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MALARIA IN CHILDREN IN ILORIN, NIGERIA
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ABSTRACT

Objectives: **To determine the prevalence of paediatric malaria admissions in an area of stable malaria transmission and to ascertain the relative contributions of different forms of severe malaria to morbidity and mortality.**
Design: **A descriptive restrospective study.**
Setting: **Olanrewaju hospital, a general practice health facility in a malaria holoendemic city in Nigeria.**
Subjects and methods: **Case files of paediatric (age <15years) admissions between 1/1/98 and 31/12/98 with a diagnosis of acute malaria were retrieved and relevant information including demographic data, clinical signs, laboratory records, treatments received and diagnosis on discharge were extracted. Grouped age-associated prevalence rates were calculated; characteristics of different groups were compared using standard statistical methods.**
Results: **Children with *Falciparum* malaria accounted for 95 (18%) of the 526 medical admissions. The proportion of children admitted with severe malaria was significantly higher among the under-fives compared to those over five years (p< 0.001; RR=5.36, 95% CI of 2.58 to 11.2). Thirty two (33.7%) children had severe malaria. Fifteen (15.8%) had convulsions without coma, 13 (13.68%) had malaria-associated anaemia and four (4.2%) were diagnosed as having had cerebral malaria. Seizures were significantly more frequent in the under-fives (p=0.001, RR=6.0; 95% CI of 1.8 to 19.6). There was a significant negative correlation between age and severe anaemia/blood transfusions (p=0.002). Cerebral malaria carried the greatest risk of fatality (CFR=25%; RR=7, 95% CI of 1.5 to 91).**
Conclusion: **High prevalence of paediatric malaria admissions in this study underscores the morbidity burden in Nigerian children, especially in under-fives in whom the severe forms are more common. A high incidence of anaemia requiring blood transfusions further increases the risk of paediatric HIV infection in Nigeria where organised control programmes are rudimentary.**

INTRODUCTION

Malaria is the most common cause of out-patient visits to health facilities in Nigeria(1). It is also one of the five leading causes of death in government health institutions(1,2) and one of the three leading causes of emergency paediatric admissions, both in private(3,4) and government(5) health facilities in Nigeria. Clinical manifestations of malaria vary from no symptoms to life-threatening symptoms depending on species and strain of plasmodium, the host's history of infection with malaria, the age and other host-related variables(6). In areas of stable malaria like Nigeria, studies have shown that parasite rate increases with age, reaching a peak at about the age of seven to eleven years, with adults usually recording low levels(7). Severity and frequency of clinical episodes are however greatest between the ages of one and four years when mortality is highest(7,8). With widespread resistance to chloroquine (CQ) and sulphadoxine-pyrimethamine (SP) of late(3,9-10), and the increasing level of poverty in Nigeria, the prevalence of severe malaria is likely to increase. This study was, therefore, aimed at determining the current pattern of occurrence of paediatric malaria admissions in a busy private/family health facility as well as to determine the age-related risk factors for development of severe(11) malaria, and to ascertain the relative contributions of different forms of severe malaria to the malaria-associated admissions, morbidity and mortality.

MATERIALS AND METHODS

Study site: The study was carried out at Olanrewaju hospital, a 30-bed private health facility with an annual in-patient turnover of 600-800 patients, about one third of whom were children below 15 years. Apart from offering general outpatient services, there were 24 beds for general admissions and six beds exclusively reserved for paediatric patients. In addition, there were three baby cots and one incubator. The hospital is centrally located in a middle class populated area of Ilorin city. The city is the

gateway between the north and southern Nigeria with a population of 1,566,469 by 1991 census (source: National Population Commission). At a population growth rate of three per cent per annum a projection of 1,926,559 for the year 1997 comprising of 972,733 males and 953,826 females for 1997 would be expected. The city occupies a 40 to 45km area with a topography mainly as that of the Guinea Savannah. Malaria is holoendemic here like any other part of Nigeria. The climate is characterised by alternating dry and wet seasons each of about six months. The wet season usually starts from the end of March and lasts till October. The dry season starts in November and lasts till early March. Malaria transmission is intense and perennial with slight increase between May and October.

There is a well-equipped laboratory for haematological, biochemical and parasitological diagnosis. The Beckton Dickinson® Quantitative Buffy Coat (QBC) haematology and malaria diagnosis kits are also available for faster patient screening in cases of emergency. Routinely, all admissions with a clinical diagnosis of malaria must have a complete blood count (CBC) in addition to Giemsa stained thick and thin blood films for malaria parasites. With the recent high level of therapeutic failure following routine antimalarial therapy in Ilorin(3), records of admission parasite densities have become routine. If there is no satisfactory clinical response or the patient's condition is deteriorating, the parasite densities can be repeated and compared with the admission levels. In the study centre malaria accounts for up to 25%(3) of the admissions in a year. For example, there were a total of 623 admissions in 1997. Of these, 180 patients had acute *P. falciparum* malaria all confirmed with laboratory diagnosis. Acute *P. falciparum* malaria thus accounted for 28.9% of all admissions for the hospital in 1997.

Subjects: Children up to 15 years of age who were admitted to the hospital during the study period with clinical diagnosis of acute malaria were recruited if they met the following inclusion criteria: (i) parasitological confirmation of malaria; (ii) absence of any other concurrent illness at admission. We excluded children whose diagnoses were changed before discharge or who developed another illness unrelated to initial admission diagnosis. We also excluded patients whose case records were not complete or poorly documented.

Study design: This was a descriptive, retrospective study. Case records of all paediatric medical admissions between 1/1/98 and 31/12/98 were retrieved and those with a final diagnosis of malaria who met our inclusion criteria were separated for further analysis. Specially designed charts were used for recording the following information: age, sex, weights, date of admission, date of discharge, diagnosis on discharge, major presenting complaints and clinical signs on admission. Admission laboratory data including CBC, Giemsa stained TBF for malaria parasites and admission parasite densities were recorded. Treatment received (pre- and during admission) was also recorded. Malaria admissions were classified as "uncomplicated acute malaria", and "severe malaria". Severe malaria was further classified as "malaria-associated convulsions" defined(12) for those with a history of seizures before admission to the hospital and/or seizures reported during in-patient stay without any other complications, "malaria-associated severe anaemia" defined(13) as haematocrit ≤15% in the presence of *P. falciparum* parasitaemia, and "cerebral malaria"(11).

Data analysis and results: Grouped age-associated prevalence rates were calculated from the data; characteristics of different groups were compared using Student's t-test or Chi-test where data were normally distributed. Data not normally distributed like parasite densities were log-transformed before analysis. Results were tabulated. P values and confidence intervals were determined where appropriate with level of $p<0.05$ taken as significant.

RESULTS

During the study period, there were 526 medical admissions, 285 (54.23%) of whom were children aged 15 years and below. Malaria was the second most common cause of paediatric medical admissions after acute diarrhoeal disorders and was responsible for 18% (95 cases) of all paediatric admissions. The monthly distribution of admission cases is presented in Figure 1. The period of May to October corresponds to a time of heavy rains when transmission is highest.

Figure 1

Monthly distribution of paediatric malaria admissions in Olanrewaju hospital from January to December 1998

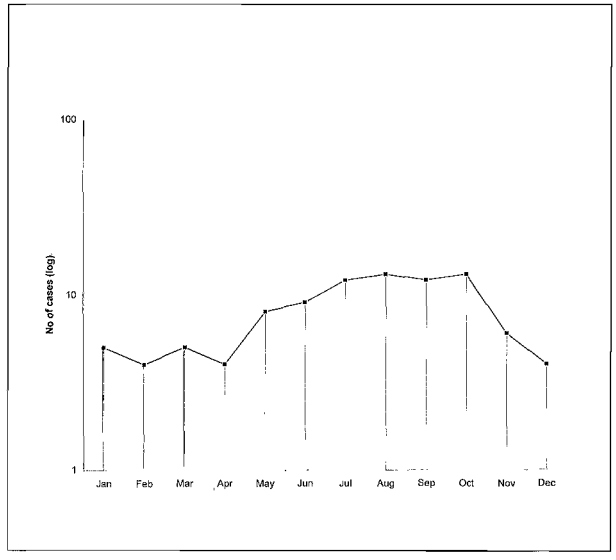

Table 1 shows the age distribution of the admissions according to diagnosis. Sixty three (66.3%) of the 95 children had acute uncomplicated malaria. The remaining 32 (33.7%) had severe malaria, of whom 15 (15.8%) had convulsions without coma, thirteen (13.68%) had malaria-associated anaemia (PCV<20), ten of whom had PCV < 15% and received blood transfusion and four (4.2%) were diagnosed as having had cerebral malaria. The mean age of all the patients was 6.29 years (SD, 3.84). The proportion of children admitted with severe malaria was significantly higher among the under-fives compared to those aged over five years (66% versus 12.3%; $p<0.001$). The risk of acquiring severe malaria was at least five times higher among children below five years compared to the older age group (RR = 5.36; 95% CI 2.58 - 11.12). Fits were significantly more common in children under five years with a prevalence of 31.57% compared to 5.26% in those children older than five years (RR = 6.0, 95% CI of 1.8 - 19.9; p= 0.001).

Table 1

Age distribution of malaria admissions according to diagnosis

Age groups (years)	0-4	5-7	8-15	Total
Number of children	38	40	17	95
Diagnosis				
Uncomplicated malaria	13	35	15	63
Malaria/convulsions	12	2	1	15
Malaria/Anaemia	8 (3)*	2	0	13
Cerebral malaria	2	1	1	4

*PCV>15%<20%

Table 2

Features of children admitted with acute P. falciparum malaria grouped by diagnosis

Diagnosis	Uncomplicated malaria	Malaria/anaemia	Malaria/convulsions	Cerebral malaria	P value
Number	63	10 (3)*	15	4	
Mean age ± SD (yrs)	7.59±3.76	3.32±1.57	3.37±3.0	5.75±2.83	0.0008†
Age range	(0-15)	(1-6)	(1-13)	(4-10)	
Mean admission T.±SD	38.84±0.76	38.58±0.6	39.9±0.89	38.85±1.3)	0.0005††
Temperature range (°C)	37.7 - 40.3	37 - 39	38 - 42	(38.2 - 41)	
Splenomegaly	6	4	1	–	0.03††
Hepatomegaly	3	2	1	1	NS
Hepato-splenomegaly	3	3	1	–	NS
Parasitaemia>150,000/µl	1	5	2	0	0.0002†††

*PCV>15%<20%; †Severe malaria versus uncomplicated malaria; ††Convulsion versus others; †††Anaemia versus others

Table 2 shows the comparative distribution of some clinical and laboratory parameters across various diagnostic categories. The mean age of children with severe anaemia requiring transfusion was 3.32 years (SD 1.57). Of the ten subjects who were transfused, six were aged <3 years, four were between ages four and seven years while none was older than eight years. There was, therefore, a significant negative correlation between age and severe anaemia/ blood transfusion ($\chi 2$ =12.5, p= 0.002). Irrespective of age, the mean admission temperature of children who presented with convulsions was significantly higher than those without convulsions (39.9°C ± 0.89 versus 38.74°C ± 0.65; p = 0.0005).

There was no statistically significant difference in admission parasite densities among all the age groups (p=0.44), however, the proportion of children with admission parasite densities >150,000µl was significantly higher in patients with malaria-associated anaemia compared to those with other complications (p= 0.0002). There was also a significantly higher incidence of splenomegaly among patients with severe malaria-associated anaemia (p=0.03). The mean age of the cerebral malaria group was slightly higher than those with the malaria-associated anaemia or malaria associated with convulsions (5.75 years ± 2.87, 3.32 years ± 1.57 and 3.37 ±3.0): There were two cases of death from malaria (2.1%). One had cerebral malaria and died within two hours of admission; the other fatality was a 2.9-year old boy with severe malaria-associated anaemia who died before blood transfusion could be arranged. Cerebral malaria appears to have carried the greatest risk of fatality in this study (CFR=25%; RR=7, 95% CI of 0.54-91).

DISCUSSION

Malaria is one of the three leading causes of paediatric hospital admissions in Nigeria(3-5). In this study, malaria-associated admissions were second only to diarrhoeal disorders confirming its continued relevance as a major cause of morbidity in Nigeria. It has been demonstrated(14,15) that the burden of morbidity and mortality from malaria is concentrated among the youngest age group under conditions of intense perennial stable transmission. Hence it is not surprising that 66% of the children with severe malaria in this study were under the age of five years. Similarly, convulsion which featured in 15.8% of the present series has been reported earlier as a common presenting feature of severe malaria in Nigerian children(16). The current prevalence was however lower than the earlier report in which 49% of children in whom malaria was diagnosed on admission had convulsion at presentation(16). Malaria diagnosis in that study was based on clinical grounds and some of the febrile illnesses associated with fits might not have been due to malaria. It may however also be attributed to a possible health-education related change in home care of febrile convulsions. The administration of cow-urine concoctions, which was noticeably associated with repeated seizures, is no longer a popular home remedy as identified earlier in Ibadan. In this study, the mean admission temperature of patients who had fits was significantly higher than those who did not, confirming fever to have been a major factor in the pathophysiology of fits. Wattanagon *et al*(12) in their study, found convulsions to have been twice as common in *falciparum* malaria as in vivax malaria in

children of similar peak temperatures and therefore suggested that the pathological processes produced *by falciparum* malaria were convulsants in themselves and may have caused a significant number of the seizures.

There were 13 cases of malaria-associated anaemia compared to only four of cerebral malaria. The relative importance of both manifestations is thought to vary according to the intensity of transmission(15,17). Severe anaemia is more common in areas of intense transmission like Nigeria with cerebral malaria being more common in areas of lower transmission intensity(14,15,17). It is therefore not surprising that severe anaemia was more diagnosed in this study than cerebral malaria. Severe malaria-associated anaemia has been attributed to a number of factors including haemolysis of parasitised and non-parasitised red cells and dyserythropoiesis(18,19). However, some researchers(20,21) are of the opinion that malaria-related anaemia involves predominantly acute haemolysis rather than dyserythropoiesis. The rapidity of drop in haemoglobin levels and the need for urgent transfusion in these children probably support that view. As observed in some earlier reports(20,22), our results show that the prevalence of severe malaria-associated anaemia and the frequency of blood transfusions decrease with age. Sixty per cent of the children transfused in the current series were under three years, while the remaining 40% were aged between four and seven years. No child above eight years was transfused. We found a significantly higher admission geometric mean parasite density in severely anaemic children compared to those who were not anaemic or had other complications. The negative correlation between haemoglobin levels and parasite density has also been observed in other studies(23). However, some studies(22,24) found no such correlations, although they identified malaria as a risk factor for anaemia. Blood transfusion remains the single most important life-saving measure for severe malaria-associated anaemia. Greenberg *et al*(25), found HIV-infection rates of 15% among malaria-associated admissions transfused, compared with two per cent among a non-transfused group and concluded that treatment of malaria with blood transfusion posed an important risk of exposure of children to HIV infection. Against the background of a rudimentary HIV/AIDS national control programme at present, the frequent need for blood transfusion occasioned by an equally frequent occurrence of malaria-associated severe anaemia, is justifiably a source of concern for child health practitioners. In view of the rapidity of marrow response following successful antimalaria treatment, stricter criteria for blood transfusion is urgently needed. Blood transfusions for malaria-associated anaemia should only be indicated if the PCV drops to at about 15%.

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