

Prevalence of anemia in women with asymptomatic malaria parasitemia at first antenatal care visit at the University of Calabar Teaching Hospital, Calabar, Nigeria

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Background: Anemia in pregnancy in malaria endemic areas is a public health challenge that has contributed either directly or indirectly to maternal morbidity and mortality in our environment. Anemia and malaria during pregnancy are highly preventable and treatable.

Objective: The aim of this study is to assess the prevalence of anemia in asymptomatic malaria parasitemic women at first antenatal visit in a tertiary hospital facility.

Method: The study was conducted at the antenatal clinic of the University of Calabar Teaching Hospital, Calabar, Nigeria over a three-month period. Five hundred and forty-five pregnant women were recruited after obtaining an informed consent. A structured questionnaire was administered to each participant and two thin and thick blood films were used to identify the malaria parasites and estimate density. The average of two packed cell volumes at booking was determined using two capillary tubes and read from a Hawksleys microhematocrit reader.

Results: A total of 545 pregnant women participated in the study. The mean ages of primigravidas and multigravidas were 21.4 ± 3.1 and 24.3 ± 4.0 years. Two hundred and ninety (53.2%) were primigravidas while 255 (46.8%) were multigravidas. The parasite density in primigravidas was 1297 ± 1234 while that for multigravidas was 661 ± 497 ($t = 7.7, P < 0.001$). The prevalence of anemia in the study population was 59.6%. There was no statistically significant difference in the prevalence of anemia among the primigravidas (60.3%) and the multigravidas (58.8%) ($\chi^2 = 1.3, P = 0.08$). There was a statistically significant association between severity of parasitemia and degree of anemia ($\chi^2 = 441.1, P < 0.001$). There was a statistically significant association between antimalarials use before booking and severity of parasitemia ($\chi^2 = 36.52, P < 0.001$).

Conclusion: Anemia at first antenatal booking was significantly associated with malaria parasitemia. Routine screening for anemia and malaria parasites at booking, prompt parasite clearance, use of intermittent preventive treatment (IPT) during pregnancy and correction of anemia can reduce the prevalence of malaria related anemia and obstetric complications associated with it.

Keywords: anemia, malaria, pregnancy, first antenatal booking

Introduction

The importance of a good hemoglobin concentration during pregnancy for both the woman and the growing fetus cannot be overemphasized. Being a driving force for oxygen and nutrients for mother and fetus, a reduction below acceptable levels can be detrimental to both. A hemoglobin concentration below 11.0 g/dL or packed cell

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volume (PCV) of less than 33.0% is regarded as anemia during pregnancy by the World Health Organization (WHO).^{1,2} This value is important and should be adopted as a standard even in our developing countries in order that we do not under-play the burden of anemia in pregnancy.³ Anemia is said to be the commonest medical condition in pregnancy with a prevalence of 50% worldwide.⁴ Recent estimates in the developing countries including Nigeria put the prevalence at 60% in pregnancy and about 7% of the women are said to be severely anemic.^{4,5} Most of those affected are the primigravidas and grandmultiparas.⁶ Excessively rapid destruction of red blood cells, bleeding during pregnancy and inadequate hematopoiesis are the three major causes. Severe malaria parasitemia appear to be a leading cause especially in our environment.^{2,3,6,7} Malaria causes increased hemolysis of parasitized red blood cells. The degree of hemolysis depends on the burden of parasites.^{8,9} It is important to state that aside from malaria, helminthiasis as well as nutritional factors also contribute variously to anemia during pregnancy.¹⁰ Although adults living in endemic areas acquire protective immunity against developing severe malaria, they become more susceptible especially when they become pregnant.⁹ In areas with stable malaria like Cross River State of Nigeria, the vast majority of infestations with *Plasmodium falciparum* in pregnancy remain asymptomatic, undetected and untreated. The high prevalence of anemia and malaria parasitemia in the general population, especially in malaria endemic areas, and the depression of immunity in pregnancy, call for assessment of the prevalence of malaria parasitemia and associated morbidity. The aim of this study is to assess the prevalence of anemia in malaria parasitemic women during first antenatal booking visit in a tertiary hospital in a low resource setting. It is hoped that the results of this study will assist in the development of strategy to reduce adverse effects associated with this medical problem in obstetrics in our society.

Method

This prospective observational study was conducted at the University of Calabar Teaching Hospital, Calabar, Nigeria over a three-month period (April to June). This period is characterized by heavy rainfall and malaria transmission. The teaching hospital is the only tertiary health institution in Cross River State (Niger Delta region) of Nigeria. The state has a population of about 3million people and female literacy level of 62.0%. It has a tropical rain forest and is holoendemic to malaria. Approval for this research was given by the Research and Ethics Committee of the hospital. A structured questionnaire was administered,

by the authors, to all pregnant women who booked for antenatal care at the University of Calabar Teaching Hospital, Calabar, after an unwritten informed consent was obtained. Those who refused to give consent, HIV-positive women, and those with symptomatic infections were excluded from the study. All antenatal bookings in the hospital are carried out in one day of the week. Information obtained included age, parity, social status, and malaria treatment prior to the visit. The method of obtaining the specimen was adequately explained to the pregnant women. After aseptic procedure, a sterile lancet was used to pierce the palmar surface of the thumb. Two capillary tubes, labeled for each patient, were filled with blood and one end sealed with a plasticin gum for determination of packed cell volume at booking. This was to ensure that the average of the two values obtained is used for calculation. Several samples were assembled in the Centrifuge (hematocrit machine) and spun at 5000 revolutions per minute for 5 minutes. When the machine had rotated to a halt the cover was opened and the PCV read from a Hawksley microhematocrit reader. Anemia was considered as a packed cell volume below 33% in line with the World Health Organization recommendation.^{3,6} Anemia was classified as mild (pcv 24.0%–<32.0%) or moderate (pcv 18.0%–<24.0%) or severe (pcv < 18.0%). Two glass slides were then labeled for each patient. Thin and thick blood films were prepared and stained with Giemsa stain. The slides were read under oil immersion with a 100x objective magnification. Parasite enumeration was done using the WHO approved method.¹³ Quality control was ensured using standard positive and negative films as well as standard operation procedures. Where there were doubts, films were cross-examined by a senior microscopist.

Minimum sample size of 464 women for the study was calculated from an earlier pilot study by the authors based on a prevalence of malaria parasitemia of 54.0% in 40 pregnant women at first antenatal visit. The findings of this study were subjected to statistical analysis using EPI – Info 2002 Statistical software of the Centre for Disease Control and Prevention, Atlanta, USA. A *P*-value of <0.05 was considered significant. Quantification of parasite density (per deciliter) used in this study is as follows: lower < 1,000; intermediate 1,000–2,999; higher > 3,000 parasites per deciliter. All those with malaria parasitemia were treated based on the Nigerian National Antimalarial Treatment Guidelines followed with two doses of sulfadoxine-pyrimethamine as intermittent preventive treatment (IPT).

Results

A total of 545 pregnant women participated in the study. The mean ages of primigravidas and multigravidas were 21.4 ± 3.1 and 24.3 ± 4.0 years. Most of the participants were literate. Two hundred and ninety (53.2%) were primigravidas while 255 (46.8%) were multigravidas. The gestational ages at first booking ranged from 8 to 37 weeks for all parities. The mean booking gestational age of the primigravidas was 16 ± 4.7 weeks while that of the multigravidas was 22.6 ± 5.5 weeks ($t = 13.6$, $P < 0.001$). The parasite density in primigravidas was 1297 ± 1234 while that for multigravidas was 661 ± 497 ($t = 7.7$, $P < 0.001$).

The prevalence of anemia in the study population was 59.6%. There was no statistically significant difference in the prevalence of anemia among the primigravidas (60.3%) and the multigravidas (58.8%) ($\chi^2 = 1.3$, $P = 0.08$).

All participants who had no parasitemia had normal packed cell volume (PCV). One hundred and sixty-seven (58.4%) participants who had mild parasitemia were mildly or moderately anemic; nobody in this group had severe anemia, while the rest (41.6%) had normal hemogram. Similarly, none of the intermediate parasitemic participants had severe anemia (Table 1); 76 (33.3%) had normal PCV while 152 (66.7%) had mild to moderate anemia. The majority (66.7%) of those who had severe parasitemia were severely anemic, 2 (33.3%) had mild to moderate anemia while none had normal hemogram. There was a statistically significant association between severity of parasitemia and degree of anemia ($\chi^2 = 441.1$, $P < 0.001$).

Two hundred and eighty (51.4%) of participants took antimalarial before first booking at the antenatal clinic. Of these, 25 (8.9%) had no parasitemia. All those who did not take antimalarials before booking had parasitemia. There was a statistically significant association between the use of antimalarials before booking and parasite clearance ($\chi^2 = 24.8$, $P < 0.001$). Those who used antimalarials before booking were more likely to be free from malaria parasitemia (Table 2). The use of antimalarials before booking also affected the

Table 1 Cross tabulation of severity of parasitemia with packed cell volume

Severity of parasitemia	PCV ≤ 20	21–32	≥ 33	Total
No parasite	0	0	25 (100%)	25 (100%)
Lower	0	167 (58.4%)	119 (41.6%)	286 (100%)
Intermediate	0	152 (66.7%)	76 (33.3%)	228 (100%)
Higher	4 (66.7%)	2 (33.3%)	0	6 (100%)
Total	4 (0.7%)	321 (58.9%)	220 (40.4%)	545 (100%)

Notes: $\chi^2 = 441.1$, $P < 0.001$.

Table 2 Cross tabulation of anti-malaria use before first booking with parasitemia

Anti-malaria use	Parasitemia		Total
	Yes	No	
Yes	255 (91.1%)	25 (8.9%)	280 (100%)
No	265 (100%)	0	265 (100%)
Total	520 (95.4%)	25 (4.6%)	545 (100%)

Notes: $\chi^2 = 24.8$, $P < 0.001$.

degree of malarial parasitemia: the parasitemia among those who took antimalarials was more likely to be mild while the parasitemia among those who did not take antimalarials was more likely to be intermediate or severe. There was a statistically significant association between antimalarials use before booking and severity of parasitemia ($\chi^2 = 36.52$, $P < 0.001$) (Table 3).

Discussion

Assessment of anemia during pregnancy is important because it directly or indirectly contributes to the high maternal and perinatal morbidity and mortality seen in Nigeria.¹² It also affords one the opportunity to institute interventions to prevent complications especially when carried out at booking visit. It is a known fact that malaria is an under-recognized cause of anemia in pregnancy in endemic areas like ours and is usually asymptomatic.^{2,8} Malaria may cause or aggravate anemia.^{3,6} This may follow hemolysis of parasitized red blood cells, increased demand for folates in pregnancy as well as hypersplenism.^{6,9} The very high prevalence of malaria parasitemia in this study (95.4%) shows how enormous it could contribute to anemia during pregnancy.⁸ This prevalence is far higher than the 16% reported from Southeastern Nigeria.¹³ However, the report from Abakiliki, South Eastern Nigeria targeted women in their third trimester that may have had significant parasite clearance with effective antimalarial drugs prior to their enrollment into the study.¹³ Both malaria and anemia in pregnancy therefore pose a serious public health challenge.

The reported incidence of anemia is between 30%–60% in pregnancy.⁴ The prevalence of anemia at first antenatal

Table 3 Cross tabulation of anti-malaria use with degree of parasitemia

Anti-malaria use	Parasitemia lower	Intermediate	Higher	Total
Yes	175 (68.6%)	80 (31.4%)	0	255 (100%)
No	112 (42.3%)	147 (55.5%)	6 (2.3%)	265 (100%)
Total	287 (55.2%)	227 (43.7%)	6 (1.2%)	520 (100%)

Notes: $\chi^2 = 36.5$, $P < 0.001$.

visit in this study of 59.6% was lower than the 71% reported from Lagos,² 67.4% reported from Enugu,¹⁴ and 66.0% reported from Burkina Faso¹⁵ but higher than that reported from Ibadan, Nigeria, and Greytown in South Africa.^{1,16} The probable explanation is that majority of the pregnant women in this study were literate and are gainfully employed, hence their nutritional status is probably better. The high prevalence of anemia in this study is not acceptable, given the fact that malaria is preventable and treatable. Malaria cause anemia mostly in the second trimester of pregnancy when there is accelerated fetal growth and may develop suddenly in severe parasitaemia that may persist into the third trimester.⁷ Anemia in pregnancy has been shown to be commoner in the second trimester especially in severe parasitemia as seen in this study which agrees with previous reports.^{2,5,8} In this study most booking visits were made in the second trimester when parasitemia tends to be highest.¹⁷

Mean parasite density in primigravidas was significantly higher than in multigravidas. This is in agreement with the fact that this group of pregnant women has lower immunity to malaria. Consequently, anemia will be expected to be severer in them.^{6,9} However, a closer look at Table 2 will show that the prevalence of anemia was higher in multigravidas than primigravidas. This could be explained by the fact that the primigravidas booked at a significantly lower gestational age than the multigravidas (see Table 1). This is in agreement with previous studies.^{2,17} The implication is that the multigravidas waited until parasitemia had adversely affected them before booking.

All the women who had severe parasitemia had anemia. The severity of anemia in this study could be related to the parasite density. Thus, the higher the parasite density, the severer the anemia tends to be.

It was observed that some of those who came for booking at the teaching hospital had various forms of antimalarial drugs either from health care providers or over the counter. There was a statistically significant association between antimalarials use before booking and severity of parasitemia. The efficacies of the ingested antimalarial medications can not be ascertained because of high volume of counterfeit and fake antimalarial drugs in circulation.^{18,19} The interval from ingestion of antimalarial drugs to first visit could not be ascertained in majority of cases. All those who did not take antimalarial drugs were parasitemic, while 91.1% of those who took medications were parasitemic. It therefore means that antimalarial chemotherapy used had effect in reducing parasite density.^{5,6} This can also modulate the effect on anemia in pregnancy.

Conclusion

Anemia in pregnancy is associated with malaria parasitemia. The severity of anemia is directly correlated with the density of parasitemia, particularly amongst the primigravidas. Antimalarial therapy that clears the parasitemia appears to have better effect on the level of anemia.

It is therefore recommended that comprehensive preventive strategy including intermittent preventive treatment of malaria in pregnancy, good nutrition and effective use of insecticide treated bed nets be encouraged among pregnant women in endemic regions.

Parasite clearance at booking using safe and effective antimalarial agents should be recommended for all pregnant women especially primigravidas to reduce the incidence and complications associated with anemia.

Disclosure

No conflicts of interest were declared in relation to this paper.

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