Malaria: A Major Cause of Anemia Among Under 5 Children on Hospital Bed in State Specialist Hospital, Ondo, Ondo State, Nigeria.
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Abstract
Background
Anemia during childhood remains a major public health challenge especially in Sub Saharan Africa with malaria being a major risk factor. Malaria also accounts for most hospital visits especially in children.

Objective
This study aimed to determine malaria as a major cause of anemia among under 5 children on hospital bed in State Specialist Hospital, Ondo, Ondo State. Nigeria.

Method
Three hundred and forty six under 5 children, 186 males and 160 females were admitted with packed cell volume (PCV) of <30% over a 6 month period from April September 2010. Malaria parasite was detected through simple chromatographic test (Rapid diagnostic test) and thick blood film microscopy. Anemia was defined as Packed Cell Volume <30%.

Results
At presentation, anemia occurred in 346[100%] of the patients admitted, 186[54%] were males and 160[46%] females, malaria parasite was positive in 315[91%] of patients. Children of age 1year had the highest prevalence of anemia which was 101[29%]; the lowest prevalence of 11[3%] was in 5years age group. Males have significant higher risk for both malaria and anemia. Mortality rate over the period of 6months was 4% [13 children died].

Conclusion
Several factors contribute to anemia in children in African countries but Malaria remains the number one risk factor. Effective control measure against malaria is however advocated. The low mortality rate in this study shows that diagnosis and prompt treatment of malaria can reduce the malaria burden while effective control is being advocated for.
Key words: Anemia, Malaria, Under 5 children.

Background
Malaria is one of the leading global health problems with over 300million clinical cases and more than 1million deaths on annual basis1. Malaria is one of the three killers among communicable diseases in Africa2. In southern Nigeria, at least 35,000 children die annually from direct effects of malaria alone, accounting for 2530% of all the mortalities in infants and childhood3.

The Roll back malaria (RBM) partnership goal to halve the malaria by 2010 suggests the need for integrated approaches to combat malaria and reduce its consequences4. Despite the advocacy for reduction of malaria by 2010, malaria still remains the major cause of outpatient visits and more so, hospital admission in under 5 children with a lot of them developing severe malarial anemia. Malaria is thought to be the primary cause of severe anemia in at least 50% of people living in malaria endemic area4.

Compared with other parasites, Plasmodium falciparum (P. falciparum) can invade a larger percentage of RBC leading to acute and chronic hemolysis and disordered red cell development resulting in severe anemia. Severity and course of clinical attack depend on the species and
strain of the infecting plasmodium parasite, Age, genetic constitution, malaria specific immunity, nutrition status of the child and previous exposure to antimalarial drugs.

Anemia is one of the complications seen in malaria infection and it contributes to its morbidity and mortality. It has been reported that over half of malaria related deaths are attributed to severe anemia. Mortality rate for children admitted to hospital with severe malaria was considered to be 15-30%. Clinical presentation of malaria overlaps with other common illnesses and attempts to develop clinical scoring system and predictive value have proved unsuccessful. Presumptive treatment has therefore resulted in overuse of antimalarial drugs increasing drug resistance and importantly, failure to treat alternative causes of fever.

WHO now recommends that parasitological confirmation by microscopy or rapid diagnostic test be obtained in all patients with suspected malaria before the start of treatment. Malaria microscopy is however the gold standard for confirmation of diagnosis and has added advantage of parasite quantification and species identification.

Simple immunochromatographic test (rapid diagnostic test) for malaria provide an alternative to microscopy at peripheral health facilities and can facilitate diagnosis guided treatment by village health workers.

Materials and Methods

Study population
A total of 346 children aged <5 years were involved in the study; all had anemia on admission at State Specialist Hospital, Ondo, Ondo-State, Nigeria. The children consisted of 186 males and 160 females.

Collection and processing of data
Blood was obtained from each patient, malaria was detected either by examination of thick blood film stained with Giemsa stain under the Microscope or Rapid diagnostic test, the presence of any stage of malaria parasite was taken to be positive, the level of parasite density was assessed as +, ++, ++++. Absence of malaria parasite was taken to be negative.

Packed cell volume (PCV) was determined with the use of hematocrit centrifuge and microhematocrit reader. Anemia was defined as PCV < 30%. Mild anemia PCV 25-29%, moderate anemia PCV 19-24% and severe anemia PCV <18% [In neonates anemia was defined as Packed cell volume <45%].

Results
All the children that were involved in the study had anemia on admission into hospital bed. A total 315 [91%] out of the 346 children had malaria with 8 [3%] developing cerebral malaria. The prevalence of anemia was higher in males 186 [54%] while it was 160 [46%] in females also, 162 [47%] males and 153 [44%] females were tested positive to malaria.

The malaria parasite test done through thick blood film microscopy and rapid diagnostic test showed that 103 [30%] had + malaria parasite density, 166 [48%] had ++ malaria parasite density, 46 [13%] had +++ malaria parasite density while 31 [9%] were negative. Out of the 31 [9%] that were tested negative to malaria parasite test; 9 [29.0%] had Pneumonia, 5 [16.1%] had Septicaemia, 7 [22.6%] had Sickle cell anemia, 2 [6.5%] had G6PD deficiency, 2 [6.5%] had Diarrhoea disease, 2 [6.5%] had birth asphyxia, 2 [6.5%] had Neonatal jaundice, 1 [3.2%] had Meningitis and 1 [3.2%] had Malnutrition.

Anemia was assessed in terms of the packed cell volume (PCV), all the children involved in the study had anemia. Anemia was defined as PCV < 30% [in neonates, PCV <45%], 184 [53%] had severe anemia, 98 [28%] had moderate anemia, 59 [17%] had mild anemia. 5 [2%] were
neonates that had PCV <45%. 267[77%] of the patients with anemia had blood transfusion, 79[23%] had hematimics only. 78[29%] of the 267[77%] that were transfused had moderate anemia but they presented with symptoms and signs of anemic heart failure, consequent of this they had to be transfused. All the patients were managed with oral and/or intramuscular Artemisinin Combination Therapy (ACT) except those with cerebral malaria that were treated initially with intravenous Quinine which was changed to oral Quinine when the patients became conscious.

Out of the 346[100%] children that were admitted 5[1%] were neonates, 98[28%] were <1 year, 101[29%] were 1 year old, 54[16%] were 2 years old, 54[16%] were 3 years old, 23[7%] were 4 years old and 11[3%] were 5 years old. The mortality rate was 4%, 13 children died out of 346 children that were involved in the study, 7[2.2%] were females and 6[1.8%] were males.

Discussion
Malaria remains a burden in sub-Saharan Africa especially among children\textsuperscript{10} and anemia has been reported to be responsible for over half of the malaria related deaths\textsuperscript{11}. The study focused on the major cause of anemia in under 5 children and its effect on the age and sex.
All the children in the study had anemia at presentation; an overall prevalence of 315 [91%] malaria infections was observed. This is a very high prevalence while other causes of anemia had prevalence of 31[9%]. This high prevalence can be attributed to poor control measures.

The data shows that male sex have higher risk of malaria parasiteamia, this is in agreement with the earlier report, in this study male sex was also found to have higher risk factor for anemia, a finding that is contrary to earlier report by F.O. Akinbo et al.12. Children aged 1 year had the highest prevalence closely followed by children aged 1month- 1year this is consistent with the previous report12 while the lowest prevalence of anemia was in neonates, but anemia due to malaria was found to have a low prevalence in 5years age group the finding is in keeping with an earlier study12. The study also showed that ++ of malaria parasite density had the highest prevalence.

Out of 100% of patients that had anemia; 184[53%] had severe anemia, 98[28%] had moderate anemia and 59[17%] had mild anemia, 5[2%] had neonatal anemia. 267[77%] of these patients were transfused, 78[29%] of these patients had moderate anemia but because they presented with symptoms and signs of anemic heart failure they were transfused. This can be justified for with the low mortality rate of 4% of severe malarial anemia as opposed to 8.6% mortality earlier reported15.

Neonates and infants are relatively protected from clinical malaria, but the mechanism of this protection is not well understood, maternally derived antibodies are commonly believed to provide protection against many infectious diseases, including malaria, for periods of up to 6-9months but several recent studies have produced conflicting results regarding a passively acquired antimalarial antibodies. Thus, it appears that neonates and infants are significantly protected against episodes of clinical malarial and against death from severe malaria. However, this protective mechanism can be overwhelmed by very high transmission intensities14.

Macdonald proposed that infants are no more protected from malaria than anyone else and that their apparent protection is simply due to less exposure15.

Studies show that as malaria parasitemia decreases the prevalence of anemia reduces. Malaria parasitemia and anemia reduce by the age of 5years. Indeed malaria parasitemia was significant risk factor for acquiring anemia. The role of Iron supplementation in the prevention and treatment of anemia in malaria endemic regions has been much debated. Iron deficiency has an adverse effect on child health development and survival. WHO guideline recommends that routine Iron supplementation should be given to children aged 6months to 24months living in area where malaria prevalence is 40% or more6. Alterations of iron metabolism in the human host are, however, thought to increase resistance to infection by restricting the availability of iron to microorganisms, and of iron supplementation of malaria and other infectious diseases has been the subject of several reviews and meta-analyses. With effective malaria control, iron supplementation should not be withheld from children with anemia in endemic areas6.

**Conclusion**

There are several causes of anemia in children but malaria has a higher prevalence in causing anemia in children especially in sub-Saharan Africa, anemia is also an important cause of malaria related deaths. The main burden of malaria occurs in children in the first 2 years of life; therefore there is a need to treat patient for both malaria and anemia. There is also a need for effective control of malaria. Much effort has been put into reducing malaria burden by 2010 but the result of this effort has not been appreciated, there should be reawakening interest in the prospect of malaria elimination and eradication in the long run. In addition, availability of effective malaria vaccine will help in this eradication process.
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