with parasitemia and mixed species of *Plasmodium* have been proved.

The association between high parasitemia, nausea and vomiting has been documented. Artemisinin derivatives showed good clinical and laboratory outcome. There was a significant immediate decrease of symptoms and sign after treatment. An average of 3.32 days malaria morbidity was found.

References

- [1] **Fact Sheet: World Malaria Report 2016.** 13 December 2016 Available at <http://www.who.int/mediacentre/factsheets/fs094/en/>. Accessed 26 Jul 2017
- [2] **Dawit G Ayele, Temesgen T Zewotir and Henry G Mwambi (2012):** Prevalence and risk factors of malaria in Ethiopia. *Malar Journal* 11: 195.
- [3] **Nimfa Teneza-Mora, Joanne Lumsden, Eileen Villasante (2015):** A malaria vaccine for travelers and military personnel: Requirements and top candidates, Available at <http://dx.doi.org/10.1016/j.vaccine.2015.10.004>
- [4] Centers for Disease Control and Prevention: **Anopheles Mosquitoes.** Available: <https://www.cdc.gov/malaria/about/biology/mosquitoes/>. Accessed 01/08/2017
- [5] **Malaria.** Available at <https://www.iamat.org/risks/malaria>. Accessed 1st Aug 2017(International Association for Medical Assistance to Travellers)
- [6] **Malaria Epidemiology.** By Dr Ananya Mandal, MD, Last Update: Jan 29, 2013
- [7] **Beatrice Autino, Alice Noris, Rosario Russo and Francesco Castelli.** Epidemiology of Malaria in Endemic Areas (2012). *Mediterr J Hematol Infect Dis*, 4(1): e2012060, DOI 10.4084/MJHID.2012.060
- [8] **Together against malaria Putting the parasite out of business:** Available http://www.magazine.emerck/en/innovation/Malaria/Medicines_for_Malaria_Venture.html. Accessed on 1st August 2017
- [9] **Kanani K, Amr ZS, Shadfan B, Al-Rashadan M, Bani Hani R.(2014).** A retrospective study on imported Malaria in Jordan. Malaria among Jordanian UN peacekeeping forces. *Bull.Soc.Pathol. Exot.* 107:110-114. DOI: 10.1007/s13149-014-0356-7 Epub 2014 Mar 17
- [10] **Incubation period of Malaria** <https://www.malaria.com/questions/malaria-incubation-period>. Accessed on 31st July 2017
- [11] **Sumadhya Deepika Fernando, Rahuman Booso, Priyani Dhamawardena et al.** The need for prevention and curative services for malaria when the military is deployed in endemic overseas territories: a case study and lessons learned. Fernando

et al. Military Medical Research (2017) 4:19 DOI 10.1186/s40779-017-0128-3

[12] **Barbara E. W, Wiolette Sz-F, Rebecca J.Humphrey, LTC Paul Colthirst, Alicia**

C. Guerrero et al. Risk of Dental disease Non-Battle injuries and severity of dental disease in deployed U.S Army personnel. *Military Medicine*, 180,5:570, 2015

[13] **Muhammad Irfan A, Naveed Akhtar M, Ayesha Raj, Nazia Shahzad, Tahira**

Muqaddas et al. Skin diseases among peacekeepers at United Nations and African Mission in Darfur.

Journal of Pakistan Association of Dermatologists. 2016;26 (1):53-57

[14] **Capt Fabien Sauvet, LC Christian Lebeau, Capt Stephane Foucher, Maj**

Olivier Flusain, Co JC Jouanin, Brig gen JM Debonne. Operational Impact of health problems observed during a four-month military deployment in Ivory Coast. *Military Medicine*, 174, 9:921, 2009

[15] **Col Jose L. Sanchez, Izidro Bendet, LTC Max Grogl, Jose BP Lima, LTC**

Lorin W. Pang et al. (2000). Malaria in Brazilian Military Personnel Deployed to Angola. *J Travel Med*, 7:275-282

[16] **Hassan Ali, Tasnim Ahsan, Tariq Mahmood, Syed Feroze Bakht, Muhammad**

Umer Farooq and Niaz Ahmed. Parasite Density and The Spectrum of Clinical Illness in Falciparum Malaria. *Journal of the College of Physicians and Surgeons Pakistan* 2008, Vol. 18 (6): 362-368)

[17] **Yehenew A. Ebstie, Ahmed Zeynudin, Tefera Belachew, Zelalem Desalegn and**

Sultan Suleman. Assessment of therapeutic efficacy and safety of artemether-lumefantrine (Coartem R) in the treatment of uncomplicated Plasmodium falciparum malaria in Bahir Dar district, Northwest Ethiopia: an observational cohort study: *Malar J*. 2015; 14:236

[18] **Houston S, Houston A** (2015). Screening and Treating UN Peacekeepers to Prevent

the Introduction of Artemisinin-Resistant Malaria into Africa.

PLoS Med 12(5):e1001822. doi:10.1371/ journal.pmed.1001822

[19] **Malaria Prophylaxis Failure with Doxycycline, Central African Republic,**

2014 http://wwwnc.cdc.gov/eid/article/21/8/15-0524_article, Volume 21, Number 8 August 2015