Original Article

Impact of Malaria in Pregnancy on Maternal and Fetal Health Among Flood-Affected Patients at GMC Sukkur

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Abstract

Objective: To evaluate the impact of malaria among flood-affected pregnant women and their fetuses who presented at Ghulam Muhammad Mahar Medical College (GMMC) Sukkur

Methodology: A descriptive cross-sectional Hospital based study was conducted at Obs& Gynae at Ghulam Muhammad Mahar Medical College (GMMC) Sukkur during the year of 2022 on pregnant women resident of flood affected areas regardless of age, parity, or booking status, with a diagnosis of malaria. Demographic and clinical details, along with data related to maternal and fetal health, were collected using a pre-designed study proforma. SPSS version 26 was used for the data entry and its analysis.

Results: Mean age of the women was 25.33+8.33 years and mean gestational age was 35.27+2.50 weeks. Plasmodium Vivax was the most common plasmodium 90.2%, followed by falciparum 4.9% and combined infection was detected in 4.9% of the women. Maternal anemia was common (76.2%), mainly linked to P. vivax (67.2%, p=0.331), while thrombocytopenia occurred in 48.4% of cases, significantly associated with P. vivax (40.2%, p=0.020). Fetal complications included preterm birth (16.4%, p=0.538) and low birth weight (16.4%, p=0.515), primarily linked to P. vivax. Intrauterine demise (4.1%) showed a significant association (p=0.001).

Conclusion: This study revealed a significant impact of malaria, particularly Plasmodium vivax, on maternal and fetal outcomes among flood-affected women presented at GMC Sukkur. Frequent maternal complications observed anemia and thrombocytopenia, while fetal complications such as preterm birth, low birth weight, and NICU admissions were predominantly associated with P. vivax.

Keywords: Flood, Malaria, Vivax, Material complications.

Cite this article as: Soomro S, Mahjabeen, Shailkh AA, Hafeez R, Memon Sh, Lakahn H. Impact of Malaria in Pregnancy on Maternal and Fetal Health among Flood-Affected Patients at GMC Sukkur. J Soc Obstet Gynaecol Pak. 2024; 14(4):394-399.

Introduction

Malaria ranks among the most lethal infectious diseases globally and it poses a significant public health challenge, particularly in developing nations. In regions where malaria is endemic, pregnant women are particularly vulnerable to contracting the infection and developing severe, life-threatening forms of the disease.[1] Enhancing the implementation of antimalarial strategies specifically designed for pregnant women, while addressing the social, cultural, and economic factors that exacerbate their vulnerability, holds significant promise for controlling the disease among high-risk and underserved populations.[1,2] Pregnant women face a heightened risk of more frequent and severe malaria compared to non-pregnant women.[3] The severity of malaria's effects depends on the woman's level of antimalarial immunity. In high-transmission areas, where women are partially immune, malaria often remains asymptomatic without causing a fever but can lead to severe anemia due to persistent infection.[3] Severe anemia is more commonly observed in regions with high malaria prevalence, particularly among primigravida compared to multigravida women.[4] Malaria infections contracted during the first or second trimester significantly elevate the risk of developing anemia.[4,5]

Malaria in pregnancy significantly impacts the health of both the mother and the developing fetus and may also influence the infant's susceptibility to malaria after birth.

Authorship Contribution: [1]design, data collection and analysis of the work, [2,3] the final approval and critical review, [4,5]Collection and interpretation of data, Literature review, [6]contributions to drafting the work, Active participation in active methodology

Funding Source: none
Conflict of Interest: none

Received: July 05, 2024
Accepted: Nov 18, 2024

While the mechanisms behind this altered risk are not fully understood, exposure to malaria antigens in utero could affect the maturation of innate immunity in the fetus and infant.[6] Malaria during pregnancy has widespread and multifaceted negative consequences, with placental malaria being a suspected common pathological feature.[7] This condition is marked by the accumulation of Plasmodium-infected erythrocytes in the intervillous spaces of the placenta, leading to placental inflammation.[7] Such inflammation can disrupt nutrient and gas exchange, resulting in adverse outcomes, including preterm births, low birth weight (LBW), still born babies and the neonatal mortality.[7-9]

The rate of mortality from severe malaria complications is influenced by a range of factors, including the patient's clinical condition, the quality and timeliness of medical treatment, and the progression of the infection. Mortality risk is further heightened by patient vulnerabilities unrelated to malaria itself, such as advanced age, concurrent infections with other pathogens, or compromised immunity.[10,11] These factors can result in death irrespective of the specific malaria parasite involved.[4,5] Severe malaria carries a notably higher mortality rate, exceeding 5%, in contrast to uncomplicated malaria, where the death rate is comparatively low, around 0.1%.[10,12]

According to WHO in Pakistan, the reported malaria cases surged dramatically following the floods, with numbers increasing at least fourfold from 400,000 cases nationwide in 2021 to over 1.6 million cases in 2022 within 60 districts supported by the Global Fund.[13]

The true number of cases is likely much higher. This sharp rise was especially pronounced in two provinces, Balochistan and Sindh.[13] Due to overburdened healthcare systems and disrupted preventative measures, women during pregnancy and their newborns are particularly at risk for malaria following extreme events, as evidenced by the rise in instances. Despite the high incidence of malaria during floods during pregnancy, not much data is available about how it affects feto-maternal health in Sindh, Pakistan. By improving healthcare systems in endemic areas, this study will help feto-maternal survive better in future emergencies.

Methodology

A descriptive cross-sectional Hospital based study was conducted at Gynae and OBS department of Ghulam Muhammad Mahar Medical College (GMMC) Sukkur. Study was done in the year of 2022 on flood affected population of Sukker presented at GMC Sukker. All pregnant women resident of food affected areas regardless of age, parity, or booking status, which were admitted to or visited the Gynecology and Obstetrics outpatient department (OPD) with a diagnosis of malaria, were included in the study. All the women with other comorbidities like typhoid fever, tuberculosis, diabetes, chronic hypertension, autoimmune disease or women who declined consent or were unable to provide complete clinical information were excluded from the study. Non probability consecutive sampling technique was used. A sample size of 122 patients was calculated by using OpenEpi software with the confidence interval of 95% and a 5% margin of error.

Patients were considered as positive based on RDTs or microscopy of blood smears for Plasmodium falciparum or Plasmodium vivax. Informed consent was obtained from each participant or their caretakers after explaining the purpose and objectives of the study. They were assured that all their information would remain confidential and that participation would not pose any risks or disadvantages to them. All demographic and clinical details, along with data related to maternal and fetal health, were collected using a pre-designed study proforma. SPSS version 26 was used for the data entry and its analysis.

Results

Mean age 25.33$\pm$8.33 years and mean gestational age 35.27$\pm$2.50 weeks. Majority of the women (63.9%) were aged between 19 to 25 years, followed by 29.5% in the 26 to 30-year age group, 4.9%, belonged to the 13 to 18-year age range, while only 1.6% were over 30 years old. Fever with chills was the most common symptom (82.8%), followed by nausea/vomiting (45.9%). Rare symptoms included unconsciousness and diarrhea (4.1% and 4.9%, respectively). Most participants (73.8%) were admitted through emergency services. Cesarean section was the predominant delivery method (68.9%), with fewer cases of spontaneous vaginal deliveries (26.2%) and SVD with episiotomy (4.9%). (Table I)

Plasmodium Vivax was the most common plasmodium detected among 90.2% of the cases, followed by falciparum in 4.9% of the cases and a combined infection was detected in 4.9% of the women. (Figure 1)

Table I: Clinical features of the women affected by malaria. (n=122)			
CLINICAL FEATURES		**N**	**%**
Fever with chills	Yes	101	82.8
	No	21	17.2
Headache	Yes	37	30.3
	No	85	69.7
Unconsciousness	Yes	5	4.1
	No	117	95.9
Diarrhea	Yes	6	4.9
	No	116	95.1
Nausea / vomiting	Yes	56	45.9
	No	66	54.1
Others	Yes	6	4.9
	No	116	95.1
Mode of admission	Emergency	90	73.8
	OPD	32	26.2
Mode of delivery	SVD	32	26.2
	SVD with EPI	6	4.9
	C Section	84	68.9

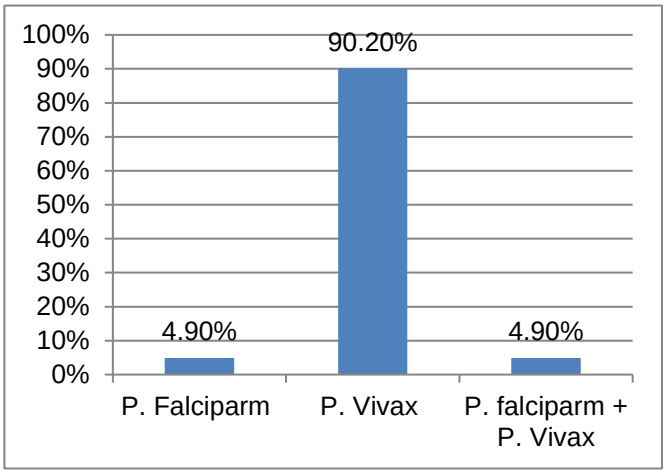

Figure 1. Types of malarial plasmodium. (n=122)

Anemia was the most common outcome, affecting 76.2% of cases, predominantly linked to *P. vivax* (67.2%, p=0.331). Thrombocytopenia occurred in 48.4%, significantly associated with *P. vivax* (40.2%, p=0.020). Rare complications included renal failure (3.3%, p=0.798), placental abruption (2.5%, p=0.746), and ICU admissions (3.3%, p=0.798). Postpartum hemorrhage was seen only with *P. falciparum* (1.6%, p=0.001). Mortality was minimal (0.8%, p=0.946), with one case linked to *P. vivax*. Overall, *P. vivax* contributed to the majority of complications. (Table II)

Preterm birth and low birth weight were observed in 16.4% of cases each, predominantly linked to *P. vivax* (15.6% and 13.9%, respectively), though the associations were not statistically significant (p=0.538 and p=0.515). Intrauterine demise (IUD) was recorded in 4.1% of cases, significantly associated with *P. falciparum* and *P. vivax* (p=0.001). NICU admission was required in 12.3% of cases, mainly associated with *P. vivax* (10.7%), but the association was not statistically significant (p=0.889). These findings highlight *P. vivax* as the primary contributor to fetal complications. (Table III)

Table II: Maternal outcomes and association with types of plasmodium. (n=122)

Maternal outcomes	TYPE OF MALARIA			Total	p-value
	P. Falciparum	P. Vivax	PF+PV		
Anemia					
Yes	6	82	5	93	0.331
	4.9%	67.2%	4.1%	76.2%	
No	0	28	1	29	
	0.0%	23.0%	0.8%	23.8%	
Thrombocytopenia					
Yes	4	49	6	59	0.020
	3.3%	40.2%	4.9%	48.4%	
No	2	61	0	63	
	1.6%	50.0%	0.0%	51.6%	
Renal failure					
Yes	0	4	0	4	0.798
	0.0%	3.3%	0.0%	3.3%	
No	6	106	6	118	
	4.9%	86.9%	4.9%	96.7%	
placental abruption					
Yes	0	3	0	3	0.746
	0.0%	2.5%	0.0%	2.5%	
No	6	107	6	119	
	4.9%	87.7%	4.9%	97.5%	
Post-partum haemorrhage					
Yes	2	0	0	2	0.001
	1.6%	0.0%	0.0%	1.6%	
No	4	110	6	120	
	3.3%	90.2%	4.9%	98.4%	
ICU admission					
Yes	0	4	0	4	0.798
	0.0%	3.3%	0.0%	3.3%	
No	6	106	6	118	
	4.9%	86.9%	4.9%	96.7%	
Mortality					
Yes	0	1	0	1	0.946
	0.0%	0.8%	0.0%	0.8%	
No	6	109	6	121	
	4.9%	89.3%	4.9%	99.2%	

Discussion

Public health is greatly impacted by floods, and one of the most concerning outcomes in areas like Sindh, Pakistan, is the rise in malaria infections, particularly among susceptible groups. Devastating floods in Sindh make malaria transmission worse by generating pools of stagnant water that provide perfect breeding grounds for malaria-carrying Anopheles mosquitoes. Pregnant women are especially vulnerable to contracting malaria because pregnancy impairs immunity. Pregnancy-related malaria is linked to severe adverse effects. This

Table III: Fetal outcomes and association with types of plasmodium. (n=122)

Fetal outcomes	TYPE OF MALARIA			Total	p-value
	P. Falciparum	P. Vivax	PF+PV		
Pre-term birth					
Yes	1	19	0	20	0.538
	0.8%	15.6%	0.0%	16.4%	
No	5	91	6	102	
	4.1%	74.6%	4.9%	83.6%	
Low birth weight					
Yes	1	17	2	20	0.515
	0.8%	13.9%	1.6%	16.4%	
No	5	93	4	102	
	4.1%	76.2%	3.3%	83.6%	
IUD					
Yes	2	3	0	5	0.001
	1.6%	2.5%	0.0%	4.1%	
No	4	107	6	117	
	3.3%	87.7%	4.9%	95.9%	
NICU admission					
Yes	1	13	1	15	0.889
	0.8%	10.7%	0.8%	12.3%	
No	5	97	5	107	
	4.1%	79.5%	4.1%	87.7%	

study has been done to explore the impact of malaria among flood-affected pregnant women and their fetuses who presented at GMMC Sukkur, with an overall mean age of 25.33±8.33 years and mean gestational age 35.27±2.50 weeks. In aligns to this study maternal average age was 25.32±5.79 years and in their study most of the patients 72.7% presented during 2nd and 3rd trimester of pregnancy. On the other hand, Dosoo DK et al[15] reported that the mean age of women with malaria was 27.4 ± 6.2 years and mean gestational age was 16.7±4.3 weeks. Consistently Mavoungou YV et al[16] also reported the mean age of women was 27 ± 7.9 years. The lower mean gestational age of pregnant women with malaria reported in other studies compared to this study may be due to the fact that this study specifically focused on enrolling patients who were nearing delivery and admitted to assess additional outcomes related to fetal health.

In this study lasmodium Vivax was the most common plasmodium detected among 90.2% of the cases, followed by falciparum in 4.9% of the cases and a combined infection was detected in 4.9% of the women. Furthermore the fever with chills was the most common symptom (82.8%), followed by nausea/vomiting (45.9%). In the supporting to this study, Qureshi H et al[17] reported that the prevalence rates of *P. falciparum*, *P. vivax*, and mixed infections were 2.1%, 96.8%, and 1.1%, respectively. Regarding clinical presentations, the most common symptoms observed in patients with *P. falciparum* included fever accompanied by the sweating and chills, while on the other hand, *P. vivax* infections were predominantly characterized by symptoms such as fever with chills, headache, and muscle pain. In consistently Soomro P et al[18] reported that the among the participants, 147 pregnant women 81.2% were diagnosed with *P. falciparum* infection, while 18.8% were affected by *P. vivax* or *P. ovale. However,* Latif N et al[19] found correlated findings as prevalence of *P. vivax* malaria was found to be highest across the three trimesters of pregnancy.

In this study anemia was the most common complication, affecting 76.2% of cases, thrombocytopenia was in 48.4%, with a significant association with *P. vivax*, p=0.020). Rare complications included renal failure (3.3%), placental abruption (2.5%), and ICU admissions (3.3%), none showing significant associations with types of plasmodium (p->0.05). Postpartum hemorrhage occurred exclusively with *P. falciparum* (1.6%, p=0.001), while mortality rate was only 0.8%. In aligns to this study Kamanzi Nyirabashitsi I et al[20] reported that the maternal complications with malaria encompass severe reduced Hb level, respiratory distress syndrome, and possible long-term health consequences. On the other hand, Latif N et al[19] reported that in terms of pregnancy outcomes, 1.35% of patients experienced puerperal fever, 2.2% had a miscarriage, 5.50% faced neonatal mortality, 6.90% were diagnosed with anemia, 1.25% developed cerebral malaria, and overall, 6.6% of complications were documented in their study.

Furthermore, Qureshi H et al[17] and the Soomro P et al[18] also reported correlated findings regarding maternal outcomes with malaria. There were some differences in maternal outcomes with malaria across studies, likely due to factors such as variations in study populations, including demographic characteristics, nutritional status, and pre-existing health conditions, as well as differences in the severity and type of malaria infections, access to healthcare, diagnostic methods, timing of interventions, geographical settings, and the use of preventive measures or antimalarial prophylaxis.

Moreover, based on the fetal outcomes, preterm birth and low birth weight were observed in 16.4% of cases and predominantly linked to *P. vivax*, IUD frequency was recorded 4.1% of cases, significantly associated with *P. falciparum* and *P. vivax* (p=0.001). NICU

admission was required in 12.3% of cases, mainly associated with *P. vivax* (10.7%), but the association was not statistically significant (p=0.889) and the findings highlight *P. vivax* as the primary contributor to fetal complications. In the comparison of this study Romero M et al[21] reported a significant prevalence of maternal and fetal complications with the most common issues being preterm deliveries, abortion, Oligohydramnios, and the fetal mortality. Additionally, like this study they also found, nearly all these complications occurred in women infected with *Plasmodium vivax*, a form of malaria generally regarded as less severe than *Plasmodium falciparum* malaria.[21] Furthermore in the studies by Latif N et al[19], Núñez-Troconis JT et al[22] and Palem G et al[23] reported several adverse effects for fetal outcomes among women with malaria. However, there were some differences in both maternal and fetal outcomes when compared to national and international studies, which may be attributed to several limitations of this study, including the small sample size, the absence of a control group, and the fact that this study was conducted exclusively on patients from flood-affected areas. These factors could have influenced the results, limiting the generalizability and comparability of the findings with other studies. Given focus of the study on flood-affected areas, it is important to explore how environmental factors, such as flooding and associated increases in mosquito breeding sites, influence malaria transmission and pregnancy outcomes. Implementation of the targeted malaria prevention activities are recommended in flood-affected areas where mosquito breeding grounds have increased. These should include the mass distribution of nets treated with insecticides, residual spraying inside, and the administration of antimalarial prophylaxis specifically for women during pregnancy. However, further large-scale studies are recommended to validate the findings and are important for developing preventive and management strategies.

Conclusion

This study revealed a significant impact of malaria, particularly Plasmodium vivax, on maternal and fetal outcomes among flood-affected women presented at GMC Sukkur. Frequent maternal complications observed anemia and thrombocytopenia, while fetal complications such as preterm birth, low birth weight, and NICU admissions were predominantly associated with P. vivax. Findings underscore the requirement for improved malaria prevention, early diagnosis, and effective management, together with strengthened antenatal care and public health strategies in disaster-affected regions to minimize the adverse fetomaternal outcomes.

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