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Epidemiology of Placental Malaria in Nnewi North L.G.A Anambra South-Eastern Nigeria.

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ABSTRACT

Malaria is a major disease of great public health importance in developing countries to pregnant women due to its morbidity and mortality among the unborn/foetus. This study was conducted between 1st June 2014 to 20th December 2015 to determine the prevalence of placental malaria burden in Anambra State, Nigeria. Venous and placenta blood samples were collected from 331 pregnant women screened in a cross-sectional hospital – based survey in urban, semi-urban and rural part of Anambra State, Nigeria. Malaria parasitaemia was diagnosed by microscopy while haemoglobin concentration was determined using a Sysmex KX-21 haematology analyzer (Sysmex Corporation, Kobe, Japan) anaemia was defined as haemoglobin concentration <12g/l. Malaria species was typed using thin film parasite morphology and count. Of the 331placental blood sample tested 160(48.3%) samples were positive for malaria parasite. Age was significantly associated with malaria infection (P=0.0001). The intensity of the malaria infection showed a very strong association with marital status, educational level, fever and anaemia (P=0.0001, respectively). Public enlightenment on control on preventive measures advocated, to enhance acceptance and compliance to control measures by mothers.

Key words: Epidemiology, Placenta, Malaria, Anambra State, Nigeria

INTRODUCTION

Malarial epidemiology especially among pregnant women, the unborn baby and infants' age 0 to 5 years is on the increase despite effort by the World Health Organization and other world government to control it [1]. Malaria is a major disease of great public health importance that causes the highest morbidity and mortality in developing countries to pregnant women [2]. Pregnancy reduces immunity against malaria and increases the risk of infection occasioned by severe illness, and death for the woman [3]. Other adverse outcomes include spontaneous abortion, still birth, low birth weight, and neonatal death [1]. In 2010, World Health Organization estimates that 219 million cases of malaria resulted in 660,000 deaths [4][5]. Other authors have estimated the number of cases at between 350 and 550 million for *falciparum*, death in 2010 due to *falciparum* at 1.24 million from 1 million deaths as at 1990 [6][2] [7]. About 125 million pregnant women are at risk of infection each year in Sub-Saharan Africa, maternal malaria is associated with up to 200,000 estimated infant deaths yearly [8]. Over 25 million pregnancies occur yearly in malaria endemic area of Sub-Saharan Africa [9]. An annual estimate of 52,900 Nigerian women die from pregnancy related complications representing about 10% of annual death of women in child bearing age in the world caused by malaria infection and

anaemia[10]. The *Plasmodium falciparum* parasite displays adhesive proteins on the surface of the infected blood cells, causing the blood cells to stick to the wall of small blood vessels, thereby sequestering the parasite from passage through the general circulation and the spleen [11].

Malaria in pregnancy may account for 2-15% of maternal anemia; 8-14% of low birth weight newborn; 8-36% of preterm birth; 13.7% intrauterine growth retardation, 30% of preventable low birth weight newborn; more than 50% congenital malaria in newborns; 3-5% of newborn deaths [12]. Each year, more than 7 million women in Nigeria become pregnant in malaria endemic areas; at any given time nearly one-quarter (1/4) may test positive to malaria parasite [13]. The epidemiology of pregnancy malaria infection and disease is complex but reflects underlying interactions between the *Plasmodium falciparum*, the mother, and the foetus [3]. Pregnancy is associated with an increase in the susceptibility to malaria especially in primigravidae [45]. Subsequently, maternal infections are usually asymptomatic among adults in malaria endemic regions, decreasing the chances of clinical detection by using clinical algorithms, primi- and secundigravidae as opposed to multigravidae are most affected as they lack sufficient previous exposure to allow the development of protective immunity [14]. More so, previous study has revealed pregnancy as potentiating malaria especially in malaria endemic areas while gravidity and parity plays a role in reducing malaria infection rate [15][16]. There are inadequate data on the prevalence of placental malaria infection among pregnant women in Anambra State, Nigeria. Against this background, this study aimed at determining the prevalence of placental malaria infection among pregnant women in Anambra State, Nigeria.

MATERIALS AND METHODS

Study Area

Anambra State lies roughly between longitude 06°00'N and 06°20'N Latitude 06°33' and 07o00/ E bounded in the West by South-South geopolitical region of Delta and Edo State respectively and South word Rivers States and two south eastern geopolitical region Imo and Abia States on the other hand, and in the East by Enugu State and in the north central geopolitical zone by Kogi State. Majority of its populace are of Igbo ethnic extraction and 2% are of Igala tribe. It occupies a land area of 4.844 km^2 (1,870.2sq miles). Based on 2006 population census, an estimated population of 4,056,048 people and ranked the 10^{th} most populous state out of the 36 states of the federation

Study Population

This study was conducted between October 2013 to September 2015 in some General Hospitals in Nnewi North and selected public health facilities in the area. A total of 331 pregnant women were enrolled and followed up till delivery in this study. Patients that did not give their consent were excluded from this study. A standardized structured questionnaire on socio-demographic characteristics was administered to the study participants. Informed consent was obtained from each participant before specimen collection. The study was approved by the Ethical Committee of the Ministry of Health, Awka, in Anambra State.

Laboratory Methods

About five milliliter of venous blood was collected from the parturient women attending antenatal into an ethylene diamine tetra acetic acid (EDTA) container. Haemoglobin concentration was determined using a Sysmex KX-21 haematology analyzer (Sysmex

Corporation, Kobe, Japan). Anaemia was defined as a haemoglobin concentration less than 12g/L. Placental blood of equal amount was collected less than 20 minutes after delivery into EDTA container by incising the cleaned maternal surface of the placenta and aspirating blood welling from the incision with a sterile pipette. Thick and thin blood films were made and stained with diluted Giemsa stain and examined for malaria parasites by microscopy using 100X objective lens. *P. faliciparum* were typed using thin film parasite morphology and count as described in [17]

Statistical Analysis

The data were entered into Microsoft excel sheath and analyzed using INSTAT. Test of significance used was odd ratio, P. value less than 0.05 were considered significant. Result was presented in frequencies and percentages.

RESULTS

Parturient women with gestational period of ≥ 24 weeks who are resident within an accessible area of the study, who gave oral or written informed consent and are willing to deliver at various health facilities selected for the study are included in the study while parturient women with brief stay/temporally resident, HIV/AIDS infected parturient women and those that refused consent were excluded from the study. A total, 520 pregnant women were screened, accessed and 416 (80%) met the inclusion criteria and were enrolled and followed up. Eighty-five women were lost to follow-up or excluded before delivery due to spontaneous abortion or relocating away from study area and withdrawal of consent owing to personal reasons. Of the enrolled patients, 331 (79.56%) successfully completed follow up, from whom venous blood samples and placental samples were taken.

The overall prevalence of the study was 48.3%. The prevalence pattern in age of mothers showed that the infection rates decreases as age of women increases in the following order ≤20years >21-30years >31-40years >41-50years >50years (Table 2). The lower infection rates among parturient women of aged 31 to 50years and above. Primigravidae mothers show more infected slides. The distribution of infection based on marital status in this study showed that single mothers had more positive slide than all other categories. Of the 37 single mother tested, 33(89.2%) were positive. Again mother education plays a significant role in placental malaria study, likewise fever, anaemia gravidity and jaundice. (Table.2). Parity, gravidity and low birth weight were significantly associated with the prevalence of placental malaria among pregnant women.

Table 1: Prevalence rate of malaria parasitaemia in maternal Placental and cord blood

Group	Positive (Slides) No. (%)	Negative (Slides) No. (%)	Total No. (%)
Maternal Venous Blood	520 (56.2)	405 (43.8)	925 (100)

Placental Cord Blood	160 (48.3)	171 (51.7)	331 (100)

Overall Prevalence of Placental malaria in this study is 48.3%

Table 2: Prevalence rate of placental malaria parasitaemia against variables measured in mothers and their babies immediate on delivery.

Characteristics	No Tested	No. Infected (%)	OR	95% CI	P value
Age (year)					
16≥20	22	20(90.9)			0.001
21-30	167	112(67.1)			
31-40	103	24(23.3)			
41-50	38	4(10.5)			
>50	1	0(0.00)			
Marital Status					
Single	37	33(89.2)			0.001
Married	263	119(45.3)			
Divorced	14	5(35.7)			
Widow	17	3(17.7)			
Level of Education					
None	0	0.00			0.001
Primary	126	83(65.9)			
Secondary	151	64(42.4)			
Tertiary	54	13(24.1)			
Fever					
Yes	101	89(88.1)	0.247	0.120-0.507	0.001
No	230	71(30.9)			
Anaemia					
Yes	116	104(89.7)	0.693	0.119-4.026	0.001
No	215	56(26.1)			
Parity					
Null parity	133	108(81.2)			0.001
1-4	150	48(32.0)			
≥5	48	4(8.3)			
Gravidity					
Primigravidae	133	108(81.2)	4.752	2.762-8.177	0.001
Multigravidae	198	51(26.3)			

Baby Weight					
Still birth	8	8(100)			
Low Birth weight (LBW)	98	97(99.0)			0.001
Normal Birth weight (NBW)	225	55(24.4)			
Jaundice in babies					
Present	135	105(77.8)	0.168	0.104-0.270	0.001
Absent	188	47(25.0)			
Weight of placenta					
Light weight	188	142(75.5)			0.001
Average weight	143	18(12.6)			
Heavy weight	None				

Key: Light Weight = 270g to 500g; Average Weight = 510g to 700g; Large (Heavy) Weight = 710 to 1000g.

DISCUSSION

Tens of millions of pregnant women who live in malaria endemic areas become infected each year [18].The epidemiology of placental malaria infection and disease is a complex but reflect underlying interaction between the plasmodium *falciparium* parasite, the mother and the foetus [3]. The overall prevalence of placental malaria observed in this study is 48.3% (Table 1), although relatively high but lower than 86.4%, 59.6%, 55.2% and 51.6% observed respectively by [19] [20] [21] [51] in separate studies carried out at different times at Nnamdi Azikiwe University Teaching Hospital Nnewi, Anambra State and other health facilities in the Local Government Area of Anambra State. The prevalence in this study was higher than that observed by [22] who reported a prevalence of 33% in Maiduguri, North Eastern Nigeria, using placental histology method. The result was also lower than that reported in other studies that have relied on placental blood in Nigeria [23] [24] [25] [26]. A total of 925 parturient women were assessed in this study; 520 (56.2%) venous blood from the parturient women tested positive to *P. falciparium* and 331 were followed up to delivery (Table 1) One hundred and sixty blood films collected from placenta tested positive to malaria parasite. The overall prevalence of peripheral blood slides was 56.2% and placental malaria was 48.3% (Table 1). This result was consistent with [27] in Cameroon, but this agreed with [28] [29] [30]. The discrepancies in findings may be due to the differences in the methods used for assessing placental infection. For instance, some used blood smear, others used pool blood and histological methods in their studies. In this study, age of parturient women significantly affected the epidemiology of placental malaria. Young mothers aged <20years were more susceptible. Of 22 placentas screened, 20(90.9%) tested positive with P.value of 0.001. the distribution of parasitaemia across age groups showed that parturient women aged 21-30years recorded highest infection rates: 67.1% of 167 parturient women of this age had *P.falciparum* in their placentas. This finding is consistent with [31] [32] but disagrees with [33] [21] held a contrary view in the relationship of age and placental malaria. The

factors surrounding the age dependent predisposition to placental malaria still require elaborate study. The age-related association with prevalence of placental malaria in this study may be due to immunity which complements the parity-specific immunity in protecting pregnant women against malaria parasite. Marital status is another socio-demographic characteristic that was considered in this study in relation to placental malaria prevalence. Single mothers seemed to show very strong association to placental malaria infection. 33(89.2) of 37 slides tested were positive P<0.001. The reason for higher prevalence of placental malaria among single mothers may be due to stigma attached to unwanted pregnancy in the south eastern region as a taboo, late registration for antenatal (ANC) which negates early prevention and control measures. The significant influence of ANC attendance and the use of Sulfadoxine Pyrimethamine (SP) by pregnant women on reduction of malaria infection have been previously reported in Cameroon [34] [35] Education showed very strong association to placental malaria in this study. Parturient women with no formal education and primary educational level status presented higher prevalence than others in the group (Table 2). Although most previous studies fail to document significant association between disease burden and level of education [20] [27] [36] recorded no positive correlation of placental malaria in education background of the own study conducted in Ilorin Kwara state. The finding was in agreement with other authors [27][37] [26]who reported that education help mothers to understand and use the preventive and control measures for malaria infection. Fever is a major clinical symptom of malaria, this was supported by the findings in the study (OR: 0.249; CI; 0.120-0.507; P0.001). The finding was in agreement with [38][20] [39] who identified febrile illness in pregnancy as a significant risk factor for placental malaria. However, [40] observed that malaria parasitaemia in peripheral circulation of asymptomatic pregnant women might not necessarily result in placental parasitaemia in all instances. Anaemia was another clinical feature of malaria that showed strong association with placental malaria in this study. This finding is consistent with the findings most studies conducted in other African countries and Nigeria[41] [42] [33] [51] the finding is in discrepancy with [27][43] both in Cameroon and[35] in Ibadan Nigeria. Many studies however explained the conflict results obtained in Sub Saharan Africa on the relationship between pregnancies associated malaria and anaemia and the inconsistency of the influences of malaria infection on haemoglobin concentration and anaemia in their study [25] [27] [51]. Further studies are therefore recommended with special interest in other risk factor such as nutrition and other infectious diseases to ascertain the level of malaria involvement in anemia during pregnancy.

Parity and gravidity was significant to placental malaria in this study. This finding is consistent with several studies conducted in different parts of Africa and Asia [28] [44] [27] the finding was inconsistent with [20]. Parturient women with null parity and primi-gravida are more susceptible to placental malaria. The reason for higher prevalence among primi-parous and reduction in prevalence as gravidity increased and parity increased may be due to acquisition of immunity over time as the number of pregnancies increase and placental malaria bouts decrease, alongside child birth. Birth weight is another variable that show strong association with placental malaria. The prevalence of low birth weight in relation to placental malaria in this study was significant 97(99.0%)

with the primigravidae having more (LBW) babies. Consequently, weight of babies born by infected mothers was significantly higher than that of uninfected mothers (P<0.001); this finding was consistent with the report of [45] [46] [47] [48] [49] The prevalence of placental malaria in relation to still birth was also significant; all the eight still births recorded in this study came from mothers whom the placenta was highly parasitized. The study also observed significant association of placental malaria and the occurrence of jaundice 24hours in neonates. Association of placental malaria and jaundice in neonates has not been widely documented in most studies carried out in Nigeria. [50] In his case report revealed the risk factor for jaundice in babies in his transplacental malaria study. [52] Noted an association between transplacental malaria and jaundice which was consistent with the current study. Placental malaria parasitaemia in relation to placental weight was significant highly parasitized placenta are usually light weight. The effect may be as a result of deprivation of essential nutrient by the parasite to the organ [36] Placental malaria was a risk factor acquiring low birth weight, may cause still birth, and a risk factor for the occurrence of jaundice in neonate.

Finally it is important to state that more effort is required to ensure that parturient women adhere to methods of malaria preventive, control strategies and advocacy to ensure that parturient women irrespective of age, educational background and residence are adequately captured in current malaria control programmes.

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