ORIGINAL RESEARCH PAPER

General Medicine

A STUDY OF MALARIA AT A TERTIARY CARE HOSPITAL IN NORTH KARNATAKA

KEY WORDS: Malaria, Anaemia, Thrombocytopenia, Hepatic, Renal.

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ABSTRACT

Background: Malaria is a major health problem in many parts of India. It has varied manifestations and it is imperative for us to know the laboratory features of malaria along with clinical presentations. **Objective:** To study the haematological parameters of malaria cases. **Methods:** This is a retrospective study of malaria cases conducted at S. Nijalingappa Medical College and HSK Hospital and Research Centre, Bagalkot from January 2016 to January 2017. **Results:** In this study, among 103 patients, 71 are males and 32 females. In this 40(38.8%) are among age group 15-30 years, 30 (29.1%) belong to 31-50 years age group, 26 (25.2%) among age group 51-70 and 7 (6.7%) are age group more than 71. Malaria is most common during the month of July 20 cases (19.4%) and August 19 cases (18.43%). Out of 103 patients 61 (59.1%) had infection with P.vivax, 23 (22.3%) had infection with P.falciparum and mixed infection in 19(18.4%). Pancytopenia is noted in 17 cases, in this 5(4.85%) are Plasmodium vivax, 6 are Plasmodium falciparum (5.82%) and 6 are mixed infection (5.82%). A total of 66 cases of anaemia noted in our study, in this 13 cases are severe anaemia, among these 8 (7.76%) are infected with Plasmodium vivax, 2 (1.94%) cases of plasmodium falciparum, and 3 (2.91%) cases of mixed infection. A total of 60 cases in our study have thrombocytopenia, 16 (15.52%) cases have platelet count less than 20,000, 19 (18.43%) have platelet count 21,000-50,000, 25 (24.25%) cases have platelet count 51,000-1,50,000. Severe thrombocytopenia is seen in 3(2.91%) cases of Plasmodium vivax infection, 4 (3.88%) cases of Plasmodium falciparum infection and 7(6.97%)cases of mixed infection. Among 103 cases we noted an increase in serum creatinine value in 22 cases, 16 (15.52%) cases are due to Plasmodium vivax, 4 (3.88%) cases are due to Plasmodium falciparum and 2 (1.94%) cases have mixed infection. Our study shows 20 cases of liver dysfunction, 10 (9.7%) cases due to Plasmodium vivax, 5 (4.85%) cases of Plasmodium falciparum and 6 (5.82%) cases of mixed infection. **Conclusion:** Our study describes the various laboratory manifestations in malaria. Thus by being more alert and knowing the different presentations and lab features of this common disease early diagnosis can be made which in turn would help us for better treatment thus reducing the morbidity and mortality associated with it. Malaria can present as a benign illness or with significant morbidity and mortality. Along with clinical features we need to keep haematological manifestations in to consideration, this can identify early organ involvement irrespective of infection caused by vivax, falciparum and/or mixed infection malaria.

INTRODUCTION

Malaria remains a major public health issue in our country. It should be considered as a serious disease, around 1.5 million cases of malaria are being reported annually by the National Vector Borne Disease Control Programs (NVBDCP), of which 50% are due to plasmodium falciparum1. In the south east Asian region, 1.4 billion people living in 11 countries, 1.2 billion are exposed to the risk of malaria most of whom live in India2. South east Asian regions contribute 2.5 million cases to the global burden of malaria, of this India alone contributes 76% of total cases2. It remains the world's most important tropical parasite disease and kills more people than any other communicable disease except tuberculosis3. In India mortality due to malaria is 2,00,000 persons annually4. Malaria is caused by Plasmodium species which is transmitted by bite of infected Anopheles mosquitoes. Malaria presents with clinical features of periodic paroxysm, chills, rigors, myalgia, headache and prostration. It can present with life threatening manifestations like cerebral malaria, acidosis, jaundice, acute kidney injury, acute respiratory distress syndrome etc. Haematological manifestations while seen both with P. falciparum and P. vivax, can become life threateninginfalciparum malaria5. In our study attempt has been made to know the various haematological features associated with malaria.

AIMS

The study of haematological profile of malaria cases.

METHOD

Setting - This study was conducted at SNMC and HSK ,Bagalkot. It is a retrospective study of malaria cases admitted in the department of General Medicine. All cases of malaria between January 2016 to January 2017 included in the study.
Design – It is a retrospective ,observational, non comparative, non randomised, analytical

Participants - A study of 103 human subjects who were diagnosed with malaria.

Study size - All human subjects who are positive for malaria and humans more than 15 years are included. The data collected included patient details and haematological profile .

MATERIALS

103 human subjects diagnosed to have malaria either by peripheral smear study or antigen testing.All individuals were admitted in the department of medicine. The human subjects received specific treatment based on clinical and laboratory diagnosis . Some individuals received blood and/ or blood products transfusion .

METHOD OF DATA COLLECTION

Inclusion criteria – Individuals more than 15 years and positive for malaria.

We collected the data of all individuals which included age, admission date , sex and all haematological investigations. The blood investigation profile included malaria testing, complete blood count and peripheral smear study, renal and liver function tests.

Malaria testing was done with either peripheral smear examination or with Pf/Pv Ag Rapid test in human whole blood specimen. Liver function tests were done with fully automated machine with bio system reagent (AST normal limit up to 40

U/L and ALT normal limit up to 41 U/L, while total bilirubin is 1 mg%, indirect bilirubin is 0.8 mg% and direct bilirubin is up to 0.2 mg%) . Creatinine estimation was done with fully automated machine with biosystems reagent the range of creatinine considered to be normal is 0.6 to 1.2 mg%

RESULTS

We collected data of 103 patients . Male patients were 71 and females 32.

Age distribution is as shown below.

Table number 1- Age group and number of cases

Age in years	Number of cases (and in percentage)
15 – 30	40 (38.8)
31-50	30 (29.1)
51-70	26 (25.2)
More than 71	07 (6.7)

Our data shows majority of cases are in the age 15 to 30years followed by 31 to 50 years.

We collected data of 103 malaria positive cases . We categorised malaria into following three types .

Table number 2- Malaria species types and cases.

Malaria species	Total cases	percentage
P.vivax	61	59.1
P.falciparum	23	22.3
Mixed infections(vivax and falciparum)	19	18.4

In our part of state we noted that P.vivax malaria is most common agent followed by P.falciparum.

We have noted the month in which malaria cases were admitted . Following table shows cases and seasonal variations in admission.

Table number 3 – Month wise malaria admissions

Month	Total cases	percentage
January	5	4.85
February	8	7.76
March	3	2.91
April	8	7.76
May	9	8.73
June	8	7.76
July	20	19.4
August	19	18.43
September	11	10.67
October	4	3.88
November	5	4.85
December	3	2.91

In our study we have noted that malaria cases are comparatively more in the month of July and August.

As malaria can have various effects on different blood cells , we have analysed the data with respect to anaemia, pancytopenia, thrombocytopenia and also tried to correlate malaria with renal and liver parameters.

A total of 66 cases of malaria had anaemia 6.This includes pancytopenia and other anaemia types. There are a 17 cases of pancytopenia and a total of 49 cases of anaemia.

Pancytopenia defined by decrease in three cell lines – RBC, WBC and platelets7 is noted in 17 cases of malaria which accounts for 16.49 % .Following table shows us pancytopenia association with different malaria species.

Table number 4 –Pancytopenia and association with malaria species

Malaria species	Total cases	Percentage (for 103 cases)
P.vivax	5	4.85
P.falciparum	6	5.82
Mixed infection	6	5.82

We have noted a correlation between anaemia and malaria in 49 cases .The cases analysed with peripheral smear examination are depicted in the following table .

Table number 5 – Anaemia (peripheral smear types) and malaria species types

PS study	Total number	Percentage (for 103 cases)	vivax	falciparum	mixed
Normocytic normo - hypochromic	22	21.34	12 (11.64%)	5 (4.85%)	5 (4.85%)
Microcytic hypochromic	5	4.85	5 (4.85%)		
dimorphic	6	5.82	2 (1.94%)	3(2.91%)	1*(0.97%)
macrocytic	1	0.97	1 (0.97%)		

*later turned out to a primary CLL case.

A total of 66 cases of anaemia are noted in our study .We have tried to classify haemoglobin values in the following way to find out association with different malaria species and severity of Hb values.

Table 6 – Haemoglobin values with different malaria species.

Hb in gram%	Vivax	Falciparum	Mixed
Less than 6	8 (7.76%)	2(1.94%)	3(2.91%)
6.1-9	5 (4.85%)	5 (4.85%)	1(0.97%)
9.1 -12	24 (23.28%)	9(8.73%)	8(7.76%)

Platelets in malaria are an integral part of study , we have tried to analyse platelets in all malaria cases .

Table number 7- Platelets in malaria

Platelets count in thousand	Total cases	Percentage
Less than 20	16	15.52
21-50	19	18.43
51-150	25	24.25
More than 151	43	41.71

Thrombocytopenia defined as platelets count less than 150,0008 observed in 60 cases of malaria. Platelets less than 20,000 carry significant bleeding tendencies . Hence malaria types with platelets less than 20,000 is shown in following table.

Table number 8– Severe/ Profound thrombocytopenia9 and malaria species

Malaria species	Cases	Percentage
Vivax	3	2.91
Falciparum	4	3.88
Mixed	7	6.97
Total	14	13.58

Malaria is associated with complications – AKI, ARDS,

cerebral malaria, metabolic acidosis etc. We have collected renal and hepatic functions data in all cases of malaria.

Among 103 cases we noted an increase in serum creatinine values in 22 cases, renal impairment can be categorised into mild and severe. Severe is one in which blood urea nitrogen is more than 60mg% and/ or creatinine is more than 3 mg%. Mild renal impairment is with BUN in 41 to 60 mg% and creatinine in 1.5 to 3 mg% 10.By considering this classification and our lab reference values we have tried to isolate cases of renal dysfunction in malaria cases.

Table number 9 – Malaria cases with raised creatinine values

Malaria	Cases	Percentage
Vivax	16	15.52
Falciparum	4	3.88
Mixed	2	1.94

Our data has pointed out abnormal liver function tests in 20 cases .

Table number 10 – Malaria cases with altered liver functions.[11]

Malaria	Cases	Percentage
Vivax	10	9.7
Falciparum	5	4.85
Mixed	6	5.82

During a retrospective analysis , associated positive laboratory findings are noted in our cases. These are with respect to fever evaluation along with malaria , the following table depicts confections of malaria.

Table number 11 – Malaria with confections

Coinfections	Vivax	Falciparum	mixed
Dengue	4	1	1
Enteric fever	2		2
Ricketsial fever	1		1
Brucella	1		
Albuminuria	4		

All cases received antimalarial treatmentaccording to the guidelines and few patients received blood and/ or blood products based on their Hb levels with associated symptoms and/ or bleeding manifestations respectively.

There were two mortalities in our study and 4 cases went against medical advice , rest other cases improved .One mortality was associated with vivax infection and the other was mixed infection .

DISCUSSION

This retrospective analysis shows males are more (68.87%) affected than females (31.13%). A study by Y.Khan et al12 showed male preponderance, males comprising 62% and females 38%. A study study by Vishwanath K et al13 also had male predilection 76% and 24% comprised females. Another study by B G Mangshetty et al 5 also noted males are affected more than females.

Our study noted majority of individuals affected are in the age group 15 to 30 years followed by 31 to 50 years. A study by Joel et al 1 noted that individuals between 15 to 45 years are more commonly affected. In a study by Kashinkunti et al 4 the predominant affected age group was 20 to 40 years.

In our analysis P.vivax malaria is most common (59.1%) followed by P.falciparum in 22.3% and individuals infected with both species are seen in 18.4% cases. Other studies which show similar association are Joel et al , Vishwanath K et al and B G Mangshetty et al .

Table number 12 – Malaria species causing illness (in %)

Malaria species	Joel et al	Vishwanath K et al	B G Mangshetty et al	Our study
P.vivax	70.9	61	60	59.1
P.falciparum	15.4	13	34	22.3
Mixed	13.7	26	06	18.4

We noted the maximum admissions in hospital for malaria in the months of July to September .M Mudhiah et al also noted increase in malaria cases during rainy season14. V V Shelat et al 15 noted malaria cases to be more during south west monsoon season.

Malaria is associated with non sequestration related haematological complication like anaemia and thrombocytopenia. We noted pancytopenia in 16.49% cases and anaemia in 47.53 % cases. P.vivax contributes 19.4% , P.falciparum 7.76% and mixed infections for 5.82% of anaemia cases. We noted pancytopenia in 5.82% cases of falciparum malaria and mixed infection malaria. In vivax malaria pancytopenia is noted in 4.85% cases.

S Nandwani et al noted anaemia and thrombocytopenia to be more commonly associated with vivax malaria, severe anaemia was noted in 65 cases due to vivax, 10 cases due to falciparum and 5 cases due to mixed infections 16 .Y Khan et al noted anaemia in 48% cases , severe anaemia (Hb less than 5gram %) was noted in 5 % cases. Vishwanath K et al noted anaemia in 17.3% cases (vivax 10.6%, falciparum in 2.6% and mixed infections in 4% cases). Chowta et al demonstrated anaemia in 37.07% cases (vivax 33.3%, falciparum 31.4% , mixed infections 29.6%)3. S J Shah et al noted moderate anaemia in 82.75% cases and there was no association between anaemia and infecting species 17. M Kashinkunti et al noted anaemia in 69% cases and it was common with falciparum infection 4.

In our study 58.2% cases had thrombocytopenia. Platelet count below 20000 is noted in 13.58% cases (vivax contributed 2.91% , falciparum 3.88% and mixed infections in 6.97% cases).Mild to moderate anaemia caused by vivax species is noted in 23.28% cases .Edgar Leonardo et al noted frequency of thrombocytopenia in falciparum malaria in 66.6% cases and in vivax malaria in 63.7% cases. However they noted severe thrombocytopenia with 10.3% falciparum cases, 10.9% vivax cases and 22.2% mixed infection cases10.K Saravu et al noted thrombocytopenia in 88% vivax cases.UM Jadhav et al18 noted platelet count between 50-150 thousand was seen in 65% vivax cases and 50% falciparum cases .Severe thrombocytopenia below 20 thousand was seen in 1.5% vivax cases and 8.5% falciparum malaria cases. QH Shaikh et al 19 concluded that thrombocytopenia in vivax malaria is marked where as in falciparum malaria it is a common haematological finding (80.6% malaria cases had thrombocytopenia, frequency was 93.3% in vivax malaria cases and 71.8% in falciparum cases.

We noted abnormal creatinine values in 21.34% cases of malaria, vivax contributed 15.5% , falciparum 3.8% and mixed infections in 1.9% cases .S Nandwani et al noted acute kidney injury in 75 cases infected with vivax malaria, 6 cases of falciparum malaria and 5 cases of mixed infections. Renal dysfunction was noted by Rajeshwar K et al in 7.6% of vivax cases and in 20% of falciparum cases . C S Limaye et al and MY Nadkar et al noted renal dysfunction in 3.5% of vivax cases and 19.4% falciparum cases and 32 % vivax cases and 55 % falciparum cases respectively 24. P vivax malaria was associated with renal failure in 6 % cases and falcpiarum malaria in 25 % cases , these were noted in a study by BG Mangshaetty et al.

WHO definition , Colombian endemic region minor criteria and related studies by Indian authors one can isolate cases of hepatic dysfunction in malaria cases . Liver failure/

dysfunction can be mild (serum bilirubin 1.5 to 3mg% and or AST 80-120U/L) and severe (bilirubin more than 3 mg% and or AST more than 120U/L).

Our study noted malaria with liver dysfunction in 19.4% cases. P vivax malaria with liver dysfunction seen in 9.7% cases, falciparum malaria causing liver dysfunction is 4.85% and with mixed infections it is 5.82%. S Nandwani et al noted liver dysfunction in 60 cases of vivax, 7 cases of falciparum and 3 cases of mixed infection malaria 16.A similar findings were noted by Kochar et al and Nautiyal et al. Rajeshwar K et al noted liver dysfunction in 31 % cases of malaria among these 29% were due to vivax and 34 % were due to falciparum .Y Khan et al noted jaundice in 13 % cases.V V Shelat et al 18 noted liver dysfunction in and vivax accounted for 23.25 % cases and falciparum accounted in 32 % cases. Vishwanath K et al noted liver dysfunction in 12 % cases of malaria(vivax in 4 cases, falciparum in 2 cases and mixed infections in 3 cases).

We analysed other infections in our 103 malaria cases. We noted that vivax malaria cases are coinfected with dengue, enteric fever, ricketsial fever and brucella. Mixed infections (vivax with falciparum) are associated with dengue , enteric fever and ricketsial coinfections. Single case of falciparum malaria is coinfected with dengue fever.

We have analysed that various haematological manifestations, which include anaemia, pancytopenia, thrombocytopenia, liver and renal dysfunctions, are not only due to falciparum infections even the same spectrum is seen with vivax malaria.We noted vivax malaria can be an etiological agent for mortality , not only falciparum malaria.P vivax malaria generally a benign condition , can at times be a notorious agent as it can lead to organ dysfunctions. As vivax malaria is most common etiological agent in our region , we need be cautious in evaluating and managing this species.There is a need for further study to explain why vivax malaria , over a period of time , is associated with such diverse manifestations.Our study being a retrospective analysis and concentrating on haematological manifestations has a limitation of not considering clinical manifestations .

CONCLUSION

Our study describes the various laboratory manifestation of three common types of infection in malaria. Thus by being more alert and knowing the different presentations and lab features of this common disease early diagnosis can be made which in turn would help us for better treatment thus reducing the morbidity and mortality associated with it.We studied 103 patients of malaria among this age group of 15-30 is most commonly affected. Malaria is most common during the month of July 20 cases (19.4%) and August 19 cases (18.43%). Among 103 patients of malaria in which 61 (59.1%) had Plasmodium vivax, 23 (22.3%) had Plasmodium Falciparum and 19(18.4%) had mixed infection. Complications of Plasmodium falciparum – Anaemia 16 (15.53%) cases, pancytopenia 6 (5.82%), raised creatinine 4 (3.88%), severe thrombocytopenia 4 (3.88%) and altered LFT in 5 (4.85%). Complications of Plasmodium vivax - Anaemia 37 (35.92%) cases, pancytopenia 5 (4.85%), raised creatinine 16 (15.52%), severe thrombocytopenia 3 (2.91%) and altered LFT in 10 (9.7%). In vivax and falciparum mixed infection – Anaemia 12(11.65%) cases, pancytopenia 6(5.82%), raised creatinine 2 (1.94%), severe thrombocytopenia 7 (6.97%) and altered LFT in 6 (5.82%). 13 (12.62%) patients had Hb <6g/dl. 7.76% of Plasmodium vivax, 1.94% of Plasmodium falciparum and 2.91% mixed infection.

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