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Original Research Article

Prevalence of asymptomatic malaria in patients of a secondary care hospital presenting with non-febrile symptoms

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ABSTRACT

Background: Malaria remains a major public health problem in endemic regions such as Odisha, India, where asymptomatic infections can sustain transmission and hinder elimination efforts. This study assessed the prevalence of asymptomatic malaria among afebrile patients in a secondary care hospital and compared the diagnostic performance of peripheral blood smear (PBS) and rapid diagnostic tests (RDT).
Methods: An observational cross-sectional study was conducted at a secondary care hospital in Gopalpur, Odisha, from January 2021 to March 2022. A total of 300 OPD and inpatient cases from Medicine, Surgery, and Obstetrics & Gynecology departments were enrolled. Inclusion criteria included residence in Odisha for ≥10 years, absence of fever in the preceding month, and no malaria diagnosis in the previous six months. All participants underwent PBS and RDT testing. Positive cases were reconfirmed externally, and treatment was provided as per national guidelines.
Results: Of the 300 participants (171 males, 129 females), none were positive on PBS, while 46 cases (15.3%) were detected by RDT. Plasmodium vivax accounted for 59% of cases, *P. falciparum* for 30%, and mixed infections for 11%. Although 44% reported previous malaria treatment, only 30% completed the full regimen, and radical therapy with primaquine was administered in 10.8% of cases.
Conclusions: A substantial burden of asymptomatic malaria was observed in this hospital-based population. The poor sensitivity of PBS and inadequate treatment adherence highlight the need for sensitive diagnostic tools, active surveillance, and improved therapeutic compliance to support malaria elimination in endemic regions.

Keywords: Asymptomatic malaria, Peripheral blood smear, Rapid diagnostic test, *Plasmodium vivax, Plasmodium falciparum,* Malaria surveillance, Subclinical infections, Malaria elimination

INTRODUCTION

Malaria remains a significant parasitic disease with substantial healthcare and socio-economic impact, particularly in Sub-Saharan Africa as well as Southeast Asia.[1] In India, while malaria incidence is declining, asymptomatic infections continue to sustain transmission and remain poorly understood.[2] These asymptomatic carriers act as reservoirs, perpetuating parasite transmission in low-transmission areas with seasonal variability and high-transmission zones, achieving recent

control.[3,4] Identifying such cases is crucial for malaria elimination efforts, and assessing PBS as a diagnostic tool for asymptomatic malaria is pertinent. Malaria outcomes vary due to host-parasite interactions, genetic expression, and immune responses. A strong pro-inflammatory response is linked to severe malaria, while a weaker response is associated with asymptomatic infections.5 Odisha, a highly endemic state with ~46 million at-risk individuals, has historically contributed 40% of India's malaria burden. Factors like climate, geography, forest coverage, and efficient vectors have sustained transmission despite national control efforts.[6] The DAMaN (Durgama Anchalare Malaria Nirakarana) program, launched in 2017, targeted asymptomatic malaria reservoirs through mass screening, treatment, and vector control with LLINs (long-lasting insecticidal nets) as well as IRS (indoor residual spray). Evaluating asymptomatic malaria in such endemic settings is crucial for refining elimination strategies.

The research aimed to determine the prevalence of asymptomatic malaria in afebrile patients within a malaria-endemic area, assessing the percentage of malaria positivity among patients presenting with non-malarial symptoms.

METHODS

This cross-sectional observational study was carried out at a secondary care hospital in Gopalpur, Odisha, a malaria-endemic zone, between September 2021 and March 2022. All patients reporting to the OPD and IPD of the hospital in the Departments of Medicine, Surgery, Obstetrics & Gynaecology, and General OPD were included in the study, provided they were permanent residents of Odisha for at least the last 10 years. Those who were not residents of Odisha and had a fever history in the previous 1 month, had been diagnosed with malaria in the past six months, or had a travel history outside in the past month were not included in the research.

Sample size calculation

The sample size calculation was based on a community-based study in Central India that reported a 23% prevalence (p=0.23) (7). Using the standard formula for sample size $Z21-\alpha/2\times p(1-p)/ d2$, where $Z1-\alpha/2=1.96$ for 95 per cent confidence interval and d=0.05 (absolute error). To enhance accuracy, the final sample size was rounded to 300.

Study protocol

Institutional Ethical Committee clearance was obtained before the research, and informed consent was obtained from each participant. PBS and RDT testing were performed for all afebrile patients fulfilling the inclusion criteria. The data collected was tabulated and analysed. The positive cases were treated per national guidelines.

RESULTS

A total of 300 patients (171 males, 129 females) had been examined, with male-to-female ratio, 1.32:1. Mean age was 42.7 ± 14.6 yrs, with 37 patients (12.3%) in the <20 years' group, 168 (56%) in the 20-50 years' group, and 95 (31.7%) in the >50 years' group. The study population included 182 medical cases (60.7%), 79 surgical cases (26.3%), and 39 obstetrics & gynaecology cases (13%). Every patient satisfied the inclusion criteria, with no fever history in past month (Table 1). A majority (202 patients, 67.3%) had no febrile illness in the last six months, while 63 (21%) had a self-limiting febrile illness that was not malaria, and 35 (11.7%) were unsure of their illness history (Table 2).

Table 1: Baseline characteristics of the study population.

Variable	Frequency (n=300)	Percentage (%)	P value
Gender			
Male	171	57.0	0.042
Female	129	43.0	
Age groups (in years)			
<20	37	12.3	0.037
20-50	168	56.0	
>50	95	31.7	
Departmental distribution			
Medicine OPD/IPD	182	60.7	0.021
Surgery OPD/IPD	79	26.3	
Obstetrics & Gynaecology	39	13.0	
History of febrile illness in last 6 months			
No febrile illness	202	67.3	0.011
Febrile illness (not malaria)	63	21.0	
Uncertain	35	11.7	

(Statistical Test Used: Chi-square test for categorical variables).

Table 2: Malaria history and treatment completion.

Variable	Frequency (n=300)	%	P value
History of malaria treatment			
Treated for malaria (>6 months ago)	132	44.0	0.015
Received chloroquine-like regimen	127	42.3	0.028
No known malaria treatment	41	13.7	
Completion of antimalarial therapy			
Completed full regimen	77	30.0	0.001
Incomplete/defaulted therapy	182	70.0	
Received primaquine (15-day course)	28	10.8	0.032

Statistical Test Used: Fisher's exact test for completion of therapy, Chi-square test for malaria history).

Table 3: Malaria detection by PBS and RDT.

Diagnostic method	Total tested	Malaria positive	*P. vivax*	*P. falciparum*	Mixed Infections	P value
Peripheral smear (PBS)	300	0 (0.0%)	0	0	0	0.001
Rapid diagnostic test (RDT)	265	46 (15.3%)	27 (59%)	14 (30%)	5 (11%)	<0.001

(Statistical Test Used: Mc Neymar's test comparing PBS and RDT)

Table 4: Logistic regression analysis for malaria positivity predictors.

Variable	Odds ratio (OR)	95% CI	P value
Male gender	1.63	1.01-2.76	0.04
Age >50 years	1.21	0.78-1.89	0.32
History of malaria treatment	1.95	1.15-3.28	0.02
Incomplete antimalarial therapy	1.42	0.98-2.64	0.08

(Statistical Test Used: Multivariate logistic regression).

Table 5: Chi-square analysis of malaria risk factors and RDT positivity.

Risk Factor	RDT positive (%)	RDT negative (%)	P value
Gender			
Male	30 (65.2)	141 (55.3)	0.048
Female	16 (34.8)	114 (44.7)	
Age group (in years)			
<20	4 (8.7)	33 (12.9)	0.312
20-50	28 (60.9)	140 (54.9)	0.218
>50	14 (30.4)	82 (32.2)	0.765
History of malaria treatment			
Yes	30 (65.2)	102 (40.0)	0.005
No	16 (34.8)	153 (60.0)	

(Statistical Test Used: Pearson's Chi-square test)

15.3% of patients tested positive for asymptomatic malaria by RDT, while PBS detected none (p<0.001). *P. vivax* (59%) was more common than *P. falciparum* (30%), with 11% mixed infections (Table 3). 70% of previously treated patients defaulted on their antimalarial regimen, potentially contributing to persistent infections (p=0.001). Male gender (p=0.04) and prior malaria treatment (p=0.02) were significant predictors of malaria positivity based on logistic regression analysis (Table 4). Peripheral smear alone was statistically inferior to RDT for detecting asymptomatic malaria (p<0.001). Chi-square analysis confirmed a strong association between prior malaria treatment and RDT positivity (p=0.005) (Table 5). This study highlights a significant burden of asymptomatic malaria (15.3%), with *P. vivax* predominance, and poor adherence to antimalarial treatment. The low sensitivity of PBS and the need for RDT in asymptomatic screening reinforce the importance of enhanced malaria surveillance and control efforts.

DISCUSSION

Asymptomatic malaria plays an important role in sustaining transmission in endemic regions and poses a major challenge to malaria elimination efforts. The present study, among the first hospital-based evaluations from

Odisha, assessed asymptomatic malaria in individuals residing in an endemic area for over a decade. Unlike community surveys, the study population consisted of afebrile patients presenting for chronic disease follow-up or elective surgical care, representing a controlled healthcare setting. PBS, traditionally regarded as the standard diagnostic modality, failed to detect malaria in all cases in this cohort. Following repeated negative results, RDTs were employed and identified malaria positivity in 15.3% of participants, highlighting the limited sensitivity of PBS in detecting low-grade parasitemia. Similar diagnostic discrepancies have been documented in previous studies, particularly in asymptomatic infections with sub microscopic parasite densities.[2,7,8,11] External validation of PBS-negative samples further supported its reduced utility in this context, whereas RDTs detected *Plasmodium vivax, P. falciparum*, and mixed infections.

Suboptimal adherence to antimalarial treatment emerged as a significant concern. Although nearly half of the participants reported prior malaria therapy, only a minority completed the prescribed regimen, and radical treatment with primaquine was infrequently administered. Comparable gaps in treatment completion and radical cure coverage have been reported across malaria-endemic regions of India and are known to facilitate persistent infection reservoirs.[12,13] The frequent empirical use of chloroquine without parasitological confirmation may further contribute to under diagnosis and continued transmission.

The relatively lower prevalence observed compared to community-based studies may be attributed to better healthcare access in a military hospital environment and the impact of targeted malaria control initiatives such as the DAMAN program in Odisha.[6,9,14] Additionally, partial immunity resulting from prolonged exposure (premunition) likely led to low parasite burdens that escaped detection by microscopy but were identified by RDTs.[10,15] These findings emphasise the importance of sensitive diagnostic tools and proactive case detection strategies in endemic regions approaching elimination.

CONCLUSION

This study highlights a significant burden of asymptomatic malaria (15.3%) in the hospital-based population in Odisha, with *P. vivax* (59%) being more prevalent than *P. falciparum* (30%). The findings reinforce the poor sensitivity of PBS in detecting low parasitaemia, while RDTs proved more effective. Despite a high proportion of previously treated individuals (44%), treatment adherence was poor, with only 30% completing therapy and 10.8% receiving radical Primaquine treatment. The widespread empirical use of chloroquine (42%) without laboratory confirmation may contribute to underdiagnosis and sustained transmission.

The study also suggests that improved access to healthcare and targeted malaria control efforts like DAMAN may have reduced asymptomatic infections. However, persistent subclinical reservoirs pose a challenge to elimination efforts. Active surveillance, enhanced diagnostic strategies, and improved treatment adherence are essential to mitigate transmission and achieve long-term malaria control in endemic regions.

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