Journal of Zoonotic Diseases
https://jzd.tabrizu.ac.ir/
Published by the University of Tabriz
Online ISSN: 2717-2910

Is malaria exclusively a disease of the poor people in India? A case report on *Plasmodium vivax* infection

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Article type:
Case report

Keywords:
Plasmodium vivax
Thrombocytopenia
Poverty
Rural health
Infection risk
India

Article history:
Received:
September 26, 2024
Revised:
October 28, 2024
Accepted:
October 30, 2024
Available online:
December 23, 2024

Abstract

Malaria remains a public health challenge in India, disproportionately affecting impoverished populations. This case report examines a 46-year-old male daily wage laborer from Raipur Range, Dehradun, who was diagnosed with *Plasmodium vivax* malaria. The patient's residence near a sewage lake and his low-income status contributed to his heightened vulnerability to mosquito-borne infections. He presented with typical malaria symptoms, including recurrent fever, chills, and fatigue, persisting for 30 days despite prior treatment. Diagnostic tests, including Abbott's Malaria Ag Pf/Pv card and general blood picture microscopy, confirmed *P. vivax* infection. Hematological results indicated mild anemia and thrombocytopenia, commonly associated with malaria. This case highlights the environmental and socioeconomic factors that exacerbate malaria risk in disadvantaged populations, raising the question of whether malaria is exclusive to the poor or if poverty worsens its impact. In India, *P. vivax* is responsible for the majority of malaria cases, especially in urban areas where controlling the disease is difficult due to slum growth and poor sanitation. *P. vivax* is complicating diagnosis due to overlapping clinical features of other infections like dengue. This case underscores the importance of targeted public health interventions to mitigate malaria transmission in low-income regions.

Introduction

Malaria is a significant public health concern in India, particularly among underprivileged populations. Despite India's attempts to eliminate malaria, the illness disproportionately affects the lowest parts of society. According to the World Health Organization (WHO), India accounted for 2% of worldwide malaria cases in 2022, with *Plasmodium vivax* being one of the most common species responsible for human malaria (1). The disease is primarily spread by the bite of infected female Anopheles mosquitoes, which flourish in

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https://doi.org/10.22034/jzd.2024.63717.1306
https://jzd.tabrizu.ac.ir/article_18995.html
Cite this article: Afzal M. Is malaria exclusively a disease of the poor people in India? A case report on Plasmodium vivax infection. Journal of Zoonotic Diseases, 2024, x (x): xx.

places with poor sanitation, stagnant water, and insufficient housing—conditions more typically seen in low-income populations (2). The risk of malaria is not limited to the poor; however, socioeconomic position has a substantial impact on vulnerability and exposure to the illness. Daily wage workers, slum dwellers, and those living near unsanitary settings, such as sewage lakes or water bodies, are at a higher risk (3). Limited access to healthcare, preventive measures like insecticide-treated bed nets, and knowledge about the disease exacerbates this problem in poorer populations (4).

This case report explores the life of a 46-year-old male daily wage laborer from Raipur Range, Dehradun, who was diagnosed with *P. vivax* malaria. His residence near a sewage lake and his low-income status likely contributed to the acquisition and progression of the infection. The case highlights the need for targeted public health interventions in impoverished areas and raises the question: Is malaria truly a disease of the poor, or does poverty exacerbate its effects?

Previous studies suggest that disadvantaged populations are at a higher risk for malaria due to poverty-related factors. These findings have broader implications for disease prevention and control in India, emphasizing the need to address socioeconomic disparities when developing strategies to combat malaria in poor populations (5, 6).

Case Report

Patient Demographics

A 46-year-old male patient residing in Raipur Range, Dehradun, presented with symptoms suggestive of malaria. He lived near a sewage lake, in conditions that likely contributed to his susceptibility to mosquito-borne infections. The patient worked as a daily wage laborer and belonged to a poor family, with limited access to healthcare and preventive measures. His socioeconomic background and living environment placed him at a higher risk of contracting malaria.

Medical History

The patient had no significant previous medical history. However, for the past 30 days, he had been experiencing typical symptoms of malaria, including recurrent episodes of fever, chills, and fatigue. Despite consulting a local physician and receiving medication, his symptoms persisted without any notable improvement.

Clinical Presentation

Seeking further evaluation, the patient visited Sikund Diagnostic Centre in Dehradun for a fever profile test. A rapid diagnostic test, the Abbott's Malaria Ag Pf/Pv card (Figure 3), was used, which confirmed the presence of *P. vivax*. To further validate this finding, a general blood picture (GBP) microscopy was performed, which identified *P. vivax* gametocytes in the blood (Figures 1 and 2).

Hematological Investigation Results

The hematological investigation revealed mild abnormalities. The patient's hemoglobin (Hb) level was 10.1 g/dL, indicating mild anemia. His red blood cell (RBC) count was within the normal range at 4.14×10^6/µL. The white blood cell (WBC) count was also within normal limits at 7.86×10^3/µL. However, the platelet count was reduced to 113 x 10^3/µL, suggesting mild thrombocytopenia, which is commonly associated with malaria (Figure 4).

Differential leukocyte count (DLC)

lymphocytes at 38.4%, granulocytes (neutrophils) at 53.2%, and mid-cells at 8.4%. These values were within the normal range, but the slightly elevated granulocyte percentage indicated a possible inflammatory response or infection.

Red Blood Cell Indices

The hematocrit (HCT) was measured at 35.0%, which is on the lower side of the normal range, consistent with mild anemia. The mean corpuscular volume (MCV) was 84.6 fL, and the mean corpuscular hemoglobin (MCH) was 24.4 pg, both of which were within the normal range. However, the mean corpuscular hemoglobin concentration (MCHC) was slightly reduced at 28.9 g/dL, indicating mild hypochromia. The red cell distribution width (RDW) was 14.2%, suggesting some variation in the size of the red blood cells. The

mean platelet volume (MPV) was 11.3 fL, within the expected range.

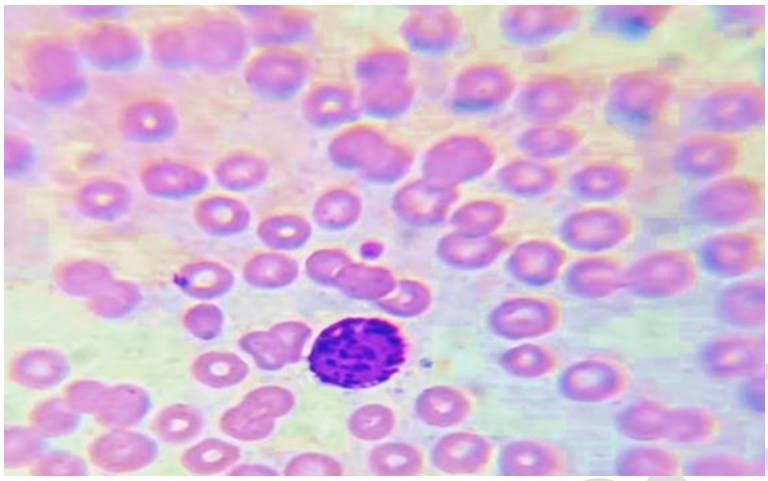

Fig. 1. This figure displays a microscopic view of *Plasmodium vivax* gametocyte, captured at a magnification of 100X (General Blood Picture (GBP) prepared using a Leishman-stain)

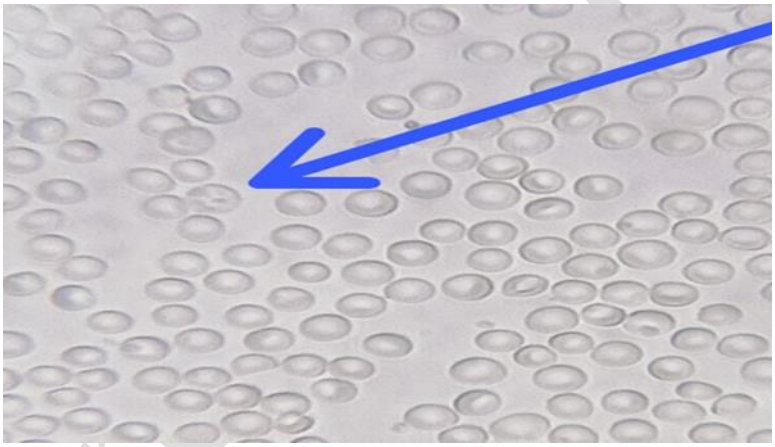

Fig. 2. This figure presents a microscopic view of an unstained blood smear at 100X magnification, showcasing the presence of *Plasmodium vivax* gametocytes.

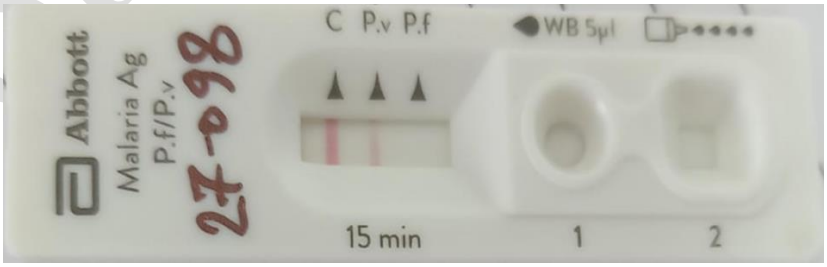

Fig. 3. Abbott's Malaria Ag P.f/P.v card displaying a positive line for *Plasmodium vivax* (P.v) confirmation.

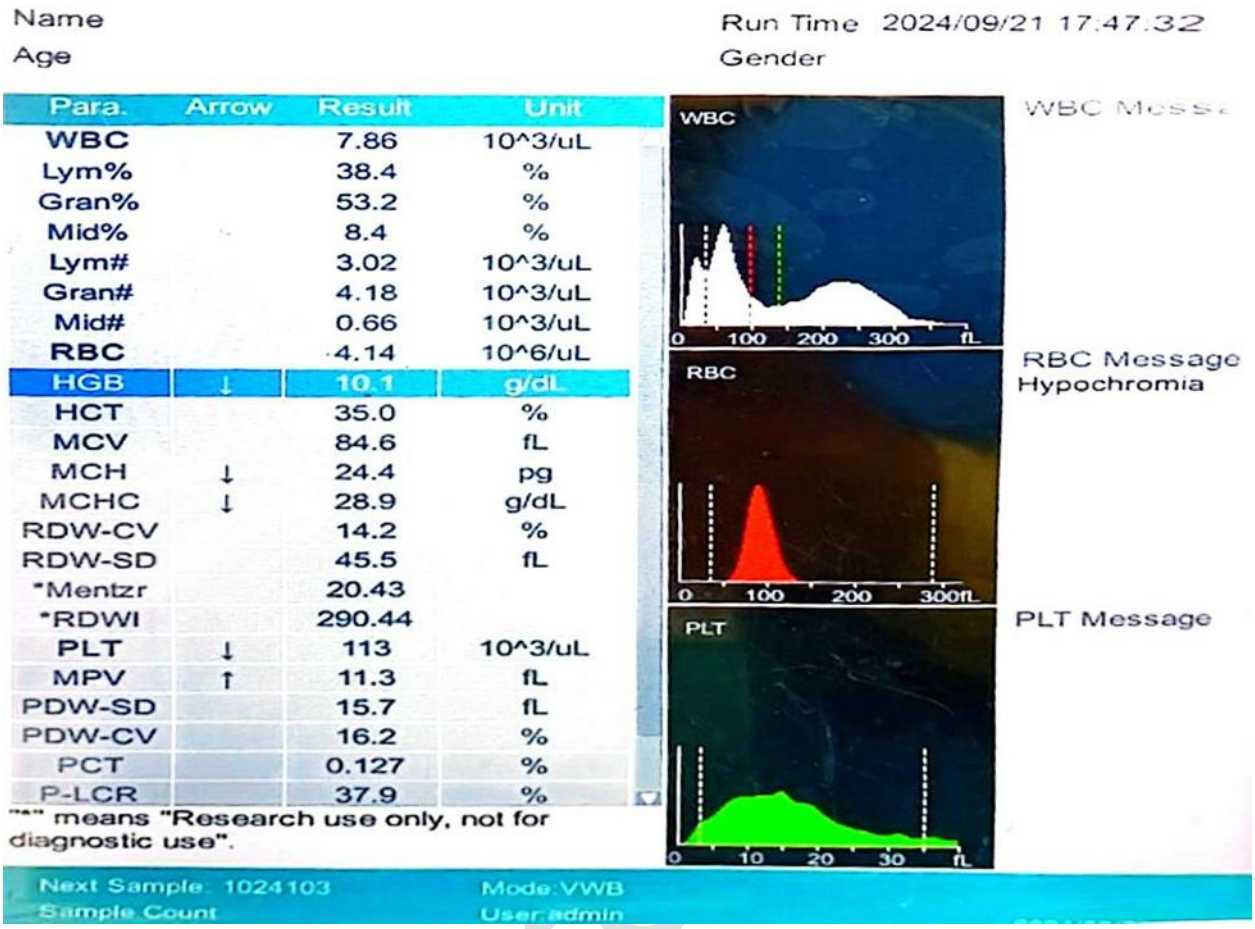

Fig. 4. Complete Blood Count (CBC) report of a patient positive for *Plasmodium vivax*. The sample was analyzed using the Erba H360 3-Part Hematology Analyzer.

Discussion

This 46-year-old male patient presented with typical symptoms of malaria, which had persisted for 30 days despite previous treatment. The patient's proximity to a sewage lake, his occupation as a daily wage laborer, and his poor living conditions suggest environmental risk factors for malaria transmission. The confirmed diagnosis of *P. vivax* malaria was made based on the results of Abbott's Malaria Ag Pf/Pv card and the detection of gametocytes in the GBP microscopy. The patient's hematological parameters revealed mild anemia and thrombocytopenia, both common findings in malaria. The decreased MCHC suggests mild hypochromia, while the slightly elevated RDW could indicate some variation in RBC size, often seen in patients with chronic infections or mild nutritional deficiencies.

In India, *P. vivax* is responsible for 60-65% of malaria cases. Once viewed as a benign infection, *P. vivax* is now acknowledged as a potential cause of severe and even fatal malaria (7). *P. vivax* poses a significant challenge in urban areas of India, where controlling malaria is difficult due to factors like rapid construction, population migration, and the growth of slums. Given the critical nature of urban malaria, these regions are specifically targeted by the Urban Malaria Scheme, a dedicated program aimed at addressing the issue. In 2014, urban areas accounted for approximately 4% of all malaria cases in India, but they represented 12% of the country's *P. vivax* infections. Under the Urban

Malaria Scheme, *P. vivax* made up 98% of all malaria cases reported in urban regions that year (8).

A study conducted in Nagongera, rural Uganda, revealed the complex link between socioeconomic position (SEP), agricultural performance, and malaria risk. It found that higher SEP, which is connected to greater success in smallholder agriculture, was associated with lower human bite rates (HBR) and a decreased risk of malaria infection in children. Specifically, those in the top wealth index tertile had a 29% lower HBR and a 48% lower chance of malaria infection than those in the bottom tertile. However, SEP had no significant effect on the incidence of clinical malaria and the study suggests that improving housing and agricultural development could be effective multisectoral strategies in controlling malaria. It emphasizes the need for further interdisciplinary research to fully understand the pathways linking poverty to malaria and to develop sustainable, broad-based malaria control interventions (9).

P. vivax is the most common form of malaria, producing major morbidity worldwide. With a population of more than one billion, India contributes significantly to the worldwide burden of vivax malaria. The renewed attention on *P. vivax*'s ignored impact, along with the recent completion of its genome sequence, makes this an appropriate moment to examine what is known about this parasite in India. The *P. vivax* population in India is highly diverse, especially in terms of recurrence patterns, treatment resistance, and clinical symptoms. Antigen genes, isoenzyme markers, and microsatellites are all highly variable, according to genetic research. The unusual epidemiological profile of malaria in India, where *P. vivax* predominates over *Plasmodium falciparum*, makes it an ideal context for studying the dynamics of co-infection (10). Co-infections with *P. vivax* and dengue have been recorded in India, particularly in Kerala, indicating the geographical overlap of malaria and dengue-endemic areas. Because the clinical manifestations of both disorders, such as fever, headache, and thrombocytopenia, are identical, such instances provide diagnostic problems (11).

The outcome emphasizes that malaria is deeply intertwined with poverty, impacting both individuals and communities. Successful malaria control requires interventions that improve living conditions in endemic areas. While an effective vaccine alone cannot eradicate malaria, addressing the poverty-related mechanisms is key to preventing and properly treating the disease (12).

Conclusions

This case report highlights a 46-year-old male patient from a high-risk area for malaria, who presented with persistent symptoms indicative of *P. vivax* infection despite prior treatment. Diagnostic tests confirmed the presence of *P. vivax*, and hematological analysis revealed mild anemia and thrombocytopenia, common findings in malaria cases. The patient's socioeconomic background and living conditions underscore the importance of targeted public health interventions to improve access to healthcare and preventive measures against mosquito-borne diseases. Timely diagnosis and treatment are crucial to manage malaria effectively and prevent complications in vulnerable populations.

Acknowledgments

Not applicable.

Ethical approval

Ethical approval for this case report was not required as per the institution's guidelines.

Informed consent was obtained from the patient for publication.

Conflict of interest statement

The authors declare that they have no conflicts of interest.

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