Prevalence and outcome of malaria among hospitalized children in Al Sabah Children Hospital, South Sudan

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Submitted: September 2020
Accepted: November 2020
Published: December 2020

Citation:
Tongun et al. Prevalence and outcome of malaria among hospitalized children in Al Sabah Children Hospital, South Sudan. South Sudan Medical Journal 2020; 13(5):178-181

Abstract

Background: Malaria remains a public health concern and the leading cause of mortality in children aged under five years in South Sudan. Understanding the burden of malaria in children may assist in developing a strategy for mitigating and eliminating malaria. This would contribute to attaining the Sustainable Development Goals. We planned to determine the prevalence and outcome of malaria among hospitalized children in Al Sabah Children Hospital, South Sudan.

Methods: We carried out a retrospective analysis of hospitalized children in Al Sabah Children Hospital between January to June 2020. The data for this study were analysed using Stata version 11 to calculate the prevalence and outcome of malaria among these children during the study period.

Results: A total 781 children were recruited, of whom 777 contributed to the analysis (the others were excluded because of missing data). Overall prevalence of malaria was 78% among hospitalized children. Severe malaria alone affected 28%, while 50% had severe malaria in combination with other diseases. The highest death rate was amongst children from Munuki Block (11%, p= 0.001). Severe malaria alone and in combination was the diagnosis for 58% of the children who died. Severe malaria alone contributed to 14% of deaths.

Conclusion: Malaria remains the number one cause of mortality in hospitalized children in this paediatric hospital. It predominantly affects young children, who are also at the highest risk of dying. Measures envisaged to protect children during their first five years of life are likely to have the greatest impact.

Key words: malaria, children, Al Sabah Children Hospital, South Sudan

Introduction

Malaria is a life-threatening and a serious public health problem in South Sudan.[1] It is caused by *Plasmodium* parasites that are transmitted to humans through the bites of infected female Anopheles mosquitoes. There are four parasite species that cause malaria in humans, two of these species *P. falciparum* and *P. vivax* pose the highest risk.[2]

According to the World Malaria Report of 2019, there were 228 million cases of malaria globally. The estimated number of malaria deaths were 405,000 in the same year. The World Health Organization (WHO) report showed that Africa carries a high proportion of the global malaria burden. Overall, there were 93% of malaria cases and 94% of malaria deaths in Africa.[3] In the same year, children aged under five years were the most affected accounting for 67% of all malaria deaths globally.[3] Therefore, reducing the malaria burden would contribute to progress towards achieving the Sustainable Development Goals.[4]

In neighbouring Uganda, malaria accounts for 30–50% of all outpatient consultations and up to 35% of hospital admissions.[5] Another study in 2014 reported the prevalence of placental malaria to be 6% in Tororo Hospital in

Uganda.[6] Children under five years are the most affected.[3] Malaria is identified as a major public health problem due to the major complications such as cerebral malaria, severe anaemia, black water fever, drug resistance, and recurrent infections.[7-9] These are serious complications and treatment is often ineffective but blood transfusion is available for severe anaemia and can be lifesaving.[10]

In South Sudan, mortality among the under five-year old children stands at 105/1,000 live births, with many factors interacting and contributing to the poor health of children and little access to health services.[11] These factors include two-decades of war and the recurrent civil unrest affecting infrastructure, resources allocated for health, illiteracy, knowledge and awareness about health problems including malaria and other poverty related diseases such as TB, HIV/AIDS, and diarrhoeal diseases.

The lack of data on malaria is a knowledge gap that hampers the creation of appropriate policies targeting the disease in South Sudan. This study provides baseline information to assist the health authorities in development of polices that may reduce malaria burden. We aimed to determine the prevalence and outcome of malaria among children admitted to Al Sabah Children Hospital, South Sudan.

Method

Study Design

This was a retrospective cross-sectional study of children aged 0-17 years admitted to Al Sabah Children Hospital between January and June 2020. This hospital is located in Juba, the capital city, located in Central Equatoria State. It is the only functional specialist paediatric hospital in South Sudan. The hospital receives children from all over the country as well as from within Juba. The services offered include, but are not limited to, general outpatient and inpatient medical services, expanded programme of immunization (EPI), management of children with severe acute malnutrition with medical complications, and comprehensive HIV services. The hospital has a capacity of 150 beds. The outpatient department attends to about 300 children and admits about 50 children daily.

Sampling procedure

There were 3952 children admitted between January and June 2020. We selected the months of January, March and May which havea total of 1689 admitted children. We then carried outrandom sampling where 1 in 3 children were recruited for this study, but we also included all children who died in each selected month. This gave a total of 781 children of whom 777 contributed to the analysis (the others were excluded because of missing data). This sample size was calculated using Open Epi (http://www.openepi.com), assuming a prevalence of malaria of 50% for children. We assumed a precision of 5% and 95% confidence intervals.

Table 1. Demographic characteristics of children

Variable	n(%)
Sex	
Male	435(55.9)
Female	342(44.1)
Age	
<1 year	431(55.5)
1 year - <5 years	254(32.7)
5 years - <10 years	61(7.8)
10 years - <18 years	31(4.0)
Residential area	
Juba Block	99(12.7)
Kator Block	193(24.9)
Munuki Block	115(14.8)
Gudele Block	130(16.7)
Outside Juba	132(17.0)
Unknown	109(14.0)
Total	777(100.0)

Because not all survivors in each selected month were selected, we performed a weighted analysis, and the numbers presented below are weighted results.

Study Variables

The outcome variable was the proportion of children admitted with malaria and the independent variables included demographic characteristics such as age, sex and residential area. Pearson's chi-squared tests, corrected for weighting are presented where relevant.

Ethical approval

We obtained ethical approval from the Ethical Review Board of University of Juba.

Results

Table 1 shows that of the 777 children included, 56% were males and 44% were females. The vast majority (88%) were aged under five years. About 25% of the children were residents of Kator Block in Juba. Table 2 shows the distribution of diagnoses and disease outcome by the children's residential areas.

The prevalence of malaria was 78% and28% of the children had severe malaria. Severe malaria with no co-morbidities accounted for 14% of the deaths (Table 3).

Discussion

Our results showed that more than three quarters (78%) of those children admitted had malaria. This agreed with

Table 2. Distribution of diagnosis and disease outcome by children's residential areas

Residential Area	Juba Block	Kator Block	Munuki Block	Gudele Block	Outside Juba	Unknown	Total
	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)
Diagnosis							
Malaria*	23(23.6)	65(33.8)	29(25.3)	32(24.5)	40(30.1)	26(23.9)	215(27.7)
M#. & gastroenteritis	14(14.0)	22(11.3)	16(14.0)	22(17.1)	11(8.7)	9(8.4)	94(12.1)
M. & sepsis	15(15.1)	17(8.7)	8(7.3)	13(10.3)	9(6.7)	5(4.6)	67(8.7)
M. & anaemia	10(10.1)	12(6.3)	6(5.0)	3(2.7)	14(10.4)	6(5.6)	51(6.6)
M. & pneumonia	9(9.3)	21(11.1)	13(11.0)	15(11.5)	8(6.4)	13(11.9)	79(10.2)
M. & dehydration	4(3.9)	5(2.6)	5(4.7)	3(2.1)	2(1.2)	3(2.8)	21(2.8)
M. & meningitis	2(2.3)	6(3.2)	3(2.7)	5(3.5)	5(3.5)	1(1.1)	22(2.8)
M. & severe acute malnutrition	0(0.0)	2(0.8)	2(1.7)	1(0.9)	3(2.3)	5(4.6)	13(1.6)
M. & other diseases	2(2.3)	10(5.3)	8(7.3)	6(4.7)	6(4.3)	10(8.8)	42(5.5)
Other diseases	19(19.4)	33(17.0)	24(21.0)	29(22.7)	35(26.4)	31(28.4)	171(22.0)
Outcome							
Alive	95(96.5)	182(94.3)	102(89.0)	124(95.6)	119(90.4)	97(89.5)	720(92.7)
Death	3(3.5)	11(5.7)	13(11.0)	6(4.4)	13(9.6)	11(10.5)	57(7.3)
Total	99(100.0)	193(100.0)	115(100.0)	130(100.0)	132(100.0)	109(100.0)	777(100.0)

*Area-diagnosis p = 0.2452, Area-outcome p = 0.0007 * almost all malaria cases admitted were severe malaria M# Malaria*

findings from a hospital in Mozambique where more than half of those admitted had malaria.[12] However, our finding is higher than that recorded in Uganda.[13] We also found that severe malaria alone without co-morbidities accounted for more than a quarter of the admitted children. This agrees with that of a recent study in a hospital in Yaoundé in Cameroon.[14]

In comparison with other residential areas, Kator block had the highest number of children admitted with malaria. However, this block had better clinical outcomes perhaps explained by being near to the hospital and hence had faster access to care. On the other hand, Munuki block and areas outside Juba recorded a higher mortality which is likely to be due to delayed treatment because of lack of transport.

Nearly two thirds of children who died in hospital were admitted with malaria. This agrees with findings from hospitalized children in Northern Zambia. In addition, mortality was high among children aged under five years - an experience similar to that in Uganda.[13]

Conclusion

Malaria remains the number one cause of admission and mortality in hospitalized children in this paediatric hospital in South Sudan. It predominantly affects young children who are at a high risk of dying. Measures envisaged to protect children from malaria during their first five years of life are likely to have a significant impact on child deaths.

We recommend that the Ministry of Health should increase public health preventive measures against malaria particularly in areas closer to the River Nile and expand health facility networks in order to facilitate access for children seeking health care.

Limitations

This study is limited by being a hospital-based study so does not represent the general population. The selected months are mostly in the dry season of the year and may be different in terms of disease burden from that in July to December which is the rainy season. It is also probable that the large number of children with unknown addresses may have distorted the analysis.

Acknowledgement. We thank Manal Juma, a statistician, for extracting the data from the hospital records.

Table 3. Distribution of ages and diagnosis against disease outcome

Variables	Outcome		
	Alive	**Death**	**Total**
	n(%)	n(%)	n(%)
Age			
<1 year	392(90.9)	39(9.1)	431(100.0)
1 year - <5 years	242(95.3)	12(4.7)	254(100.0)
5 years - <10 years	57(94.3)	3(5.7)	61(100.0)
10 years - <18 years	29(92.6)	2(7.4)	31(100.0)
Diagnosis			
Malaria	208(96.4)	8(3.6)	215(100.0)
M#. & gastroenteritis	91(96.0)	4(4.0)	94(100.0)
M. & sepsis	63(93.8)	4(6.3)	67(100.0)
M. & anaemia	46(89.6)	5(10.4)	51(100.0)
M. & pneumonia	76(95.2)	4(4.8)	79(100.0)
M. & dehydration	18(85.7)	3(14.3)	21(100.0)
M. & meningitis	21(94.7)	1(5.3)	22(100.0)
M. & severe acute malnutrition	10(81.8)	2(18.2)	13(100.0)
M. & other diseases	41(97.3)	1(2.7)	42(100.0)
Other diseases	147(85.7)	24(14.3)	171(100.0)
Total	720(92.7)	57(7.3)	777(100.0)

Outcome-age p = 0.0096, Outcome-diagnosis p < 0.0001, M# Malaria

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