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Prevalence of Congenital Malaria in Port Harcourt, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author IOG designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors IJ and TK managed the analyses of the study. Author TK managed the literature searches. All authors read and approved the final manuscript.

Research Article

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ABSTRACT

Aim: To determine the prevalence of congenital malaria among newborn babies delivered at University of Port Harcourt Teaching Hospital, Nigeria.
Study Design: Cross-sectional study.
Place and Duration of Study: Antenatal clinic and labour ward of the University of Port Harcourt Teaching Hospital, Nigeria between January and September 2010.
Methodology: This study was conducted among 281 pregnant women attending antenatal services at the hospital. Socio-demographic and obstetric information of the mothers was collected. Samples of cord blood smears of babies were stained with Giemsa and examined for malaria parasites.
Results: *Plasmodium falciparum* was the only malaria parasite species. The prevalence of congenital malaria among newly born was 9.6%. This was more prevalent in women of Para 0 (5.3%) compared to other parities (4.3%) (P = 0.048). Malaria parasite was found in 4(16.7%) of preterm and 23(8.9%) of term deliveries (P>0.05).
Conclusion: Congenital malaria is still common in Port Harcourt, Nigeria. It is important that blood smear from neonates are taken and examined for malaria parasite soon after

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birth. Malaria prevention measures such as intermittent preventive treatment, prompt management of all malaria cases and use of insecticide treated bed nets should be emphasized for all pregnant women.

Keywords: Congenital malaria; cord blood; prevalence; Nigeria.

1. INTRODUCTION

Malaria remains the most severe and complex health challenge facing the vast majority of the countries in the sub-Saharan Africa [1]. It a major contributor to high rate of the global infectious disease–related mortality and morbidity particularly in Africa, South-East Asia, Eastern Mediterranean Regions and parts of South America[2]. In the World Malaria Report (WMR) of 2011 the World Health Organization (WHO) estimated that 216 million cases of malaria occurred worldwide in 2010, and majority of the cases (80.55%) occurred in the African Region, followed by the South-East Asia (13.96%) and Eastern Mediterranean Regions (4.63%) [2]. Nigeria accounts for a quarter of all malaria cases in the 45 malaria endemic countries in Africa [2].

In areas of high malaria endemicity most of the malaria-associated morbidity and mortality are recorded in pregnant women and young children [1,3]. Indeed, a child dies of malaria every 30 seconds, a death toll of about 3000 children every day in the sub region alone [1]. Reports from studies and reviews within the last few years are of the opinion that malaria causes at least 20% of all deaths in children under 5 years of age in sub-Saharan Africa [4,5].

Congenital malaria was first described in 1876 [6]. It can be acquired by transmission of parasites from mother to child during pregnancy or perinatally during labour [7]. It was previously thought to be uncommon especially in indigenous populations [8]. More recent studies, however, suggest that incidence has increased [7,9-11]. Studies in Africa have shown that 7–10% or more of newborns have malaria parasites in their placental blood and significant part of the transmission of parasites from the mother to the child occurs well before the time of delivery [12,13]. It is also estimated that, 6% of all infant deaths in malaria-endemic areas are a result of malaria infection that took place during the child's prenatal life [14].

In the control of malaria during pregnancy the WHO recommends the use of insecticide-treated bed nets, intermittent preventive treatment in pregnancy and effective case management and treatment of malaria. Despite all these efforts congenital malaria is still increasingly being reported in endemic countries such as ours.

The aim of this study therefore, was to determine the prevalence of congenital malaria at the University of Port Harcourt Teaching Hospital (UPTH), Nigeria.

2. MATERIALS AND METHODS

2.1 Study Area

This study was conducted among pregnant women receiving antenatal services at University of Port Harcourt Teaching Hospital, Nigeria. The UPTH is located in Port Harcourt

metropolis, the heart of the Niger Delta region of Nigeria. The topography is that of flat plains with a network of rivers, tributaries and creeks which have a high potential for breeding of mosquitoes. Malaria transmission is intense year round with a peak during the rainy season months of March to November and a nadir during the dry season months of December to February.Malaria is one of the ten most common causes of morbidity in the region.

2.2 Study Design, Sampling Frame and Sample Size

A cross-sectional survey was conducted among pregnant women reporting for antenatal services at the UPTH, Nigeria between January and September 2010. The sampling frame comprised all term-pregnant women receiving antenatal service at the hospital and their newly born babies.

Systematic random sampling technique was used to obtain the pregnant women. The sample size was determined according to WHO [15]. Using an expected congenital malaria prevalence rate of 15% and degree of desired precision of 0.05, the sample size of 196 pregnant women was obtained which was the minimum sample size [13].

2.3 Blood Samples

One µl of cord blood was taken after from the umbilical vein (about 15 cm from its place of attachment to the placenta) after cleaning the cord with 70% alcohol to avoid mixing the cord blood with the maternal blood. The placenta was cleaned immediately after delivery and multiple aspirations made on the maternal half of the placenta as described by Sowunmi et al. [16]. The cord was clamped before blood sample was taken to prevent contamination of cord blood from the placenta. From the aspirates, thin and thick films were made on clean microscope slides. Each film was examined by at least two experienced laboratory technicians blinded to each other's outcome at a magnification of x100 under oil immersion. Presence of trophozoites or rings on the blood film was taken as a laboratory evidence of malaria. Identification of Plasmodium falciparum; trophozoites are ring-shaped, small to medium size in dimension (Æ = 2-4 mm) depending on maturation. Young form may lay in marginal position. Polyparasitism and double chromatin dots possible. Schizonts are small and compact, containing 15 to 30 merozoites and with a dense dark brown pigmented residual body. While gametocytes are crescent-shaped with coarse rice-like granules and pigment. The female is blue in colour and granules are in central position, while the male form is violet and granules are scattered over the parasite. Parasite counts were done using standard methods[17].

2.4 Socio-Demographic and Malaria Prevention Data

A structured, pre-tested questionnaire was administered to the selected sample of pregnant women to solicit information about socio-demographic, maternal birth order, malaria status at delivery, malaria chemoprophylaxis, birth weight and gestational age at birth. The data were collected through face-to-face interview with the pregnant women at their delivery wards.

2.5 Statistical Analysis

Data were compiled, coded and analysed using Statistcal Package for Social Science (SPSS) programme version 17. Means with standard deviations, and frequencies were used

to describe the various parameters. Chi square was used to determine correlation between variables. A difference was considered to be significant at $p \leq 0.05$.

2.6 Ethical Clearance

Ethical clearance was obtained from the Ethical Committee of UPTH. All women who participated in the study signed an informed consent form to affirm their willingness to participate in the study. Respondents had the liberty to decline participation or withdraw from the study at any stage without the fear of vengeance. Newborn babies who tested positive for malaria were treated immediately with antimalarial drugs according to national guidelines.

3. RESULTS

Three hundred and fifty (350) antenatal clinic attendees were recruited for the study. However, only 281 (80.3%) presented for delivery giving an attrition rate of 19.7%. All the participants received sulphadoxine-pyrimethamine and proguanil as malaria chemoprophylaxis in pregnancy. The majority of the women 230 (81.9%) were young (<35 years). About 13(4.6%) of the women were teenagers while 51 (18.1%) of the mothers were above 35 years old. About 102 (36.2%) of women involved were primiparous and 179 (63.8%) were multiparous (Table 1). The mean maternal age for all participants was 29.6 ± 5.58 years with a range of 16 to 43 years. Majority of them, 198 (70.5%) had tertiary education (Table 1). Mean gestational age at delivery was 38.69 ± 1.72 weeks.

3.1 *Plasmodium falciparum* was the Only Malaria Parasite Species Encountered

Maternal malaria parasitaemia at delivery was 35(12.5%) of the participants. There was no statistically significant difference between mothers who were primiparous and those of higher parities (Table 2). Cord blood parasitaemia was found in 27 (9.6%) of the babies and this was more prevalent in babies born to women of Para 0 (5.3%) compared to other parities (4.3%). This was statistically significant (P = 0.048) as shown in Table 3.

Majority of the babies 257 (91.5 %%) were born at term (37- 42 weeks) while 24 (8.5%) were preterm. Malaria parasite was found in 4 (16.7%) of pretem and 23(8.9%) of term deliveries. There was no statistically significant difference between the two groups (p=0.266). The mean birth weight was 3306 ± 501g. Twenty three babies were found to be low birth weight. Of these, 4 of them had cord blood malaria parasitaemia and 19 had none. Of the normal weight babies (n= 258) 23 of them had cord blood parasitaemia. There was no statistically significant difference between them (p=0.255).

Table 1. Sociodemographic characteristics of respondents

Characteristic	No	%
Age		
Mean age 29.6 ± 5.58	29.56 ± 5.46	
<20	13	4.6
20 – 24	40	14.2
25 – 29	78	27.8
30 – 34	99	35.2
35 – 39	37	13.2
≥ 40	14	5.0
Total	281	100
Parity		
Mean parity		
0	1.45±1.59	
1 – 4	102	36.3
≥ 5	165	58.7
Total	14	5.0
Marital status	281	100
Married		
Single	267	
Total	14	95.0
Educational status	281	5.0
Primary		
Secondary	8	
Tertiary	75	2.9
Total	198	26.7
	281	70.4
		100

Table 2. Maternal malaria parasitaemia at delivery in relation to parity

Parity	MP (+)	MP (-)	Total	X^2	P-value
0	16 (15.7%)	86 (84.3%)	102 (36.3%)	1.10	0.294
≥ 1	19 (10.6%)	160 (89.4%)	179 (63.7%)		
Total	35(12.5%)	246(87.5%)	281 (100%)		

MP (+) = Malarial parasite positive, MP (-) = Malarial parasite negative

Table 3. Cord blood parasitamia in relation to parity

Parity	MP (+)	MP (-)	Total	X^2	P-value
0	15 (5.3%)	87 (30.9%)	102 (36.3%)	4.79	0.048*
≥ 1	12 (4.3%)	167 (59.4%)	179 (63.7%)		
Total	27 (9.6%)	254 (90.4%)	281 (100%)		

**Statistically significant – P-value < 0.05*

MP (+) = Malarial parasite positive, MP (-) = Malarial parasite negative

4. DISCUSSION

The prevalence rate of congenital malaria observed in this study was 9.6%. Evidence from most of the cross-sectional studies conducted in parts of sub-Saharan Africa on congenital malaria within the last two decades (1990-2010) showed that congenital malaria is not as uncommon as previously thought. For instance a Kenyan study reported a prevalence of 10.8 % [18]. In Tanzania prevalence of congenital malaria was 19.1%[13]. Reports from other parts of Nigeria indicate prevalence rates ranging from 5.1% to as high as 54.2 %[7,9-11,19]. In Calabar, Nigeria, a prevalence of 2.0% using polymerase chain reaction (PCR) was reported recently [20]. This report further revealed that PCR method was more sensitive and specific than microscopy method of examining malaria parasite in the cord blood. Congenital malaria was described as an extremely rare occurrence before 1970s[8]. The rarity was thought to be due to t*he* effectiveness of the placenta to restrain the malaria parasite passage to the foetus and the remarkable capacity of the foetus to resist infection. Furthermore, physical barrier of the placenta to infected red cells, the passive transfer of maternal antibodies, and the poor environment afforded by foetal erythrocytes for plasmodial replication, due to their foetal haemoglobin composition and low free-oxygen tension was responsible for the rarity congenital malaria in these studies[21].

Significant disparities in risk and severity of malaria infection have been reported between women in their first pregnancy and women who are multiparous. In this study, congenital malaria was higher among primiparous than among their multiparous counterparts. Until recently, it was unclear if the presence of malaria parasites in umbilical cord blood was an indication of infection acquired antenatally or a result of contamination with infected maternal blood at delivery. In a 2006 report however, Malhotra *et al*. [22] demonstrated from their study in Kenya that malaria parasites identified in cord blood were acquired antenatally by transplacental transmission of infected erythrocytes and that primigravid and secundigravid women with placental malaria were at increased risk for congenital infection. This finding therefore confirmed earlier reports which had noted that the rate of transplacental transmission of malaria in endemic region was high and suggested that the placental barrier is not very effective when infected with malaria parasites [23,24]. In this study maternal malaria parasitaemia at delivery was higher than that of cord blood. However there was no significant difference between them.

In this study, 12.5% of mothers had malaria parasitaemia at delivery. Previous studies from Nigeria reported maternal malaria parasitaemia rates at delivery ranging from of 24.8% to 80% [11,25-27].

Plasmodium falciparum was the only species encountered in this study. This agrees with a similar study done in Libreville, Gabon [28]. Malaria parasitaemia did not seem to have affected the fetal weight of the babies in this study. Ezechukwu et al. [27] and Sule-Odun et al. [25] made similar observation but this contradicts the work done by Larkin and Thuma, [29] who reported that parasitized babies had lower birth weight.

Prompt and accurate diagnosis is an important tool in the effective management and control of malaria, a disease which accounts for more than a million deaths annually. Microscopy remains the cheapest and most commonly used method for malaria diagnosis and relies on the microscopic examination of stained blood films. Microscopy, however, has its own limitations, even when performed by an expert. It is time-consuming and its sensitivity is limited, particularly when parasitaemia is low.

Sensitivity and specificity are of crucial importance in any identification method as a false negative result could result in the non-treatment of a potentially fatal disease and conversely a false positive result will expose individuals to unnecessary drug intake, with its associated side-effects and high cost, while leaving the true cause of the illness untreated. Polymerase chain reaction (PCR) is an important, reliable, rapid and efficient method of malaria parasite detection. Unfortunately we were not able to perform PCR because it was not available in our study centre.

5. CONCLUSION

Congenital malaria is not uncommon in Port Harcourt, Nigeria. It is important that blood smear from neonates are taken and examined for malaria parasite soon after birth. Malaria prevention measures such as intermittent preventive treatment, prompt management of all malaria cases and use of insecticide treated bed nets should be reinforced for all pregnant women. More studies on effectiveness of control measures during pregnancy are recommended.

CONSENT

All authors declare that verbal informed consent was obtained from the patient for publication of this case report.

ETHICAL APPROVAL

All authors hereby declare that the research was approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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