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Original Research Article

Clinical Profile and Smear Microscopy for the Diagnosis Of Malaria – A Comparative Evaluation

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Abstract:

Introduction: Malaria remains a significant health burden in endemic regions. While symptoms are nonspecific, peripheral smear microscopy is the gold standard for diagnosis, identifying species and parasitemia levels. This study evaluates the correlation between clinical features and smear results to assess the diagnostic utility of microscopy in suspected malaria cases.

Methods: A prospective observational study was conducted at GSL Medical College from August 2024 to March 2025, involving adults with malaria symptoms. Peripheral smears were examined using Giemsa stain to detect Plasmodium species. Data were statistically analyzed to correlate clinical features with smear results after obtaining consent and ethical clearance.

Results: In this study of 115 adults, 55.7% tested positive for malaria via smear microscopy. *Plasmodium vivax* was most common. Fever, headache, and vomiting were prevalent. Moderate parasitemia was seen in 43.8% of cases. Splenomegaly and jaundice were observed in 46.9% and 21.9% of positive cases, respectively.

Conclusion: Peripheral smear microscopy remains a valuable diagnostic tool for malaria, especially in resource-limited settings. *Plasmodium vivax* was the predominant species. Clinical features alone were insufficient for diagnosis, emphasizing the need for laboratory confirmation. Limitations included single-center design and absence of molecular diagnostics for species confirmation and sensitivity comparison.

Keywords: Malaria, Smear Microscopy, Plasmodium Vivax, Clinical Features, Parasite Density.

Introduction

Malaria remains a major public health concern in tropical and subtropical regions, causing significant morbidity and mortality. According to the World Health Organization, over 247 million cases of malaria occurred worldwide in 2021, with Plasmodium falciparum and Plasmodium vivax being the predominant species affecting humans [1]. Clinical diagnosis based on symptoms such as fever, chills, headache, vomiting, and splenomegaly is often nonspecific and overlaps with other febrile illnesses, particularly in endemic settings [2]. This highlights the importance of parasitological confirmation for accurate diagnosis and appropriate treatment.

Microscopic examination of Giemsa-stained peripheral blood smears remains the gold standard for malaria diagnosis due to its ability to detect species and quantify parasitemia [3]. However, its diagnostic accuracy may be influenced by technical expertise, parasite density, and quality of slide preparation [4]. Despite advances in rapid diagnostic tests (RDTs) and molecular techniques, smear microscopy continues to play a central role in malaria diagnosis in resource-limited settings due to its low cost and wide availability [5].

This study aims to evaluate and compare the clinical presentation and smear microscopy findings in patients suspected of malaria. By correlating clinical features with microscopic diagnosis, we seek to assess the utility and limitations of smear microscopy as a diagnostic tool in malaria-endemic areas.

Methods

This was a prospective observational study, conducted in GSL Medical College, Rajahmundry. Study was carried from August 2024 to March 2025, 8 months. Necessary approvals were obtained and informed consent was obtained before initiating the study.

Bothe gender, ≥ 18 years presented with clinical features suggestive of malaria, such as intermittent fever with chills and rigors, sweating, headache, vomiting, myalgia, and splenomegaly, were included in the study. Non cooperative individuals, those received antimalarial therapy in the preceding two weeks or those with confirmed alternate diagnoses were excluded. Ethical clearance was obtained from the Institution. Informed written consent was taken.

The study was clearly explained and all the doubts were clarified. Detailed clinical history and physical examination findings were recorded using a pre-designed case proforma. Blood samples were collected via finger prick or venepuncture under aseptic precautions. Both thick and thin blood smears were prepared for each patient and stained using Giemsa stain. The smears were examined under oil immersion to detect and identify Plasmodium species and assess parasite density. The study team was trained on smear microscopy. If any doubt in smear results, expert opinion was considered. Relevant demographic details and clinical symptoms were correlated with smear results.

Data were entered in Microsoft Excel and analyzed using descriptive and inferential statistics to determine the association between clinical features and microscopy findings.

Results

In this prospective study of 115 adult patients suspected of malaria, the majority belonged to the 31 – 45 years age group (29.6%), followed by those aged 18–30 years (26.1%). Males (68) outnumbered females (47). The least represented group was those above 60 years (21.7%), indicating a relatively balanced distribution across age groups. Clinically, all patients presented with fever and chills (100%), while headache (76.5%) and vomiting (55.7%) were the next most common symptoms. Sweating (50.4%), myalgia (44.3%), and splenomegaly (32.2%) were also frequently observed. Jaundice, noted in 16.5% of patients, pointed to possible hepatic or hemolytic involvement.

Peripheral smear microscopy confirmed malaria in 64 of the 115 cases (55.7%). Among these, Plasmodium vivax was the most commonly detected species (33%), followed by Plasmodium falciparum (18.3%) and mixed infections (4.3%). In smear-positive cases, all patients had fever and chills, while headache (81.3%) and vomiting (60.9%) were prominent features. Splenomegaly and jaundice were seen in 46.9% and 21.9%, respectively. Parasite density was moderate (1,000–10,000/µL) in 43.8% of positive cases, low (<1,000/µL) in 34.4%, and high (>10,000/µL) in 21.8%, indicating varied parasitemia levels.

Discussion

In this prospective study involving 115 adult patients clinically suspected of malaria, the most affected age group was 31–45 years (29.6%), followed by 18–30 years (26.1%). These findings are consistent with previous studies that suggest malaria predominantly affects the working-age population due to higher exposure to mosquito bites during outdoor activities [6]. Males (59.1%) outnumbered females (40.9%), a trend also observed in other Indian studies where sociocultural factors and occupational exposure contribute to higher male prevalence [7]. The age distribution reflects a typical epidemiological pattern seen in endemic regions, where acquired immunity in older individuals may lead to reduced incidence or milder presentations [8].

Clinically, all patients presented with fever and chills, which remain hallmark symptoms of malaria, but are nonspecific and overlap with other febrile illnesses. Headache (76.5%) and vomiting (55.7%) were the next most common symptoms, aligning with reports that describe these as frequent features of both Plasmodium vivax and Plasmodium falciparum infections [4]. Splenomegaly (32.2%) and jaundice (16.5%) were less commonly observed but are significant clinical markers suggestive of prolonged parasitemia and possible hemolysis [10]. Sweating and myalgia, reported in 50.4% and 44.3% of patients respectively, are associated with the cyclical rupture of infected erythrocytes and release of merozoites.

These clinical findings reaffirm the diagnostic value of peripheral smear microscopy, especially when combined with clinical suspicion in endemic settings. The variability in symptom presentation necessitates laboratory confirmation, as empirical diagnosis based solely on symptoms may lead to misdiagnosis or over-treatment.

In this study, peripheral smear microscopy confirmed malaria in 64 out of 115 suspected cases, reflecting a positivity rate of 55.7%. This finding is comparable with similar studies conducted in endemic regions, where peripheral smear remains a reliable and accessible diagnostic tool [11]. Among the positive cases, P. vivax was the most frequently detected species (33%), followed by Plasmodium falciparum (18.3%) and mixed infections (4.3%). This predominance of P. vivax aligns with the epidemiological trend observed in India, where P. vivax continues to contribute significantly to malaria morbidity despite global attention focusing more on P. falciparum due to its severity [10].

Clinically, all smear-positive cases exhibited fever with chills, reinforcing its role as a cardinal symptom of malaria. However, other symptoms such as headache (81.3%) and vomiting (60.9%)

were also frequently observed. These non-specific symptoms often overlap with other febrile illnesses like dengue and enteric fever, necessitating laboratory confirmation for accurate diagnosis [12]. Splenomegaly (46.9%) was a notable finding, particularly in P. vivax infections, supporting evidence that this species can cause significant splenic involvement due to recurrent erythrocytic cycles and immune stimulation [13]. Jaundice was reported in 21.9% of positive cases, possibly linked to hemolysis or hepatic dysfunction, a complication more often associated with P. falciparum but also increasingly reported in severe P. vivax malaria [14].

Parasite density estimation revealed that the majority of smear-positive patients (43.8%) had moderate parasitemia (1,000–10,000/µL), while low-density parasitemia (<1,000/µL) was seen in 34.4%, and high-density parasitemia (>10,000/µL) in 21.8%. These findings suggest a variable burden of infection, potentially influenced by host immunity, nutritional status, or delay in seeking care. Previous studies have shown that severe manifestations can occur even with low parasite loads, particularly in P. vivax infections, challenging the traditional view that only high parasitemia is clinically significant [15]. Hence, monitoring parasite density is essential not only for guiding treatment but also for prognostication and follow-up.

Conclusion This study highlights that peripheral smear microscopy remains a reliable diagnostic tool for malaria, particularly in resource-limited settings. Plasmodium vivax was the predominant species, with fever, headache, and vomiting being the most common clinical features. Moderate parasitemia was the most frequently observed density level. However, clinical symptoms alone were insufficient for diagnosis, underscoring the need for laboratory confirmation. A key limitation of the study was its single-center design with a relatively small sample size, potentially limiting generalizability. Additionally, the exclusion of molecular and rapid diagnostic methods restricted comparative analysis of diagnostic accuracy across different modalities.

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