Malaria parasitemia during delivery

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ABSTRACT

Objectives: The aim of this study is to investigate the impact of *plasmodium falciparum* infection in parturient women in Central Sudan where malaria transmission is mesoendemic. The purpose of this paper is to find out the prevalence of malaria parasitemia and the risk of anemia among parturient women and to suggest appropriate strategies to lower their prevalence rates.

Methods: This prospective study was conducted at Medani Teaching Hospital, Sudan, a tertiary regional referral center, during the period January 1997 through to December 1997. All cases were admitted during labor to the delivery room and were clinically suspected to have malaria. History, examination and investigations were carried out on all patients.

Results: The total number of patients enrolled in this study was 550, amounting to 14.9% of all women (N=3,687) who delivered during the study period. The prevalence of malaria parasitemia was 58.9% (N=550) while prevalence of anemia (defined as hemoglobulin <9.0 g/dl) was 24.1%. The mean hemoglobulin levels in patients with positive and negative malaria parasitemia was 9.72 ± 1.62 and 9.85 ± 1.60 g/dl. Statistically the difference in the mean hemoglobulin level was not significant, t=0.879, (P>0.05). A significant negative correlation between parasite count in maternal blood and hemoglobulin level of the mother, was observed, where r=-0.121 (P=0.032). Out of 17 (3.3%) patients who had used chloroquine tablets for prophylaxis, 11 patients still had positive parasitemia. Although there was a higher parasite count in those 11 patients, statistically the difference was not significance where P> 0.05.

Conclusion: The study documents a high prevalence of malaria parasitemia and anemia among the parturient women in Central Sudan. There were 533 pregnant women (97%) who did not use chloroquine tablets as chemoprophylaxis and 17 (3%) had prophylaxis. Eleven of the later (N=17) had positive parasitemia. In view of the high prevalence of parasitemia and anemia, and although the sample of patients who used chloroquine tablets for prophylaxis and had positive parasitemia is small (17 out of 550), a wide scale prophylaxis placebo-controlled trial is recommended to test the impact of prophylactic drugs in pregnancy and to measure the effect on the mother, and the neonate. The drug that proves to be effective as a prophylactic, should be an integral part of ante-natal care along with iron and folic acid as anti-anemic therapy. Moreover, prompt treatment of malaria infection with the appropriate anti-malarial drug, spray of insecticides and the use of insecticide-impregnated bed-nets and curtains for preventing malaria are recommended.

Keywords: Malaria, parasitemia, pregnancy.

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Malaria remains one of the most wide spread parasitic diseases in the world.[1] It is a serious problem particularly in Africa, South of the Sahara, where approximately 90% of clinical cases occur. Either alone or in combination with other diseases, it is estmated to kill between 1.1 and 2.7 million people worldwide each year.[2] Malaria was reported to be one of the most frequent infectious diseases in Sub Sahara Africa where 300-500 million episodes of clinical malaria cases were treated annually with over one million deaths.[3] Pregnant women constitute an important high risk group for malaria infection which may cause abortions, stillbirths, intra-uterine growth retardation (IUGR) and preterm labor. The mortality rate was significantly high in pregnant females in comparison to non-pregnant females.[4] Human infection by *plasmodium faciparum (P.falciparum)* species is associated with a reduction in hemoglobin levels, frequently leading to anemia. Severe anemia in pregnancy was also found to be an important contributor to maternal and perinatal morbidity and mortality.[5-7] In sub-Sahara Africa, severe anemia in pregnancy is very common, the main causes being iron and folate deficiency, malaria, hookworm infestation and advanced human immuno-deficiency virus (HIV) infection.[6] A syndrome of acute hemolysis of anemia especially in mid-pregnancy in women with spleenomegally had been described in Africa, and it responds to antimalarial drugs and prednisolone.[8,9] Previous hospital case-control and community follow-up studies, were conducted in the same region of Central Sudan and showed that there was a significant association between low birth weight and malaria during pregnancy.[10] Another study, in the area, showed also an association between increased risk of neonatal mortality and maternal malaria.[11] The aim of this study is to investigate the impact of *P.falciparum* infection on parturient women in a mesoendemic area in Central Sudan. The maternal and fetal morbidity and mortality, the placental and maternal parasitemia and their effect on fetal weight, and the common hematological changes in those patients are going to be discussed in other papers. The purpose of this paper is to find out the prevalence of malaria parasitemia and the risk of anemia among those parturient women and to suggest recommendations to lower the prevalence rate.

Methods. This is a prospective study on Sudanese pregnant women to investigate the prevalence and effect of *P.falciparum* infection in parturient women in peri-urban and urban locations carried out during the period January 1997 through to December 1997. The study was carried out in Central Sudan where malaria transmission is low to moderate (Mesoendemic). Malaria transmission in this region is described as perennial with *P.falciparum* accounting for over 90% of the cases.[12] The region is famous for its agricultural scheme where water borne diseases are very common especially malaria and bilharzia.[12] The women included in this study, were those who presented to the labor room in labor at Medani Teaching Hospital (MTH), Sudan, and were clinically suspected to have malaria. They had 2 or more of the clinical presentations of fever, rigors, headache, vomiting, diarrhea, abdominal and joint pains. The diagnosis of malaria was only made if the patient was found to have a positive blood film for malaria parasite. An informed consent was given by all patients. A form containing a detailed medical history was filled up by the attending physician (a resident or a registrar). The form contained the name of the patient, age, locality, level of education, gravidity, parity, number of miscarriages, gestational age in weeks, number of attacks of malaria during that pregnancy, the use of chloroquine phosphate tablets as prophylaxis (2 tablets weekly, each tablet contains 600 mg chloroquine phosphate base), and whether taking iron and folate or not. Then all patients underwent a physical examination. Peripheral blood samples were obtained and sent for thin and thick blood film examination for malaria parasite. Then venous blood sample was drawn from those who have positive blood film for parasite count. Parasitologic examinations were conducted in Giemsa-stained slides prepared from maternal blood at the Gezira University Reference Laboratory in Wad Medani, Sudan. A team of trained technicians examined 100 microscopic field on each slide to determine parasite species and counts. All slides were reviewed by a 2nd technician to confirm the diagnosis. For all patients, a complete blood count was carried out. The hemoglobulin (Hb) was determined by the acid hematin method (Sahli) described by Baker and Silverton.[13] All laboratory investigations were conducted under close supervision of a pathologist. The data was computed and analyzed using statistical package for social sciences (SPSS) for windows. Student t-test and chi-square were used as test of significance at 5% level of significance. A simple correlation coefficient (r) was used to study the correlation between quantitatives variables.

Results. The total number of patients enrolled in the study was 550 parturient women (14.9%) of all women number (N)=3687 who delivered during the study period. Their ages ranged from 14 to 42 years with a mean age of 30.03 ± 6.96 years. The parity ranged from one to 9 with a mean parity of 3.43 ± 1.94. The prevalence of malaria parasitemia among the parturient women examined, was 58.9% (N=550). The prevalence of anemia (defined as Hb less than 9.0 g/dl) was 24.1%. The overall Hb levels ranged from 2.3 to 14.4 g/dl with a mean Hb level of 9.77 ± 1.61 g/dl.

Maternal parasitemia and hemoglobulin level (Table 1). The mean Hb level in patients with positive malarial parasitemia was 9.72 ± 1.62 g/dl and the mean Hb level in patients with negative malarial parasitemia was 9.85 ± 1.60 g/dl. Statistically the difference in the mean Hb level was not significant t = 0.879, (p > 0.05). Though there was no difference in Hb levels between patients who had parasitemia and patient who had not, there was significant negative correlation between parasite count in maternal blood and Hb level of the mother, where r= -0.211 (p=0.032).

Mother parasitemia and parity (Table 2). Out of the 146 primigravida, 82 (56.2%) had parasitemia, 179 (57.7%) of the multiparous patients (2-5) (N=310) had positive parasite and 63 (67%) of the grandmultipara (6+) (N=94) had parasitemia. There was no statistically significant difference between the presence of parasitemia in primigravidae and other parities. X^2=3.182 (p>0.05).

Parasite counts in patients who had prophylaxis and those did not. Seventeen patients (3.3%) (N=550) used chloroquine tablets as prophylaxis. Out of those 17, 11 had positive parasitemia (68%). The mean parasite count among those 11 patients was 108.64 ± 183.59 and 66.88 ± 132.80 in those who had no prophylaxis (N=313). Although there were more parasite count in those 11, patients, statistically the difference was not significant where p>0.05.

Table 1 - Maternal parasitemia and hemoglobulin level.

Mother parasitemia	N of patients	Mean hemoglobulin level (SD)
Negative (-ve)	226	9.85 (1.60)
Positive (+ve)	324	9.72 (1.62)
N - number, SD - standard deviation, t-0.879, (P>0.05)		

Table 2 - Mother parasitemia and parity.

Parasitemia	Pregnant Patients				Total	
	Primigravida		Multiparous (2-5)		Grandmulti-parous (6+)	
	N	(%)	N	(%)	N (%)	N (%)
Mother -ve	64	(43.8)	131	(42.3)	31 (33)	226 (41.1)
Mother +ve	82	(56.2)	179	(57.7)	63 (67)	324 (58.9)
Total	**146**	**(100)**	**310**	**(100)**	**94 (100)**	**550 (100)**
N - number, -ve - negative, +ve - positive, X^2-3.183, p-0.05						

Discussion. Malaria infection in humans by *P. falciparum* species is associated with a reduction in Hb levels, frequently leading to anemia. *Plasmodium falciparum* causes the most severe and profound anemia with significant risk of death.[5] The potential maternal and neonatal morbidity and mortality due to malaria infection have generated a lot of concern among practicing clinicians.[2-6] Analysis of data from a malaria clinic in Central India, showed a high malaria prevalence among pregnant women to non-pregnant women.[14] The same study showed that malaria infection was more frequent in primigravidae falling progressively with increasing parity. Severe anemia, hepatic and renal failure, again were observed more commonly in pregnant females (20%) in comparison to non-pregnant females (4.1%) suffering from *P. falciparum*.[4] In Sub-Sahara Africa, severe anemia in pregnancy is very common and it is an important contributor to maternal and perinatal morbidity and mortality. The main causes of anemia being iron and folate deficiency, malaria hookworm infestation and advanced HIV infection.[6] Previous studies in the Sudan showed that *P.falciparum,* represents the main malaria parasite species in the country.[15,16] Several surveys carried out in the Gezira (Central Sudan) showed that *P.falciparum* remaining the dominant species and *P.ovale* was not reported.[17] This study which is carried out in Central Sudan showed a prevalence of 58.9% (N=550) of *P. falciparum* malaria parasitemia among the parturient women examined and a prevalence of 24% of anemia. There was no statistical significant difference in mean Hb level between patients with positive and negative malarial parasitemia where t=0.879, (p=> 0.05). A similar study carried out in Tanzania, showed a lower prevalence of malaria parasitemia among pregnant women examined, 9.4% (N=705) and lower prevalence of anemia (defined as hemoglobulin (Hb) <8.5 g/dl), of 12.4% (N=579). They also observed that there was no significant difference in prevalence proportions of malaria parasitemia in relation to age and parity.[18] However the prevalence of anemia among women of the age group 31-45 years was significantly lower than that observed among women in the age group 14-20. Another study carried out in Malawi for malaria and anemia in antenatal women showed a similar prevalence of parasitemia and anemia to the findings of this study. They found 42.7% (N=4762) had a malaria parasitemia which was more common and of higher densities in primigravidae and teenagers than multigravidae or older women.[19] Also, they showed that 57.2% of the women were anemic and women with moderate or severe anemia (7.0-8.9 g/dl), (<7.0 g/dl), had higher parasite prevalence and densities than women with mild/no malaria. A similar trend was observed in this study, where there was a significant negative correlation between parasite count in maternal blood and Hb level of the mother,

r=-0.121 (P=0.032). In other words with an increase in parasite count in the maternal blood, there was an associated decrease in Hb level in the mother. It was also found that the Hb level of the patient in relationship to parity was statistically different (F=4.629; P=0.01). When further statistical analysis using Schiffe test was carried out, it was found that the mean Hb levels of the primigravidae was significantly higher than the multiparous (2-5) and grandmultiparous (6+). These findings are not in agreement with other findings, which indicated that parasitemia and anemia are more common in primigravidae than multiparous. Mockenhaupt et al[20] showed in their study that with increasing gravidity, *P.falciparum* infection rates and parasite densities decreased and the corresponding anemia, fever and evidence of inflammation were more frequent in primigravidae than in multigravidae.[14] The primigravida in this study had higher Hb levels than the multiparous patient. This could be explained by the fact that the anemia is usually more common in multifarious patients.[21] Though malaria as a cause of anemia is preventable, the overall prevalence of anemia and parasitemia has not changed over many years.[5] This is probably due to several reasons including, operational problems and inadequate intervention measures. In Central Sudan the problem of malaria is most acute in pregnant women where malaria transmission is mesoendemic. In recent years malaria transmission has been influenced by amount of rain, population movements, extension of agricultural and irrigation projects, the spread of resistance to insecticide and the deterioration of health infrastructure. On the other hand, *P. falciparum* is increasing worldwide due to an increase of development of resistance to the available antimalarials. All these factors aggravate the situation of malaria in pregnant women, and the options for their treatment, are even more restrictive due to the unknown effects of anti malarials on the fetus. Chemoprophylaxis using chloroquine was claimed to be effective in reducing peripheral malaria parasitemia.[22] Ndyomugyenyi et al[23] in Western Uganda, found that chloroquine prophylaxis and iron and folic acid supplementation significantly increased Hb levels during pregnancy as compared to case management. In this study 533 patients (97%) did not use chloroquine as prophylaxis, and out of those who used chloroquine prophylaxis 17 (3%), 11 had positive parasitemia. Whether this was due to chloroquine resistant is not clear, due to the small number of cases.

It is obvious from the above results that the prevalence of malaria parasitemia and anemia were high in Central Sudan. The patients who used chloroquine for prophylaxis are few (3%). These findings suggest the need for intervention measures that should be directed at controlling malaria in pregnancy, which is a major public health problem. Improved control of such disease requires better integration into the health care system. Given the costs and inputs required to effectively deliver a wide scale prophylaxis program, we believe a large simple placebo-controlled trial, testing the impact of prophylactic drugs given during pregnancy, to see the outcome on mother and neonatal is warranted. Then the drug that proves to be effective as a prophylactic, should be an integral part of ante-natal care along with iron and folic acid as anti-anemic therapy. Prompt treatment of malaria infection with the appropriate anti-malarial drugs, and other general control measures, such as insecticide spraying, use of insecticide impregnated bed nets and curtains for preventing malaria are also recommended.

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