Vol. 4 No. 12 (2023): December 2023 Issue
https://doi.org/10.51168/sjhrafrica.v4i12.902
Original article

A RETROSPECTIVE STUDY OF THE CLINICAL PROFILE OF SEVERE MALARIA CONDUCTED AT A TERTIARY CARE CENTRE IN INDIA AMONG CHILDREN AND ADULTS.

[1]Dr. Wakil Paswan, [2]Dr. Kamlesh Kumar*.
[1]Assistant Professor, Department of Pediatrics, A. N. M. Medical College, Gaya, Bihar, India.
[2]Assistant Professor, Department of Medicine, A. N. M. Medical College, Gaya, Bihar, India.

Abstract

Objectives
Despite declining malaria cases, it remains a public health concern in our country, prompting an investigation into the changing clinical and epidemiological profile, especially the severity of vivax malaria, among adult patients in an Indian tertiary health-care centre. The study aims to explore the changing clinical and epidemiological profile of malaria, specifically the emergence of severe complications in vivax malaria, among adults in an Indian tertiary health-care centre.

Methods
A longitudinal observational research was undertaken, encompassing adults and children diagnosed with *Plasmodium vivax, P. falciparum*, or mixed malarial infections from a tertiary care centre in A. N. M. Medical College, Gaya, Bihar, India through rapid diagnostic tests or peripheral smear.

Results
Involving 147 patients, the study revealed *vivax* as the most prominent species (62 %), after which *falciparum* showed the next highest number of cases encompassing 29 % of the population. Mixed plasmodium species was identified to affect only 9 % of the study population. The average patient age was 34.13 years, comprising 64 % men and 36 % women. Notably, 23 % of patients exhibited clinical manifestations of malaria, at least a single symptom. Patients with *P. vivax* demonstrated significantly higher rates of severe anaemia (hemoglobin lesser than 5 mg per dl), acute kidney injury, and thrombocytopenia (platelet count lesser than 1 lac/cmm). Additionally, comorbid illnesses were present in a substantial portion (32 %) of the malaria affected individuals.

Conclusion
The predominant cause of malaria cases is attributed to P. vivax, raising concerns about its potential to induce life-threatening illnesses. Further exploration into the influence of comorbid conditions on malaria's clinical outcomes is warranted.

Recommendation
The study recommends for broader multicentric clinical and epidemiologic investigations to deepen our understanding of malaria's pathogenesis and drug resistance, emphasizing the need to implement comprehensive strategies for alleviating the country's malaria burden.

Keywords: *Clinical Outcomes, Malaria, Epidemiological Profile, Anaemia*

Submitted: 2023-12-07 Accepted: 2023-12-07

*Corresponding author: Dr. Kamlesh Kumar**
Email:drkumar.kamlesh@gmail.com
Assistant Professor, Department of Medicine, A. N. M. Medical College, Gaya, Bihar, India,,

Introduction
Malaria, a global health issue, is a protozoal infection caused by the members of the Plasmodium genus, with five species, including *P. malariae, P. falciparum, P. knowlesi, P. ovale*, and *P. vivax,* being the primary agents [1]. During the 20th century, malaria became a dreaded illness, yet collaborative endeavours by health authorities and the accessibility of artemisinin-based medicines have resulted in a notable reduction in both mortality and morbidity. These efforts renewed optimism that malaria could be eradicated in the upcoming years. While recent drop in the number of cases has been witnessed, it is still a notable cause of illness and death globally, with approximately 300–500 million illnesses and 3 million fatal cases per year [2].

Malaria caused by *Plasmodium falciparum* species has been linked to multiple complications and high fatality rates. Comparing the present epidemiological and clinical data of malaria with the past reveals significant differences. According to the World Health Organization

(WHO), *P. vivax* accounted 7.5 million cases globally in 2017, making it the predominant causative parasite in Southeast Asia [2,3]. P. vivax poses a challenge in urban areas due to heightened development and construction activities, coupled with a growing number of migrants in Indian cities. Once considered relatively benign, this malarial species is now responsible for various complications of associated with this disease worldwide [4,5].

In referral centres operating at the advanced healthcare set-ups, patients who have received partial treatment, arrive from peripheral rural or urban centres. These patients often have other health conditions that can influence the clinical progression and final health outcomes. Limited research exists on adult population with severe case of this protozoal infection in the northern region of India recently. Hence, this study was undertaken for examining the clinical characteristics, and the presence of co-existing illnesses among paediatric and adult demographic patients admitted to an advanced health care centre in A.N.M.M. College, India.

Materials and Methods

Study design

A retrospective study was on individuals diagnosed with malaria for over 5 months to analyse the clinical profile of the patients.

Inclusion and exclusion criteria

People identified as having malaria through either microscopy or rapid diagnostic tests (RDT) at the hospital, within the age range of 1 to 65 years and women who did not show any signs of pregnancy, were directed to this study. Individuals attending outpatient department (OPD) services and those admitted to the Medicine, Paediatric, and Intensive Cardiac Care Unit (ICCU) wards were invited to participate for this analysis. Critically sick patients in need of mechanical ventilation support and, consequently, hospitalized to the Intensive Care Unit (ICU), were excluded from this study. Other exclusion criteria encompassed positive serology for typhoid, scrub typhus, dengue, hepatitis C, leptospirosis, HIV, and hepatitis B.

Those testing positive for malaria received both verbal and written explanations of the protocols and requested to give their nod in a written document. For children aged between 12 months to 18 yrs, the concerned parent or guardian's consent was sought, along with the children's assent. All the study participants were identified by a unique numerical code to facilitate organized data collation.

Study size

The study included 147 patients who were confirmed positive for *P. vivax, P. falciparum*, or a combination through smear test and/or RDT based on antigens.

Study setting

The study was conducted in a tertiary health care centre in A. N. M. Medical College, Gaya, Bihar, India. The study encompassed individuals diagnosed with malaria and hospitalized in the institute. This study was conducted during a period of 5 months from May 2023 to October 2023.

Malaria diagnosis

The study adhered to the criteria outlined by the National Vector Borne Disease Control Programme (NVBDCP) for defining serious case of malaria, and all patients received treatment in accordance with the NVBDCP guidelines, which align with the criteria set forth by the World Health Organization (WHO) [6,7].

Identification of malaria involved observing specific clinical manifestations in patients. When any or all of these clinical signs, such as impaired consciousness, convulsions, acute lung injury, collapse of the circulatory system with a systolic blood pressure below 80 mm of Hg, jaundice accompanied by other organ dysfunction, hemoglobinuria, and abnormal bleeding, were noted, diagnosis of severe malaria was confirmed.

In every patient, a thorough medical history and geographic details were documented, coupled with a comprehensive general examination. Biochemical and hematological assessments, encompassing a haematological profile, highly sensitive C-reactive protein, sedimentation speed of red blood cells, kidney function test, urine analysis, serum electrolytes, prothrombin time, procalcitonin, urine cultures, and chest X-ray were conducted. Additionally, G6PD screening tests and cerebrospinal fluid analysis were performed as required. Further, specific assessments such as brain and abdominal imaging were undertaken based on clinical judgment.

Bias

The study's single-center design, small sample size, and exclusion of pregnant females introduce selection and institutional bias, limiting generalizability. Caution is needed in extrapolating results, and acknowledging these limitations is crucial for maintaining the study's external validity.

Ethical consideration

The study adhered to ethical considerations by obtaining approval from the institutional ethics committee before commencement. Additionally, written informed consent was obtained from all study participants, ensuring respect for autonomy and protection of participants' rights.

Statistical Analysis

The analysis of data was conducted utilizing SPSS for Windows, specifically version 11.5. Results were presented either as mean along with standard deviation or

as numerical values and percentages. To assess the normal distribution of data, the K-S test was used. For this study, a p-value < 0.05 was considered to determine statistical significance.

Results/Outcomes

Participants

The study presents the demographic and clinical features of 147 malaria cases. The average age of patients was 34 years, with the most affected age group being 21 to 40 years. No significant variation was seen in age between the severe and uncomplicated malaria cases. Males constituted 64.4% (52 patients), while females were 35.6% (94 patients). The predominant symptom was fever (100%), followed by chills (73.4%), pain in the abdomen (29%), and altered mental state (16%) (Table 1).

Table 1: Population profile and medical parameters of 147 patients with malaria

Sex	Frequency of malaria (percentage)
Male	52 (35.6%)
Female	94 (64.6%)
Clinical signs	**Frequency of malaria (percentage)**
Fever	147 (100%)
Chills	107 (73.4%)
Nausea	66 (45.5%)
Diarrhoea	14 (19%)
Head ache	42 (29.2%)
Paleness	70 (48.1%)
Jaundice	89 (60.9%)
Seizure	67 (46.2%)
Altered mental state	5 (3.8%)
Trauma	44 (30.4%)
Oliguria	9 (6.4%)
Enlarged spleen	28 (19.6%)

In this study, falciparum malaria exhibited a notably lower haemoglobin level compared to *mixed* or *vivax* malaria, while the former showed a significantly lower white blood cell count compared to the other two types of malaria. However, no statistically significant variations were noted in other biochemical or haematological measures. At the species level, P. falciparum affected 42 patients, P. vivax infected 91 patients, showing a notable contrast with 13 patients demonstrating mixed infections (Table 2). A substantial portion of affected individuals (32%) presented comorbid conditions

.

Vol. 4 No. 12 (2023): December 2023 Issue
https://doi.org/10.51168/sjhrafrica.v4i12.902
Original article

Table 2: Comparative Analysis of Various Laboratory Parameters Across Different Malaria Types

Characteristics	*P. falciparum* (n = 42)	*P. vivax* (n = 91)	Mixed (n = 13)	Total	*p* value
Hemoglobin (g/dl)	7.87	9.06	8.08	8.29	0.002
Total white blood cell count (per mm^3)	9476	9038	7514	9157	0.015
Platelets (per mm^3)	79768	77771	79230	79036	0.962
Blood glucose (mg/dl)	115.9	114.4	96.37	113.6	0.190
Serum sodium (mEq per litre)	135	135.9	136.8	135.5	0.386
Serum potassium (mEq per litre)	4.07	4.15	3.74	4.07	0.06
Serum urea (mg per dl)	84.01	76.34	61.77	79.44	0.261
Serum creatinine (mg per dl)	2.03	1.77	1.62	1.91	0.484
Serum bilirubin (mg/dl)	3.73	3.23	2.29	3.43	0.224
Alanine transaminase (IU/L)	124.07	108.85	61.57	113.06	0.131
Aspartate transaminase (IU/L)	101.14	74.57	61.87	88.60	0.264
Glucose (md/gl)	68.22	67.88	77.75	69.29	0.33

Among all patients, 23% had at most one severe malaria component. The clinical and laboratory profiles of uncomplicated and serious malaria patients revealed higher signs of inflammation, increased co-existing illnesses, acute kidney injury, altered mental state, thrombocytopenia, and transaminitis in severe cases. Interestingly, an almost equal proportion of severe cases of malaria occurred in both *P. falciparum* and *P. vivax* infections, but not in mixed infections.

Discussion

In this study, the Plasmodium species distribution aligns with previous reports from North India, reflecting 56.5% for *vivax* species and 39.1% for *falciparum* species. This pattern demonstrating a higher prevalence of vivax compared to falciparum, is consistent with previous observations [8-10]. Furthermore, we observed a higher incidence of malaria in males aged 18 to 40, possibly due to increased outdoor exposure, consistent with previous findings [11].

In our study, common symptoms like headache, chills, fever, and gastric complaints were consistent with observations in other research works [12,13]. Spleen enlargement, noted in 34% of cases, is believed to be due to the phagocytosis of parasitized erythrocytes and their accumulation for clearance. Importantly, no statistical variation was observed in the occurrence of splenomegaly among severe and uncomplicated malaria cases.

An equal distribution of patients was noted between uncomplicated and severe malaria, suggesting a widespread prevalence of *vivax* species in India, contributing significantly to diseases [11,14,15]. Recent reports emphasize the potential of this species to induce serious complications, although the precise pathogenesis and organ-specific illness remain poorly understood due to limited research in this domain [16].

Our study identified anaemia as a significant clinical finding, with severe anaemia observed in 43 % of *vivax* malaria cases in contrast to the 17 % in *falciparum* malaria. In contrast, Limaye et al. reported much lower anaemia rates, approximately 13 % for *falciparum* species and 3 % for *vivax* species, possibly influenced by infection seriousness, differences in endemic traits, and patient immune response [17]. Additionally, co-existing helminthiasis and malnutrition were identified as factors exacerbating anemia, consistent with reports by others [18].

Plasmodium species invasion renders red blood cells rigid, leading to hemolysis. Thrombocytopenia, noted in 67 % of malaria patients with severe disease, aligns with

findings from other studies emphasizing its sensitivity as a malaria marker [19,20,21]. Proposed mechanisms for thrombocytopenia include bone marrow alteration, excessive platelet removal, and peripheral destruction, via splenic accumulation and destruction by antibodies.

The study observed higher rates of severe malaria in patients having comorbidities unlike those with uncomplicated malaria, potentially reflecting the patient's immune condition. Literature suggests that co-existing illnesses, particularly diabetes and obesity, may serve as predisposing factors for high-severity malaria in adults, but further evidence is needed for confirmation [22]. Notably, two patients with *vivax* malaria died in our study, both having secondary sepsis, and multi-organ failure due to mechanical ventilation-related pneumonia. Another patient with *falciparum* malaria succumbed due to glioblastoma.

The study focussing on the health profile of severe malaria from an advanced health centre in Bihar has a retrospective design, encompassing all positive cases at a referral health-care facility, highlighting the need for large-scale multicentric clinical and epidemiologic studies. However, limitations such as a single-centre approach and a small sample size underscore the necessity for expansive research on pathogenesis and drug resistance involving larger populations to alleviate the malaria burden in our country.

Conclusion

The current study on a clinical profile of malaria from an advanced health centre highlights the clinical and geographic data of the patients in Bihar. In recent years, a steady decline in incidence is observed but despite this malaria remains a significant public health concern. The predominant species contributing to the majority of cases, and raising concerns about its ability to induce fatal disease is *P. vivax*. Further exploration of the impact of comorbid conditions on the clinical outcome of malaria is warranted.

Limitations

The study is constrained by its single-centre design and limited sample size, underscoring the necessity for broader multicentric clinical and epidemiologic investigations into pathogenesis and drug resistance with more extensive participant cohorts to mitigate the malaria burden in our country.

Recommendations

Our study recommends for larger multicentric clinical and epidemiologic investigations to enhance our understanding of malaria's pathogenesis and drug resistance, exploring the impact of comorbid conditions on clinical outcomes and implementing comprehensive strategies to alleviate the burden of malaria in the country.

Generalizability

The generalizability of this study may be limited due to its single-center design, small sample size, and exclusion of pregnant females. Caution should be exercised in extending the findings to broader populations, and further multicentric studies with diverse cohorts are needed to enhance the study's generalizability.

List of Abbreviations

WHO – World Health Organization
RDT – Rapid Diagnostic Tests
OPD – Out-Patient Department
ICCU - Intensive Cardiac Care Unit
NVBDCP - National Vector Borne Disease Control Programme

Source of funding

No source of funding.

Conflict of interest

No conflict of interesr.

References

1. White NJ, Pukrittayakamee S, Hien TT, Faiz MA, Mokuolu OA, Dondorp AM. Malaria. Lancet. 2014;383:723–35.
2. World Health Organization. 2013. Available from: http://who.int/malaria/publications/world_malaria_report_2013/en.
3. Murray CJ, Ortblad KF, Guinovart C, Lim SS, Wolock TM, Roberts DA, et al. Global, regional, and national incidence and mortality for HIV, tuberculosis, and malaria during 1990-2013: A systematic analysis for the global burden of disease study 2013. Lancet. 2014;384:1005–70.
4. Sharma A, Khanduri U. How benign is benign tertian malaria? J Vector Borne Dis. 2009;46:141–4.
5. Singh H, Parakh A, Basu S, Rath B. Plasmodium vivax malaria: Is it actually benign? J Infect Public Health. 2011;4:91–5.
6. National Vector Born Disease Control Program. Available from: https://nvbdcp.gov.in/WriteReadData/l892s/Guidelines%20for%20Diagnosis2011.pdf .
7. World Health Organization. Severe malaria. Trop Med Int Health. 2014;19:7–131.
8. Guerra CA, Snow RW, Hay SI. Mapping the global extent of malaria in 2005. Trends in Parasitology. 2006 Aug;22(8):353–8.
9. Genton B, D'Acremont V, Rare L, Baea K, Reeder JC, Alpers MP, et al. Plasmodium vivax and mixed infections are associated with severe malaria in children: A prospective cohort study from Papua New Guinea. PLoS Med. 2008;5:e127.
10. Gupta NK, Bansal SB, Jain UC, Sahare K. Study of thrombocytopenia in patients of malaria. Trop Parasitol. 2013;3:58–61.

11. Joshi H, Prajapati SK, Verma A, Kang'a S, Carlton JM. Plasmodium vivax in India. Trends Parasitol. 2008;24:228–35.
12. Muddaiah M, Prakash PS. A study of clinical profile of malaria in a tertiary referral centre in South Canara. J Vector Borne Dis. 2006;43:29–33.
13. Rasheed A, Saeed S, Khan SA. Clinical and laboratory findings in acute malaria cases by various Plasmodium species. J Pak Med Assoc. 2009;54:220–3.
14. Barcus MJ, Basri H, Picarima H, Manyakori C, Sekartuti Elyazar I, Bangs MJ, et al. Demographic risk factor for severe and fatal vivax and falciparum malariaamong hospital admissions in North Eastern Indonesian Papua. Am J Trop Med Hyg. 2007;77:984–91.
15. Rizvi I, Tripathi DK, Chughtai AM, Beg M, Zaman S, Zaidi N. Complications associated with Plasmodium vivax malaria: A retrospective study from a tertiary care hospital based in Western Uttar Pradesh, India. Ann Afr Med. 2013;12:155–9. [PubMed: 24005587]
16. Rahimi BA, Thakkinstian A, White NJ, Sirivichayakul C, Dondorp AM, Chokejindachai W. Severe vivax malaria: A systematic review and metaanalysis of clinical studies since 1900. Malar J. 2014;13:481.
17. Limaye CS, Londhey VA, Nabar ST. The study of complications of vivax malaria in comparision with falciparum malaria in Mumbai. J Assoc Physicians India. 2012;60:15–8.
18. Ayeh-Kumi PF, Osafo AK Attah SK, Tetteh-Quarcoo PB, Nkrumah ON, Mensah AG, et al. Malaria, helminths and malnutrition: A cross-sectional survey of school children in the South-Tongu district of Ghana. BMC Res Notes. 2016;9:242.
19. Jadhav UM, Patkar VS, Kadam NN. Thrombocytopenia in malariacorrelation with type and severity of malaria. J Assoc Physicians India. 2004;52:615–8.
20. Kochar DK, Das A, Kochar A, Middha S, Acharya J, Tanwar GS, et al. Thrombocytopenia in Plasmodium falciparum, Plasmodium vivax and mixed infection malaria: A study from Bikaner (Northwestern India) Platelets. 2010;21:623–7.
21. Tanwar GS, Khatri PC, Chahar CK, Sengar GS, Kochar A, Tanwar G, et al. Thrombocytopenia in childhood malaria with special reference to P. vivax monoinfection: A study from Bikaner (Northwestern India) Platelets. 2012;23:211–6.
22. Wyss K, Wångdahl A, Vesterlund M, Hammar U, Dashti S, Naucler P, et al. Obesity and diabetes as risk factors for severe Plasmodium falciparum malaria: Results from a Swedish nationwide study. Clin Infect Dis. 2017;65:949–58.

Vol. 4 No. 12 (2023): December 2023 Issue
https://doi.org/10.51168/sjhrafrica.v4i12.902
Original article

Publisher details:

Publishing Journal: Student's Journal of Health Research Africa.
Email: studentsjournal2020@gmail.com or admin@sjhresearchafrica.org

(ISSN: 2709-9997)

Publisher: SJC Publishers Company Limited
Category: Non-Government & Non-profit Organisation
Contact: +256775434261(WhatsApp)
Email: admin@sjpublisher.org
Website: https://sjpublisher.org
Location: Wisdom Centre Annex, P.O. BOX. 701432 Entebbe, Uganda, East Africa.