MALARIA PARASITAEMIA AMONGST ANTENATAL WOMEN IN A TERTIARY HEALTH FACILITY IN THE SAVANNA.

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ABSTRACT

Context: Malaria is a major public health problem in Nigeria. Pregnant women are particularly susceptible because of their reduced natural immunity and the presence of a unique form of the disease – placental malaria. Peripheral parasitaemia may be a guide to the presence or absence of placental malaria with its attendant sequelae.

Objectives: The goal of the study was to determine the prevalence of malaria parasitaemia in the Jos University Teaching Hospital and the socio-demographic risk factors for malaria parasitaemia.

Methodology: A descriptive cross sectional study was carried out at the antenatal clinic of Jos University Teaching Hospital from 1st August to 30th September 2008. A structured interviewer-administered questionnaire was used to collect information about socio-demographic characteristics and blood samples obtained for malaria parasitaemia, blood group, haemoglobin solubility and HIV test. All the information obtained was analyzed using Epi-info 3.5.1, Atlanta, USA.

Results: The prevalence of malaria parasitaemia at booking antenatal visit in JUTH was 39.7%. The presence of sickle cell trait, use of insecticide treated nets, and those aged less than 20 years were protected against malaria parasitaemia. HIV seropositivity, primiparity and those with anaemia were more likely to have parasitaemia. Blood group, previous history of fever and the use of anti-malarial drugs did not have any association with malaria parasitaemia.

Conclusion: The prevalence of malaria parasitaemia in pregnancy is still high in spite of the availability of evidence-based and cost-effective interventions to prevent malaria in pregnancy.

INTRODUCTION

Malaria is a parasitic disease that affects red blood cells. In West Africa, species of the protozoa (*Plasmodium)* are known to cause malaria – *P. falciparum*, *P. vivax*, *P. malariae* and *P. ovale*. Of these, *P. falciparum* is the commonest and most dangerous.[1] The parasite is transmitted in by the female mosquito of the *Anopheles* genus.[1,]

Up to 2 billion people are affected by malaria worldwide. About 300-500 million cases are reported annually with 2-3 million deaths per year. About 90% of these occur in sub-Saharan Africa most of who are pregnant women and children under 5 years of age.[4] An estimated 30 million women living in malaria endemic areas get pregnant each year. For these women, malaria is a threat both to themselves and to their babies with up to 200,000 newborn deaths each year attributed to malaria in pregnancy.[5] The exact burden of the disease in Nigeria is difficult to ascertain for many reasons including poor record keeping.

Malaria infection during pregnancy is a major public health problem in tropical and subtropical regions of the world. Malaria and pregnancy are mutually synergistic aggravating conditions. The physiological changes that occur in pregnancy and the pathological effects of malaria have a synergistic effect on the course of the illness. Malaria in pregnancy tends to be more atypical and more deadly.[,] [A]dditionally, some anti-malarial medications are contraindicated in pregnancy and may cause adverse effects.[3] All these make the management of malaria in pregnancy more difficult. Even though direct maternal mortality from malaria is less common in areas of stable transmission, *P. falciparum* infection is estimated to cause up to 10,000 maternal deaths annually as well as 8-14 % of all low birth weight babies and 3-8 % of all infant deaths annually.

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Placental histology is considered the gold standard for the diagnosis of malaria in pregnancy especially for epidemiological studies.[7] However, from a clinical perspective, there is still a role for peripheral blood smears.[7]

The pathophysiology of malaria in pregnancy is largely due to the alteration in immunity and the presence of a new organ (the placenta) in pregnancy.[1] Cell-mediated immunity is suppressed during pregnancy and this is thought to be responsible for the increased susceptibility of pregnant women to malaria.[7] However, this does not explain the diminished susceptibility to malaria observed in multigravid women compared to primigravidae. The increased risk of malaria amongst primigravidae is explained by the presence of placental malaria.[1]

Placental sequestration of *P. falciparum* results in the accumulation of parasitized red blood cells in the placental intervillous space, inflammatory cell infiltration, and the release of mediators of inflammation.[8] These cause pathologic changes in the placental bed that impairs feto-maternal exchanges that result in adverse pregnancy outcomes including spontaneous abortion, low birth weight, preterm delivery, intrauterine growth restriction, fetal anaemia, congenital malaria and perinatal mortality.[8,,,] Maternal deaths may result either directly from severe malaria or indirectly from malaria-related anaemia.[7]

In areas of stable transmission, acquired immunity is high.[3] Infection with *P. falciparum* may not result in fever or other clinical symptoms[7] and incidental peripheral parasitaemia is commonly seen.[3] The proportion of parasitized red blood cells is usually higher in the placenta than in the peripheral blood and placental infection may be detected in the absence of peripheral blood parasitaemia and may even persist after anti-malarial treatment.[7] The principal impact of malaria in these areas is malaria-related anaemia and placental parasitaemia.[7]

Heavy placental parasitaemia and maternal anaemia may result in less nutritional support for the fetus leading to spontaneous abortion, still birth, prematurity and increased perinatal mortality.[3] These problems are seen more in primigravidae.

The occurrence of peripheral blood parasitaemia at the beginning, and at the end of pregnancy has been shown to be significantly related to placental infection whereas parasitaemia in the middle of pregnancy was not. Although maternal peripheral blood parasitaemia towards the end of pregnancy predisposes the woman to placental malaria, the risk of placental infection is greater if peripheral parasitaemia occurred at the beginning of pregnancy.[4] This suggests that peripheral blood parasitaemia at the beginning of pregnancy may persist within the placenta throughout pregnancy and may cause more serious complications for the fetus / newborn than infection acquired later in pregnancy.

Based on evidence, the World Health Organisation recommends a three-pronged approach to the prevention and management of malaria during pregnancy: sleeping under insecticide treated nets, intermittent preventive treatment with an anti-malarial drug (currently sulphadoxine and pyrimethamine) and effective case management of malaria illness in pregnancy.[7,13,]

This study was therefore aimed at determining the prevalence of malaria parasitaemia amongst pregnant women, and the associated socio-demographic risk factors attending antenatal clinic at the Jos University Teaching Hospital, Jos.

METHODOLOGY

The study was carried out amongst pregnant women attending the booking visit at the antenatal clinic of the Jos University teaching Hospital, Jos, Plateau state in North Central Nigeria.

Study Design

This was a cross-sectional descriptive study.

Sample size

The minimum sample size was determined using the Fischer's formula

$$n = \frac{(Z)^2(1-P)(P)}{d^2}$$

Where:

n = minimum sample size

Z = 95% confidence = interval (1.96)

P = prevalence of peripheral malaria parasitaemia in Nigerian pregnant women = 12%[23]

d = absolute precision at 95% confidence interval = 0.05

$$n = \frac{(1.96)^2 (1-0.12)(0.12)}{(0.05)^2}$$

n = 162

In order to enhance the power of interpretation, 200 pregnant women will be studied

Data Collection and Analysis

This study was carried out at the antenatal clinic of the Jos University Teaching Hospital between

August and September 2008. After appropriate counseling and obtaining informed consent, 200 consecutive pregnant women were enrolled into the study at the booking visit. Subjects enrolled in the study were interviewed with the aid of an investigator administered pre-structured questionnaire to obtain the socio-demographic and medical information. Blood samples were then obtained and screened for malaria by thin and thick smears using Giemsa staining. The packed cell volume, human immunodeficiency virus (HIV) screening, haemoglobin solubility and blood group were also determined from the obtained blood. All information obtained were analyzed using Epi-info version 3.5.1.

RESULTS

Two hundred (200) women were recruited into the study. However, one of the subjects was later discovered not to be pregnant and was subsequently excluded from the study (attrition rate 0.5%). Of the 199 subjects, 79 had malaria parasites in peripheral blood smears. Thus, the prevalence of malaria parasitaemia in the study was 39.7%.

Table 1 is a descriptive statistics of the study population. The age distribution of the study population ranged from 16 to 42 years with a mean of 27.3 years (standard deviation 5.586). There were 107 (53.8%) Christians and 92 (46.2%) Muslims involved in the study. Most of the women (197 – 99.0%) were married, 1 (0.5%) was single and 1 (0.5%) was divorced. Twelve (6.0%) of the women did not have any form of education, 7 (3.5%) had Arabic education while 88 (44.2%) had formal western education up to secondary school level. Forty-eight (24.1%) subjects identified themselves as housewives, 7 (3.5%) were unemployed, 32 (16.1%) were students and others (12.1%) included nurses, hairdressers, accountants, caterers and a youth corps member.

The gestational age of the study population at the time of the study ranged from 7 to 38 weeks with a mean of 22.48 weeks (standard deviation, SD; 7.02). The mean parity of the subjects was 1.55 (SD;1.86). There were 103 (51.8%) women whose blood group was O, 51 (25.6%) blood group B, 31 (15.6%) blood group A and 14 (7.0%) had blood group AB. Fifty-three (26.6%) of the study population had the sickle cell trait. Only 44 (22.1%) of the study population used insecticide treated nets.

The packed cell volume of the study population ranged from 23% to 41% with a mean of 31.98% (SD; 3.19). Thirty-two (16.1%) had packed cell volume less than 30% which was the definition of anaemia in the study. Fifty-one (25.6%) of the subjects had a history of fever within the last 4 weeks prior to the study.

Table 2 shows the relationship between the presence of malaria parasitaemia and various parameters. The presence of anaemia (p-value 0.0040), sickle cell trait (0.0001) and HIV seropositivity (p-value 0.0001) were significantly associated with malaria parasitaemia.

Table 3 shows the logistic regression statistics to account for confounding variables. The results show that the use of insecticide treated net (OR 0.3214), sickle cell trait (OR 0.227) and age less than 20 years (OR 0.2745) were protective against malaria parasitaemia. HIV positive subjects (OR 13.2091), primigravidae (OR 2.2642) and subjects with anaemia (OR 3.8155) were more likely to have malaria parasitaemia.

Table 1: Characteristics of study population

		Frequency (N =199)	%
Age	15 – 19	15	7.5
	20 – 24	48	24.2
	25 – 29	58	29.1
	30 – 34	53	26.6
	35 – 39	23	11.6
	40 - 44	2	1.0
Religion:	Christian	107	53.8
	Muslim	92	46.2
Marital status			
	Married	197	99.0
	Single	1	0.5
	Divorced	1	0.5
Occupation			
	Business women	21	10.6
	Civil servant	15	7.5
	Housewife	48	24.1
	Student	32	16.1
	Tailors	42	21.1
	Teacher	10	5.0
	Unemployed	7	3.5
Others		24	12.1

Educational status		
None	12	6.0
Primary	29	14.6
Secondary	88	44.2
Tertiary	63	31.7
Arabic	7	3.5
Gestational age at booking		
First trimester	25	12.6
Second trimester	113	56.7
Third trimester	61	30.7
Parity: 0	77	38.7
1	41	20.6
2	33	16.6
3	24	12.1
4	9	4.5
=5	15	
7.5		
Blood group		
A	31	15.6
B	14	7.0
AB	51	25.6
O	103	51.8
Genotype		
AA	146	73.4
AS	50	25.1
SS	3	1.5

Table 2: Relationship between parasitaemia and various parameters

		Parasitaemia		
		Present	Absent	Total
Presence of anaemia				
	Yes	20	12	32
	No	59	108	167
	Total	79	120	199
		$\chi^2 = 8.2815$	p-value = 0.0040	
Anti-malarial use				
	Yes	33	45	78
	No	46	75	121
	Total	79	120	199
		$\chi^2 = 0.3648$	p-value = 0.5458	
History of fever				
	Yes	25	26	51
	No	54	94	148
	Total	79	120	199
		$\chi^2 = 2.488$	p-value = 0.1147	
Sickle cell trait				
	Yes	9	44	53
	No	70	76	146
	Total	79	120	199
		$\chi^2 = 15.5736$	p-value = 0.0001	
HIV screen				
	Positive	13	2	15
	Negative	66	118	184
	Total	79	120	199
		$\chi^2 = 14.9497$	p-value = 0.0001	
Use of insecticide treated net				
	Yes	12	32	44
	No	67	88	155
	Total	79	120	199
		$\chi^2 = 3.6435$	p-value 0.05663	
Age less than 20 years				
	Yes	10	25	35
	No	69	95	164
	Total	79	120	199

			$\chi^2 = 2.1965$ p-value = 0.1383	
Parity				
	0	35	42	77
	Others	44	78	122
	Total	79	120	199
			$\chi^2 = 1.7353$ p-value = 0.1874	
Religion	Christians	43	64	107
	Muslims	36	56	92
	Total	79	120	199
			$\chi^2 = 0.0231$ p-value = 0.8792	

Table 3: Logistic regression statistics showing various asso ciations with parasitaemia

Term	Odds Ratio	95 % C.I.		Coefficient	S.E.	Z	-Statistics P-Value
Anaemia	3.8155	1.5067	9.6623	1.3391	0.4741	2.8247	0.0047
HIV screen	13.2091	2.3567	74.0358	2.5809	0.8794	2.9348	0.0033
ITN	0.3214	0.1326	0.7793	-1.1349	0.4518	-2.5118	0.0121
ITN	0.3214	0.1326	0.7793	-1.1349	0.4518	-2.5118	0.0121
Age less than 20	0.2745	0.0983	0.7668	-1.2927	0.5241	-2.4667	0.0136
Primipara	2.2642	1.0712	4.7858	0.8172	0.3819	2.1402	0.0323
Sickle trait	0.2271	0.0968	0.5322	-1.4828	0.4348	-3.4105	0.0006
CONSTANT	*	*	*	-0.3518	0.2455	-1.4332	0.1518

DISCUSSION

The prevalence rate of 39.7% for malaria parasitaemia amongst pregnant women in thus study was much higher than the rate of 12% in a study from south western Nigeria and 13% from Benin City. However, this is much less than 80% in a study from south eastern Nigeria. A Mozambican study reports a prevalence of 35.3%. The differences in prevalence rates reported in the various studies may be due to differences in the study population. It may also be accounted for by the time of the year the study was done as increased parasitaemia has been noted in the rainy season.[25]

There was no association between a history of fever and malaria parasitaemia. This is not surprising as malarial infection in endemic areas like Nigeria may not result in clinical symptoms.[16] There was no association between anti-malarial use and malarial parasitaemia. Several studies have shown that the use of sulphadoxine-pyrimethamine combination decreased the prevalence of malarial parasitaemia[22,]. The lack of association in this study may be due to the study design. Some of the subjects may have taken the anti-malarial drug a short while before the study and this may not have had an effect on the presence of parasitaemia.

There was low usage (22.1%) of insecticide treated nets amongst pregnant women in the Jos University Teaching Hospital. A similar study from Jos showed that only 22.0% of antenatal women use insecticide treated nets.[27] The reasons given for non-utilization from that study were: non-availability of the nets and the cost of the nets. The use of insecticide treated nets was found to be associated with reduced parasitaemia in this study (OR 0.3214, p-value 0.0120). This is not surprising as evidence supports the use of insecticide treated nets to prevent malaria in pregnancy[9,].

The prevalence of HIV seropositivity in the study (7.5%) though higher than the Nigerian national average (4.4%) , is close to the 8.2% from a previous investigation. This study shows that HIV positive subjects have an increased risk of malaria parasitaemia (OR 13.2091, p-value 0.0033). This is consistent with studies that have shown an association between HIV and Malaria.'

There was no association between blood group and parasitaemia. Even though blood group O has been found to be significantly associated with increased placental malarial infection in primigravidae and reduced risk of infection in multiparae, no studies have been identified that assess the relationship between ABO blood group and peripheral malarial parasitaemia.

Sickle cell trait was associated with a significantly reduced rate of malaria parasitaemia (OR 0.2270, p-value 0.0006). It is known that the sickle cell trait is protective against malaria. This study also shows that those less than 20 years are less likely to have malaria parasitaemia (OR o.2745, p-value 0.0136). A previous study had shown increased prevalence of malaria parasitaemia in this age group. The reason for the reduced prevalence in this study is unclear but may be that the younger age groups are more likely to be educated about malaria preventive measures like intermittent preventive treatment and the use of insecticide treated nets. However, this will require further evaluation.

Women with anaemia were significantly more prone to have malaria parasitaemia (OR 3.8155, p-value

0.0047). The association between malaria and anaemia in malaria endemic areas has been clearly documented.[16,] Accordingly, this was not A surprising finding. Primiparous women had an increased risk of malaria parasitaemia in the study (OR 2.2642, p-value 0.0323. This is consistent with previous studies.[35,]

CONCLUSION / RECOMMENDATION

The prevalence of malaria parasitaemia in Jos University Teaching Hospital is 39.7%. The presence of sickle cell trait, use of insecticide treated nets and those less than 20 years were protected against malaria parasitaemia. HIV seropositivity, primiparity and those with anaemia were more likely to have parasitaemia.

Even though the protective effect of using insecticide treated nets is well established, the use of such nets among pregnant women attending antenatal clinic in JUTH is very low. Efforts should be made to make insecticide treated nets more affordable and readily available. The use of insecticide treated nets amongst women in the reproductive age group should be promoted as a means of reducing the incidence of malaria in pregnancy and its attendant complications.

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