Retrospective study of congenital malaria in Calabar, South-Eastern Nigeria

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ABSTRACT

Background: Perinatal infection heightens the risk of childhood malaria in endemic areas. In Nigeria, exhaustive case studies are necessary to document obviously unrecorded cases of infantile malaria to aid control efforts. Aim: The study aimed to determine the prevalence of congenital malaria among neonates delivered in the hospital. Methods: A retrospective analysis of a five-year medical record, 2009 to 2013 was conducted in General Hospital, Calabar. The study examined laboratory data of 9,398 pregnant women on antenatal admission and 5,730 children aged 0 -7 days; delivered in the hospital within the five-year period. Records of confirmed blood tests by microscopy for Plasmodium species were extracted for analysis. Data were analysed using descriptive and non-parametric statistics. Results: The study identified congenital malaria prevalence of 1.08% and maternal malaria prevalence of 9.17% within the period. The relationship between maternal malaria and congenital malaria was statistically significant ($X^2 = 13.62; P = 0.05$). The five-year prevalence profile indicated a rising trend of congenital malaria towards the current year; from 21% in 2009, 29% in 2010, 14.5% in both 2011 and 2012, to 21% in 2013. Conclusion: Findings suggest possible weakness in the mechanism of maternal malaria management in the city. There is a need to strengthen the existing malaria control capabilities, with ardent attention on vector control, intermittent preventive treatment for pregnant women and capacity for early diagnosis and case management.

Key words: Malaria, congenital, prevalence, maternal, Plasmodium falciparum, vector control

INTRODUCTION

With a global estimate of 214 million cases and 438,000 deaths in 2015,[1] malaria is unarguably still a major killer disease that mankind has to grapple with. The scourge is endemic in sub-Saharan Africa, where 90% of global malaria deaths are recorded owing principally to the predominance of the deadly Plasmodium falciparum and the most effective vector, Anopheles gambiae.[2] Generally, malaria-related illnesses and deaths occur mostly...
among children below 5 years of age and pregnant women.[3,4] Although malaria is spread by active transmission through the bite of the mosquito, passive transmission contributes some percentage of its prevalence as occurs in congenital infections.

Congenital malaria refers to malaria associated with neonates. It is defined as the presence of malaria parasites in the erythrocytes of newborns below seven days of age.[5] This can be acquired by transmission of parasites from mother to child during pregnancy or perinatally during labour,[6] demonstrated in the peripheral blood smear of the neonate.[6] Symptoms occur 10 to 30 days after birth.[7,8] The most common clinical features in 80% of cases are fever, anaemia and splenomegaly.[8,10] Other symptoms may include hepatomegaly, jaundice, regurgitation, loose stools, poor feeding, and in some cases, drowsiness, restlessness and cyanosis.[9,10]

Although it had been documented for many years and first described in 1876,[11] until recently, congenital malaria was known to be a rare condition.[11] Subsequent studies however suggested increasing incidence with values between 0.3% and 33.0% observed from both endemic and non-endemic areas.[12] A review of cross-sectional studies conducted in parts of sub-Saharan Africa between 1990 and 2010 showed that congenital malaria is not as uncommon as previously thought; with prevalence rates between 10.8% and 54.2% observed from the studies conducted between 2005 and 2010 in the region.[13]

The rate of child mortality due to malaria has declined remarkably within the last two decades, with under-five deaths reducing from 12.7 million in 1990 to 5.9 million in 2015.[14] However, the option of perinatal infection still heightens the risk of childhood malaria in endemic areas. Studies have associated the high burden of childhood malaria in endemic regions of the world with malaria during pregnancy.[15]

In Nigeria, prevalence rate of congenital malaria in the ranges of 5.1% to 54.2% have been recorded.[16,17] Exhaustive case studies are necessary to document obviously unrecorded cases in this area. This study is a 5-year retrospective survey of cases of infantile malaria recorded in the General Hospital, Calabar, a major public health institution, aimed at determining the prevalence of congenital malaria in this part of Nigeria.

**METHODOLOGY**

**Study area**

Calabar is the capital city of Cross River State in southern Nigeria. It is geographically located on the coastal fringe of the state, which itself sits on the Atlantic Ocean, straddling Latitudes 4°28′ and 6°55′ north of the Equator and Longitudes 7°50′ and 9°28′ east of the Greenwich Meridian. Cross River State is bordered by the Republic of Cameroun in the East and shares boundaries with the Nigerian states of Benue on the North, Ebonyi and Abia on the west and Akwa Ibom on the south west. Calabar politically comprises two local government areas namely, Calabar South and Calabar Municipal; within a land area of 406Km², with a population of 371,022 people.[18] It is an international tourist destination, which convokes visitors and tourists from around the globe in December. This study was undertaken in the antenatal unit of the General Hospital located in the heart of the city.

**Data collection**

The study relied on secondary data on maternal and neonatal malaria, which were obtained from medical records of the General Hospital, Calabar. The data comprised a five-year record of pregnant women attending the hospital, pregnant women infected with malaria parasites, children born in the hospital and children infected with malaria parasites; from 2009 to 2013. Laboratory data of clinically diagnosed malaria and confirmed blood tests for *Plasmodium* species were extracted from the ward register and hospital files. Laboratory data of 9,398 pregnant women on antenatal admission and 5,730 children delivered in the hospital within the five-year period were examined. Cases of congenital malaria were determined by neonates aged 0 -7 days with confirmed parasitaemia from microscopy; who were still under the care of health personnel and were yet to be discharged from the hospital after delivery.

**Consent / ethical considerations**

The study was approved by the ethical committee of the General Hospital, Calabar.
**Statistical analysis**

All data were analysed using descriptive statistics (mean, percentages prepared in Microsoft Excel), and chi-square test to determine relationship between maternal and congenital malaria, for statistical significance.

**RESULTS**

The total antenatal admission in the hospital within the study period, 2009 to 2013, was 9,398 pregnant women. Out of these, 862 (9.20%) were infected with *Plasmodium falciparum*. A total of 5,730 children were delivered in the hospital within the five-year period; out of which 62 (1.08%), aged 0-7 days, had parasitaemia by microscopy, positive for *Plasmodium falciparum*. The least prevalence (14.5%) was recorded in 2011 and 2012, while the highest (29.0%) was recorded in 2010. The five-year profile showed that prevalence rose from 21% in 2009 to 29% in 2010 and dropped within the following two years, 2011 and 2012; but rose subsequently in 2013 to 21%. Yearly birth and prevalence of maternal and neonatal infection are presented in table 1.

**DISCUSSION**

Malaria prevalence of 1.08% was recorded amongst the newborn in this study. The neonates examined were 0-7 days old who were not discharged from the hospital after delivery; they were deemed to be absolutely protected from mosquito bites, hence active transmission of parasites by the vector was ruled out as source of infection for those with parasitaemia in their peripheral blood. Also, malaria prevalence of 9.17% was recorded amongst the pregnant women within the antenatal period. This strongly suggests that malaria infection observed among the newborns was congenital; obviously due to transplacental transmission of infected erythrocytes, as previously noted.\(^{[18]}\) It has been suggested that congenital malaria is possible where there are leakages between the mother’s blood circulation and the foetus, which causes transfer of infected maternal red blood cells to the child before birth.\(^{[20]}\) Earlier studies\(^{[21,22]}\) have observed the high rate of transplacental transmission of malaria in endemic areas and the seeming less effectiveness of the placental barrier to malaria parasites.

### Table 1: Prevalence of maternal and congenital malaria in General Hospital, Calabar (2009-2013)

<table>
<thead>
<tr>
<th>Period</th>
<th>Pregnant women Attending Hospital N (%)</th>
<th>Pregnant women infected N (%)</th>
<th>Babies Delivered N (%)</th>
<th>Babies Infected N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>1851 (19.7)</td>
<td>208 (24.1)</td>
<td>1098 (19.2)</td>
<td>13 (21.0)</td>
</tr>
<tr>
<td>2010</td>
<td>1489 (15.8)</td>
<td>110 (12.8)</td>
<td>1105 (19.3)</td>
<td>18 (29.0)</td>
</tr>
<tr>
<td>2011</td>
<td>1356 (14.4)</td>
<td>144 (16.7)</td>
<td>593 (10.3)</td>
<td>9 (14.5)</td>
</tr>
<tr>
<td>2012</td>
<td>2030 (21.6)</td>
<td>203 (23.5)</td>
<td>1428 (24.9)</td>
<td>9 (14.5)</td>
</tr>
<tr>
<td>2013</td>
<td>2672 (28.4)</td>
<td>197 (22.9)</td>
<td>1506 (26.3)</td>
<td>13 (21.0)</td>
</tr>
<tr>
<td>Total</td>
<td>9398</td>
<td>862</td>
<td>5730</td>
<td>62</td>
</tr>
</tbody>
</table>

Prevalence 9.17 1.08

\(X^2 = 13.62; P = 0.05\)
The prevalence of congenital malaria identified in this study is a far cry from 46.7% reported a decade earlier in Ile-Ife, South-western Nigeria. However, subsequent hospital-based studies in the country have recorded lower prevalence, such as 13.0% in the University of Calabar Teaching Hospital; 5.1% in the University College Hospital, Ibadan, western Nigeria; 2.0% in the University of Calabar Teaching Hospital; 14% in the General Hospital, Minna, North-central Nigeria; and 9.6% in the University of Port Harcourt Teaching Hospital. However, comparatively lower rates have been reported in neighbouring West African countries such as 2.2% in Ghana and 4.7% in Cote d’Ivore. Reports of such variable prevalence of congenital malaria in these countries with similar endemicity as Nigeria have been explained in terms of differences in malaria prevention coverage during pregnancy or laboratory operational factors. Obviously, the use of Polymerase Chain reaction (PCR), a rapid and efficient method of malaria parasite detection, that can diagnose congenital malaria more frequently because of its ability to detect parasite macromolecules and not necessarily live parasites, would record higher prevalence than microscopy. This study was based on positive parasitaemia by microscopy. Low percentage of congenital malaria may be attributed to transplacentally transmitted antibodies (IgG) which afford transient protection for the infant and thus delayed the onset of clinical manifestations. More so, it has been noted that onset of congenital malaria can be delayed for weeks or months. Rare occurrence of clinical symptoms and absence of febrile episode in younger infants have been described. This study examined records of infants 0 -7 days of age whose peripheral blood was positive for Plasmodium species; and obviously excluded neonates with possible delayed clinical symptoms.

Considering the huge burden of maternal malaria and infant deaths attributed to it in sub-saharan Africa, the reported prevalence may be underestimating the burden of congenital malaria in these endemic countries, including Nigeria. There is a glaring likelihood that the prevalence of congenital malaria in Calabar might be higher than reported, taking into consideration the prevailing dearth of effective control measures. Environmental indicators of effective vector breeding are evident in the poor state of urban drainage, especially in the rainy season. Also, public enlightenment on prevention and control measures is inadequate. Previous studies have reported high transmission rate of malaria in Calabar. This could accordingly express the prevalence of the infection, especially maternal infection, in the area. Prevalence of maternal malaria (9.17%) recorded in this study would also indicate that congenital malaria might be more common than has been identified. The relationship between maternal malaria and congenital malaria was statistically significant ($X^2 = 13.62; P = 0.05$). A strong correlation between placental and congenital parasitaemia has been reported from previous studies in Calabar.

This study has provided a current profile of congenital malaria in Calabar, and would rekindle research focus on maternal and infantile malaria in the study area and other locations. Although the finding in this study compares with the low, 2.0%, prevalence from studies in the University of Calabar Teaching Hospital, reported within the same period; the five-year prevalence profile indicates that congenital malaria was rising from 14.5% in 2011 and 2012 to 21% in 2013, suggesting possible weakness in the mechanism of maternal malaria management in the city. There is justifiable need for the federal and state governments to improve and strengthen existing malaria control capacities, with ardent attention on vector control (man–vector contact), intermittent preventive treatment (IPT) for pregnant women, and capabilities for early diagnosis and case management. The hospital management should engage in thorough screening of neonates before they are discharged.

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