ORIGINAL RESEARCH PAPER

Pathology

STUDY OF COMMON CHANGES IN HAEMATOLOGICAL PARAMETERS IN CHILDREN SUFFERING FROM MALARIA IN CENTRAL ODISHA

KEY WORDS: Malaria, Haematological changes, Children, Pl.falciparum,Pl.vivax,CBC

Chandra Sekhar Mohapatra*

(MD) Assistant Professor Pathology, SCB Medical College, Cuttack *Corresponding Author

ABSTRACT

Background- Malaria infection is common in the state of Odisha and is a common cause of childhood morbidity, with varied heamatological consequences. This study was conducted to find out pattern of the haemotological changes in children infected with malaria.

Objectives: The changes in the blood in acute malaria are previously described.The present study was undertaken to examine and compare the incidence and severity of changes in blood-parameters in children suffering from two most common types Pl.Falciparum and Pl.vivax malaria and to find out which blood changes are most important predictors of malaria infection in this study area of central Odisha

Methods: This was an observational study included eighty one cases of acute malaria patients who attended Paediatric Medical Out patient Department of Sardar Vallabhbhai PatelPost Graduate Institute of Paediatrics (Sishu bhawan), Cuttack, Odisha,during the period from September 2015 to August 2016.The diagnosis of malaria was confirmed by examining both thick and thin blood smears after being stained with Leishman's stain.The blood slides were examined for malaria parasites by two independent pathologists and complete blood count(CBC) were performed using an automated coulter counter` Sysmax machine".

Results: From examination of blood samples of 81 children who were confirmed malaria cases it was found that 80% of patients had anaemia,59% thrombocytopenia and 51% neutrophilia. The other overall finding were lymphopenia (14%), leukopenia (12%), eosinophilia(12%)and monocytosis (4%).There was no significant difference in incidence of anaemia in Pl.falciparum (81%) and in Pl.vivax (78%) p value>0.05, whereas the incidence of thrombocytopenia was more in Pl falciparum (62%) than that of Pl vivax (33%).Moreover lymphopenia was found in 44% in Pl vivax in comparision to 10% in Pl falciparum malaria,p value <0.04. Eosinophil, basophil and monocyte count showed no significant changes in two most common falciparum and vivax malaria.

Conclusions: Pl. falciparum and Pl.vivax malaria infection can cause significant haematological changes in children with more commonly of anaemia,thrombocytopenia, lymphopenia and frequently neutrophilia which may be considered as coroborative predictors of malaria infection. Though not specific, when used in combination with other clinical and microscopic findings,these parameters could improve malaria diagnosis in children.

Introduction:

Malaria is a serious mosquitoborne disease which is one of the most prevalent human infections in the world.It is a disease of tropical and sub-tropical countries mostly of Africa and Asia[1,2].It continues to cause significant morbidity and mortality in India including the state of Odisha[3].The haematological changes in malaria has been investigated as blood is the most easily obtainable diagnostic tissue. Changes in blood parameters are likely to be influenced by any disease process including malaria where haematological changes play important role in pathogenesis and therefore such changes may be predictors of diagnosis and complications of the disease[4,6].

Objective : The aim of the study was to elucidate and asses the haematological changes that frequently occur in malaria infection in children in this locality of central Odisha.

Methods: The present studty was an observational study and was conducted in Sardar Vallabhbhai Patel Post Graduate Institute of Paediatrics (Sishu Bhawan),Cuttack,which is the largest tertiary care children hospital in the state of Odisha,and is an extended unit of SCB Medical College Hospital. Partcipants were all 81 children with confirmed diagnosis of malaria who attended the Outpatient Department of Sardar Vallabhbhai Patel Post Graduate Institute of Paediatrics (Sishu Bhawan),Cuttack,during the period September 2015 to August 2016.The parent/gurdians of the study participants gave a written informed consent before being enrolled in to the study.

Inclusion criteria: Patients of paediatric age (upto 14 years) both male and female who were having diagnosis of malaria as evidenced by positive blood smears for any malaria parasite(Pf,Pv or mixed),and whose parents agreed with written consent to participate in the study.

Exclusion criteria: Children with clinical history and/or finding suggestive of other infections, bleeding disorder, thrombocytopenia, drug intake or conditions which might have contributed in blood changes and when there was unwillingness by parents to participate were excluded from the study.

A total of 81 children with microscopically confirmed malaria were investigated. Biodemographic information obtained include age,gender,detailed clinical history,duration of illness and history of treatment received.All the recruited subjects were investigated for microscopic examination of malaria parasite in blood smear using Leishman stain and complete blood count(CBC) were performed using an automated coulter counter ACT5 Diff Haematology Analyzer `XN-350 Sysmax machine" as per company guideline following SOPs within 1 hour. Everyday quality control checks were performed and recorded; commercial controls were used in accordance with manufacturer's recommendations.

The machine provided data on WBCs, RBCs, haemoglobin level, platelet counts, Mean platelet volume, red cell distribution width (RDW) and five part differentials and histograms. Haematological parameters (red blood cells, white blood cells, platelets, red cell distribution width, mean platelet volume and haemoglobin) of children suffering from Pl.falciparum and Pl.vivax were compared and analyzed. According to WHO criteria the thrombocytopenia was defined when total platelet count is below 100,000/cu mm of blood, where as anaemia was defined as haemoglobin level <10g/dl for both male and female patients of paediatric age group.All other parameters were compared against normal reference range which are internationally accepted and mentioned in the manual of the machine. Data was analyzed by SAS Enterprise Guide 4. Statistical analysis included descriptive statistics, bivariate analysis i.e., t-test, chi-square and analysis of variance (ANOVA). A *p* value of <.05 was taken as significant for all statistical analysis.

The diagnosis of malaria was confirmed by examining both thick and thin blood smears after being stained with Leishman's stain. The blood slides were examined for malaria parasites by two independent pathologists and species of malaria was detected from thin smear from which WBC differential was also done for all patients. All malaria positive smears were reviewed by another

hematologist/pathologist for confirmation, identification of species and review of smear for platelets count and other hematological changes.

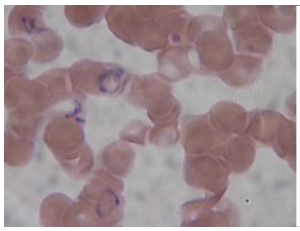
Results: In this study we found 81 children who were diagnosed of malaria infection,Pl.falciparum being the most common species comprising majority(84%) of malaria infection (Table-1).

From examination of blood samples of 81 children who were confirmed malaria cases it was found that 80% of patients had anaemia,59% thrombocytopenia and 51% neutrophilia.The other overall finding were lymphopenia(14%), leukopenia(12%), eosinophilia (12%) and only(4%)monocytosis (Table-2). There was no significant difference in incidence of anaemia in Pl.falciparum (81%) and in Pl.vivax (78%) p value>0.05 ,whereas the incidence of thrombocytopenia was more in Pl falciparum (62%) than that of Pl vivax(33%).Moreover lymphopenia was found in 44% in Pl vivax in comparision to 10% in Pl falciparum malaria,p value <0.04.Eosinophil,basophil and monocyte count showed no significant changes in two most common falciparum and vivax malaria.

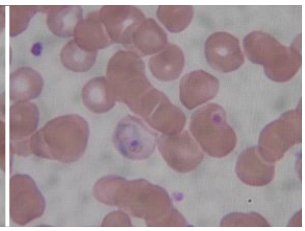
Median values for Haemoglobin, Platelet count, RBC count, lymphocyte and eosinophils counts were significantly lower where as the Mean platelet volume (MPV), Monocyte and neutrophil counts were higher in the children suffering from malaria compared to the controls. There was no significant change noted in total WBC and RDW in children with malaria infection.

Table1:Showing species of malaria found in the study

Total malaria cases	Pl.falciparum malaria	Pl.vivax malaria	Mixed malaria infection
81	68 (84%)	9 (11%)	4 (5%)



Leishmanstain500x, showing multiple Pf rings



Leishmanstain500x, showing P.vivax ring

Table2: Showing various haematological changes in different species of malaria

Haematological changes	Pl.falciparum malaria	Pl.vivax malaria	Mixed mal. infection
Anaemia	55 (81%)	07 (78%)	03 (75%)
Thrombocytopenia	42 (62%)	03 (33%)	03 (75%)
Leukopenia	08 (12%)	01 (11%)	01 (25%)
Lymphopenia	07 (10%)	04 (44%)	00
Neutrophilia	37 (54%)	04 (44%)	00
Eosinophilia	09 (13%)	01 (11%)	00
Monocytosis	02 (3%)	01 (11%)	00

Diagnostic values of haematological parameters in this study: Low haemoglobin, low platelet count and increased neutrophil count had fairly good predictors to diagnose malaria in children.

Discussion

The present study confirms that haematological abnormalities are common and more pronounced in Pl. falciparum malaria infection, possibly due to the higher levels of parasitaemia found in these patients similar to finding as reported previously by Wickramasinghe SN and **Richards MW** [7,8]. Anaemia is one of the most common complications in malaria especially in younger children in endemic areas [9] which is thought to result from a combination of haemolytic mechanisms and accelerated removal of both parasitized and non-parasitized red blood cells, depressed and ineffective erythropoiesis [10,11].Many children with malaria in this study had significantly high neutrophil count, while low lymphocyte count is also common in malaria [6,7,8] the lymphopenia found might be due to redistribution of lymphocytes with sequestration in the spleen [7] however Lymphocytosis has also been reported elsewhere by Ladhani S [12]. Thrombocytopaenia may be due to peripheral destruction [12], excessive removal of platelets by splenic pooling [13, 14] as well as platelet consumption by the process of DIC [15]. Our study confirms no bleeding-episode in children with malaria inspite of thrombocytopenia was common which was also previously reported [10]. Hypersensitive platelets, which are thought to enhance haemostatic responses, have been reported and may be the cause for rare bleeding episodes in acute malaria infection, despite the thrombocytopaenia [16,17, 18].

Conclusions:

Presence of anaemia ,thrombocytopenia in combination with **and neutrophilia** in children from endemic areas may be useful as supportive diagnostic criteria for malaria in situations where definitive microscopic or RDT may be non-available due to any reasons. Therefore, when used in adjunct to clinical and microscopy findings, changes in haematological parameters can significantly improve early malaria diagnosis thereby reducing morbidity and mortality in children.

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