International Journal of Medical and Health Research
ISSN: 2454-9142
Received: 13-02-2019; Accepted: 16-03-2019
www.medicalsciencejournal.com
Volume 5; Issue 4; April 2019; Page No. 43-46

Assessment of clinical and pathological trends in children suffering from Malaria

Dr. Chandra Bhushan Kumar[1], Dr. AK Jaiswal[2]
[1] Associate Professor, Upgraded Department of Paediatrics, Patna Medical College Patna, Bihar, India
[2] Professor & H.O.D, Upgraded Department of Pediatrics, Patna Medical College & Hospital, Patna, Bihar, India
[*] Corresponding Author: Dr. AK Jaiswal

Abstract
Plasmodium vivax malaria is increasingly being reported as cause of severe malaria and different manifestation of severe malaria as compared to *P. falciparum* malaria from several countries across the world. Drug resistance and demographic development will contribute to a further increase in malaria morbidity and mortality. The present study was done to find out the clinico-haematological profile and outcome of malaria.
The present study was planned in the Upgraded Department of Paediatrics, Patna Medical College Patna, Bihar from July 2018 to Dec 2018.50 children's diagnosed with the symptoms of the malaria were enrolled in the present study. Data regarding patient's age, sex, clinical presentation, investigation and outcome was recorded. The clinical features and lab reports were analysed to label severity based on WHO guidelines for classification of severe malaria
Plasmodium vivax was most common etiology of severe malaria in children. It should no longer be considered as benign malaria. Thrombocytopenia was most common haematological observation. *P. vivax* malaria though traditionally considered to be a benign entity can also have a severe and complicated course, which is usually associated with *P. falciparum* malaria. Adequate health care should be provided to the patients. More attention should be given to prevention of malaria to avoid cerebral malaria as a serious complications and prompt action taken for those infected.

Keywords: *Plasmodium vivax*, malaria, *Plasmodium falciparum*, India

Introduction
Most of the 1-3 million who die each year from malaria are children, mainly in Africa, which is hyperendemic for malaria. In older children, malaria has a similar course as in adults. However, in children below the age of 5 years, particularly infants, the disease tends to be atypical and more severe. In the first two months of life, children may not contract malaria or the manifestations may be mild with low-grade parasitemia, due to the passive immunity offered by the maternal antibodies. In endemic and hyperendemic areas, the parasite rate increases with age from 0 to 10% during first three months of life to 80 to 90% by one year of age and the rate persists at a high level during early childhood. The mortality rate is highest during the first two years of life. By school age, a considerable degree of immunity would have developed and asymptomatic parasitemia can be as high as 75% in primary school children. In Africa, on an average about 1 in 20 children die from malaria, and in worst affected areas, even 1 in 5 or 6 die from malaria and its related diseases (e.g., anaemia).
In areas of low endemicity, where the immunity is low, severe infection occurs in all age groups including adults. The morbidity and mortality due to malaria in children tends to be very high in these areas. Malnutrition does not increase susceptibility to severe falciparum malaria. In fact, it has been observed that well-nourished children are more likely to develop severe disease than those with malnutrition. However, when severe malaria does occur, malnourished children have a higher morbidity and mortality. Hemoglobin types in the newborn and the susceptibility to malaria: It has been observed that congenital malaria and malarial parasitemia in newborns are very rare, in spite of significant maternal parasitemia and sequestration of the parasites in the placenta. The reasons for this are not fully understood. Passive immunity due to maternal antibodies, retarded growth of the parasites in erythrocytes containing Hemoglobin F and resistance for parasite growth in old red cells with HbF may be the causes.
Children with heterozygous sickle cell trait have lower parasite rates and less fatal infections compared to normal children (however, homozygous sickle cell disease does not protect against fatal infection). Thalassemias may also confer some protection, may be due to higher levels of HbF. Glucose 6-phosphate dehydrogenase deficiency has been found to have a protective effect against malaria in some studies.
Severe falciparum malaria is the commonest cause of death in infants and children in areas endemic and hyperendemic for malaria. Inadequate immunity results in rapid increase in the parasite count and development of complications. Delay in diagnosis and treatment also contributes to the mortality. Clinical features of severe disease should be given utmost priority. History of travel to malarious area, history of previous antimalarial therapy, history of vomiting, diarrhoea, fluid intake, urine output, convulsions etc. should be obtained from parents. Physical examination should include assessment of hydration and of complications of falciparum malaria. Rectal temperature should be measured in infants and small children. All children should be weighed on admission.
Thick and thin films for malaria, haematocrit and hemoglobin, blood glucose (by finger prick) should be done

in all cases. If the report is likely to be delayed, presumptive antimalarial treatment should be started. Parasite count should be done in all positive cases of falciparum malaria and a parasite count of >2% indicates impending problems and >5% should be considered as severe infection. All cases with severe falciparum malaria should be managed as medical emergency [1].

wing to the non-specific nature of the presentation of symptoms, diagnosis of malaria in non-endemic areas requires a high degree of suspicion, which might be elicited by any of the following: recent travel history, enlarged spleen, fever, low number of platelets in the blood, and higher-than-normal levels of bilirubin in the blood combined with a normal level of white blood cells [5]. Reports in 2016 and 2017 from countries where malaria is common suggest high levels of over diagnosis due to insufficient or inaccurate laboratory testing [2].

Malaria is usually confirmed by the microscopic examination of blood films or by antigen-based rapid diagnostic tests (RDT). In some areas, RDTs must be able to distinguish whether the malaria symptoms are caused by *Plasmodium falciparum* or by other species of parasites since treatment strategies could differ for non-*P. falciparum* infections. Microscopy is the most commonly used method to detect the malarial parasite—about 165 million blood films were examined for malaria in 2010. Despite its widespread usage, diagnosis by microscopy suffers from two main drawbacks: many settings (especially rural) are not equipped to perform the test, and the accuracy of the results depends on both the skill of the person examining the blood film and the levels of the parasite in the blood. The sensitivity of blood films ranges from 75–90% in optimum conditions, to as low as 50%. Commercially available RDTs are often more accurate than blood films at predicting the presence of malaria parasites, but they are widely variable in diagnostic sensitivity and specificity depending on manufacturer, and are unable to tell how many parasites are present [3].

In regions where laboratory tests are readily available, malaria should be suspected, and tested for, in any unwell person who has been in an area where malaria is endemic. In areas that cannot afford laboratory diagnostic tests, it has become common to use only a history of fever as the indication to treat for malaria—thus the common teaching "fever equals malaria unless proven otherwise". A drawback of this practice is overdiagnosis of malaria and mismanagement of non-malarial fever, which wastes limited resources, erodes confidence in the health care system, and contributes to drug resistance. Although polymerase chain reaction-based tests have been developed, they are not widely used in areas where malaria is common as of 2012, due to their complexity [4].

The biggest burden of malaria in India is borne by the most backward, poor and remote parts of the country, with >90-95% cases reported from rural areas and <5-10% from urban areas; however, the low malaria incidence in urban areas may be due to almost non-existing surveillance. The state of Orissa, with a population of 36.7 million (3.5%), contributes about 25% of the total annual malaria cases, more than 40% of *P. falciparum* malaria cases and nearly 20–30% of deaths caused by malaria in India, followed by Meghalaya, Mizoram, Maharashtra, Rajasthan, Gujarat, Karnataka, Goa, southern Madhya Pradesh, Chhattisgarh, and Jharkhand that also report significant number of malaria cases and deaths [3, 17]. The proportion of *P. vivax* and *P. falciparum* varies in different parts of India; *P. falciparum* accounts for 30–90% of the infections in the forested areas inhabited by ethnic tribes and <10% of malaria cases in mostly indo-gangetic plains and northern hilly states, north western India, and southern Tamil Nadu [15].

Unbridled urbanization, drought, migration of workers, and lax control efforts are all contributing to the resurgence of malaria in India and the problem is expected to exacerbate in the years to come. With increasing global warming, it is projected that in 2050s, malaria is likely to persist in Orissa, West Bengal and southern parts of Assam, bordering north of West Bengal, but may shift from the central Indian region to the south western coastal states of Maharashtra, Karnataka and Kerala. Also the northern states, including Himachal Pradesh and Arunachal Pradesh, Nagaland, Manipur and Mizoram in the northeast may become malaria prone [16].

The malaria prevention and control is still challenging in developing countries. India has maximum burden of malaria cases in Southeast Asia. Historically *P. falciparum* malaria has been associated with severe complications and significant mortality. However *P. vivax* malaria is increasingly being reported as cause of severe malaria and different manifestation of severe malaria as compared to *P. falciparum* malaria from several countries across the world. Drug resistance and demographic development will contribute to a further increase in malaria morbidity and mortality. The present study was done to find out the clinico-haematological profile and outcome of malaria.

Methodology

The present study was planned in the Upgraded Department of Paediatrics, Patna Medical College Patna, Bihar from July 2018 to Dec 2018. 50 children's diagnosed with the symptoms of the malaria were enrolled in the present study. Data regarding patient's age, sex, clinical presentation, investigation and outcome was recorded. The clinical features and lab reports were analysed to label severity based on WHO guidelines for classification of severe malaria.

All the patients were informed consents. The aim and the objective of the present study were conveyed to them. Approval of the institutional ethical committee was taken prior to conduct of this study.

Following was the inclusion and exclusion criteria for the present study.

Inclusion criteria: children under 18 years of age with smear positive malaria cases diagnosed; Any Acute Febrile Illness lasting for 2-7 days.

Exclusion criteria: Children with congenital liver and/or renal diseases; Co-infection with dengue (dengue antigen or dengue serology positive); Chronic illnesses, bleeding disorders, renal disorders, progressive neurological diseases.

Results & Discussion

Malaria is one of major health concern of India. Malaria is completely curable if effective treatment started promptly. Delay in effective treatment may lead to devastating consequences including death. In present study the most common causative agent of malaria was *P. vivax*.

Many factors influence a patient's risk of developing severe malaria, particularly the species of malaria parasite and the patient's immune status, which depends on previous

exposure to malaria. As noted, *P. falciparum* is the most virulent of the plasmodia. Complications of *P. falciparum* infection are the result of cytokine release and of the parasite's unique ability to cause parasitized RBCs to adhere to vascular endothelium and cause RBC sequestration, altered blood flow, and ischemia. The patient's immune status also greatly affects the manifestations of malaria. In populations originating from areas of constant, high-intensity malaria transmission, most mortality occurs among younger children, as a result of severe anaemia. In the same populations, infected adults and older children may have minimal symptoms or may be asymptomatic [5].

Another study from India which was done on children who were hospitalized with malaria, shown that the risk of severe disease was greatest with the *P. vivax* infections (63.1%) [6]. The studies from other part of globe also suggested that *P. vivax* is now new emerging challenge because it is also cause severe malaria [7-8].

Males were more affected than females in the present study. Similar male preponderance has been reported earlier [9]. This is possibly due to increased outdoor activity and increased exposure to mosquitoes in males as compared to females. This may also be due to sick females not being brought to hospital perhaps due to prevalent gender bias.

Falciparum malaria is associated with life-threatening complications in children. It is important for the clinicians in tropical countries to be alert for the symptoms and signs which may progress to life-threatening disease of falciparum malaria. The high index of suspicion is rewarding most of the times because the disease has bizarre manifestations especially in young children; septicaemia and encephalitis illnesses predominate [10].

Table 1: Age and gender distribution of malaria

Types of Malaria	***P. vivax***	***P. falciparum***	**Mixed**	**Total**
Age (years)	**No. of Cases**	**No. of Cases**	**No. of Cases**	**No. of Cases**
< 1 year	2	0	0	2
1-5 year	22	2	1	25
> 5 years	16	4	3	23
Total	40	6	4	50
Gender				
Male	31	4	3	38
Female	9	2	1	12
Total	40	6	4	50

Table 2: Distribution of clinical features

Types of Malaria	***P. vivax***	***P. falciparum***	**Mixed**
Clinical features Seen in	**No. of Cases**	**No. of Cases**	**No. of Cases**
Pallor	22	5	4
Hepatosplenomegaly	16	2	2
Hepatomegaly	3	0	0
Seizures	1	0	0
Cough and respiratory distress	2	0	0
Lab parameters			
Hemoglobin 5-10gm%	19	4	2
Hemoglobin > 10gm%	5	0	1
Platelet/cmm < 50,000	12	2	1
50,000-1 lakhs	11	1	0
>1 lakhs	3	1	0
Hemoglobinuria	1	0	0

Table 3: Severity parameters

Severity parameters	**No. of Cases**
Bleeding	13
Shock	10
Acidosis	10
Severe anemia	5
Jaundice	5
Renal impairment	3
Impaired consciousness	2
Pulmonary edema	1
Hypoglycemia	0

Thrombocytopenia was described as the most common manifestation of malaria in the WHO report. Recent reports from various parts of the world suggest that the incidence of thrombocytopenia, which was earlier considered to be rare in *P. vivax* malaria, is currently similar in vivax and falciparum malaria [11]. The association of severe thrombocytopenia to skin and mucosal bleeding has been observed in children with especially *P. vivax* malaria [12]. The exact mechanism of the *P. vivax* associated thrombocytopenia is not known. Both immunological and non-immunological factors are involved.

Anaemia is the important cause for morbidity and mortality in falciparum malaria as seen with this study. The pathogenesis of anaemia in malaria is multifactorial. A complex chain of pathogenic processes involving mechanical destruction of parasitized RBCs, marrow suppression, ineffective erythropoiesis, and accelerated immune destruction of non-parasitized RBCs have been implicated [13]. Thrombocytopenia was a common observation in falciparum malaria with spontaneous recovery on treatment but in this study, it showed increased thrombocytes. Both leucopenia and leukocytosis have been described in malaria [14].

Children do not present with classical features of malaria but may have protean manifestations like gastroenteritis, pneumonia, meningitis, encephalitis, or hepatic

dysfunction13. The atypical presentation in paediatric age group is further compounded by the irregular and incomplete treatment taken prior to hospitalisation.
Those suffering from this complication of malaria should receive full attention and the haematological parameters should be monitored especially the red cell line which may lead to increase morbidity and mortality.

Conclusion

Plasmodium vivax was most common etiology of severe malaria in children. It should no longer be considered as benign malaria. Thrombocytopenia was most common haematological observation. *P. vivax* malaria though traditionally considered to be a benign entity can also have a severe and complicated course, which is usually associated with *P. falciparum* malaria. Adequate health care should be provided to the patients. More attention should be given to prevention of malaria to avoid cerebral malaria as a serious complications and prompt action taken for those infected.

References

1. https://www.malariasite.com/malaria-children/
2. Manguin, Sylvie, Foumane, Vincent, Besnard, Patrick, Fortes, Filomeno. Malaria overdiagnosis and subsequent overconsumption of antimalarial drugs in Angola: Consequences and effects on human health. 201;7 (71):58-63.
3. Wilson ML. Malaria rapid diagnostic tests. Clinical Infectious Diseases. 2012; 54(11):1637-41. doi:10. 1093/cid/cis228. PMID 22550113.
4. Nadjm B, Behrens RH. Malaria: An update for physicians. Infectious Disease Clinics of North America. 2012; 26(2):243-59.
5. World Health Organization. Severe falciparum malaria, Trans R Soc Trop Med Hyg. 2000; 94(1):1-90.
6. Kochar DK, Tanwar GS, Khatri PC, *et al*. Clinical features of children hospitalized with malaria - A study from Bikaner, Northwest India. Am J Trop Med Hyg. 2010; 83:981-999.
7. Genton B, Acremont V, Rare L, *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; 5:881-889.
8. Tjitra E, Anstey NM, Sugiarto P, *et al*. Multidrugresistant *Plasmodium vivax* associated with severe and fatal malaria: A prospective study in Papua, Indonesia. PLoS Med 2008; 5:e128.
9. Kumari M, Ghildiyal R. Clinical Profile of *Plasmodium vivax* Malaria in Children and Study of Severity Parameters in relation to Mortality: Tertiary Care Centre Perspective in Mumbai, India. Malaria Res Treat. 2014:7656-57.
10. Thapa BR, Mehta S, Singh LM. Complicated chloroquine resistant malaria. Indian J Pediatr. 1985; 52:209-212.
11. Saravu K, Docherla M, Vasudev A, *et al*. Thrombocytopenia in vivax and falciparum malaria: An observational study of 131 patients in Karnataka, India. Ann Trop Med Parasitol. 2011; 105:593-598.
12. Thapa R, Biswas B, Mallick D, *et al*. Childhood *Plasmodium vivax* malaria with severe thrombocytopenia and bleeding manifestations. J Pediatr Hematol Oncol. 2009; 31:758-759.
13. Sen R, Tewari AD, Sehgal PK, Singh U, Sikka R, *et al*. Clinico-hematological ĐđŽĮůĞ in acute and chronic *Plasmodium falciparum* malaria in children. J Coin Dis. 1994; 26:31-38.
14. Lee GR, Foerster J, Leukens J. Wintrobe's clinical hematology. (10th edn). Bethseda, Maryland: Lippincot Williams and Wilkins, USA, 1999.
15. Ashwani Kumar, Neena Valecha, Tanu Jain, Aditya P. Dash. Burden of Malaria in India: Retrospective and Prospective View. Am J Trop Med Hyg. 2007; 77(6_Suppl):69-78.
16. Bhattacharya S, Sharma C, Dhiman RC, Mitra AP. Climate change and malaria in India. Current Science. 2006; 90(3):369-375.