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Original Research Article.

Study of Hematological Parameters in Plasmodium Falciparum Malaria in Tertiary Care Hospital

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ABSTRACT

Background: Malaria still continue to be a major killer of mankind especially in developing countries. Almost all deaths and severe disease are due to plasmodium falciparum. It is observed that the patients of falciparum malaria with liver, renal and hematological abnormalities are more vulnerable to development of complications like cerebral malaria, anaemia, acute respiratory distress syndrome etc.

Methods: 50 cases of plasmodium falciparum malaria diagnosed by peripheral smear examination or by immunochromatographic tests were included in the study. All these patients are subjected to blood investigations.

Results: 68% patients were males with sex ratio M:F was 2.12: 1. Majority of patients (26%) belong to age group of 21-30 years. Most common presentation was fever in 100% of patients, followed by headache in 48% of patients, vomiting in 46% of patients. 18% and 14% patients having haemoglobin between ≤7 and 7-9 mg% respectively with mean haemoglobin was 09.69+-2.95mg% with range of 2.5-15 mg%.58% patients having WBC count between 4000 – 11000/mm^3 with mean was 7074 +/-4049.48/mm^3 with range of 1200-17800/mm^3. 28% patients were seen having platelet count between 50001 – 75000/dl and 75001-150000/dl and only 8% patients were having platelet count ≤25000/dl. Mean RBSL level was 98.3+/-23.47 mg % with range of 54 – 190 mg%. 08% patients were having RBSL less than 60mg%. Only 4%patients were showing derranged bleeding, clotting time and PT-INR .But none of patients showing bleeding diathesis. P Falciparum malaria with renal and liver dysfunction mostly associated with coagulation abnormality with or without bleeding diathesis having bad prognosis.

Keywords: Plasmodium Falciparum, Cerebral Malaria, Coagulation Abnormality.

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INTRODUCTION

Malaria is an Italian word composed of *"*mala*"* and *"*aria,*"* derived from malus (bad), and aeris (air).[1]

Several species affect humans, leading to different patterns of the disease. The most important are Plasmodium falciparum, which causes falciparum malaria, P. malariae, which causes Quartan malaria, and P. vivax *and* P. ovale, which cause tertian malaria. Genetic interspecies differences explain the variance in the clinical syndromes caused by these sporozoans. These include the rate of multiplication, expression of different antigenic and ligand proteins on the host's parasitized cells, influence of host factors on the parasite's antigenic variability, and others. A striking expression of this divergence is the ability of different strains to invade human red cells of different ages. Thus, P. vivax *and P.* ovale infect only young red cells, whereas P. malariae infects only aging cells. P. falciparum invades erythrocytes at any age, which explains the heavy parasitemia associated with this species. In contrast, erythrocytes with haemoglobin S typically are resistant to this species.[2] Malaria is widely spread throughout the world and affects close to 400 million people, most of whom live in Africa, India, Southeast Asia, and Latin America. With the increasing immigration of natives from those regions to Europe and North America, "imported malaria" imposed itself on the list of differential diagnosis of many medical conditions in the West as recurrent fever, jaundice, hemolytic anemia, acute renal failure (ARF), systemic inflammatory response (SIR) syndrome, and posttransplantation pyrexia.[1,3]

A study based on 31 American soldiers in Vietnam with chloroquine-resistant falciparum malaria noted that the patients with more severe thrombocytopenia also had DIC and that there was correlation between platelet count and C3 protein levels. However, the reduction in C3 was proportional to that in parasitaemia, suggesting that thrombocytopenia was not independently associated with C3. In Manaus 2004, a study with falciparum and vivax patients demonstrated a negative correlation between platelet counts, thrombin-anti-thrombin complex and D-dimers, suggesting that the activation of coagulation could be partially responsible for thrombocytopenia.[4]

MATERIAL AND METHODS

The present study was carried out in department of medicine at tertiary care hospital for three year. Patients selected those who got admitted in department of medicine at tertiary care hospital with either peripheral smear or RMT positive for plasmodium falciparum. Patients with past history of alcoholism, jaundice, chronic renal failure, bleeding diathesis or coagulopathy were excluded. Patients with mixed malaria, plasmodium falciparum and other malarial parasites infection i.e. P Vivax, P Ovale, P. Malariae were excluded from studies. Aim of our study is to study Hematological Parameters in Plasmodium falciparum Malaria.

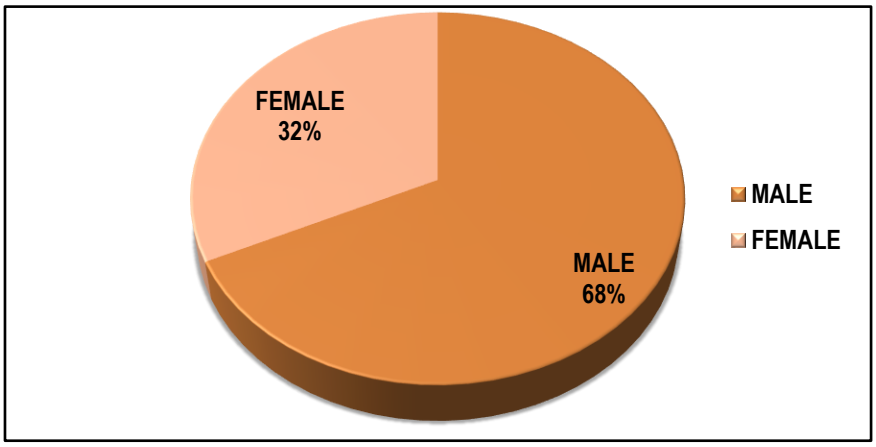

Fig. 1: Sex distribution

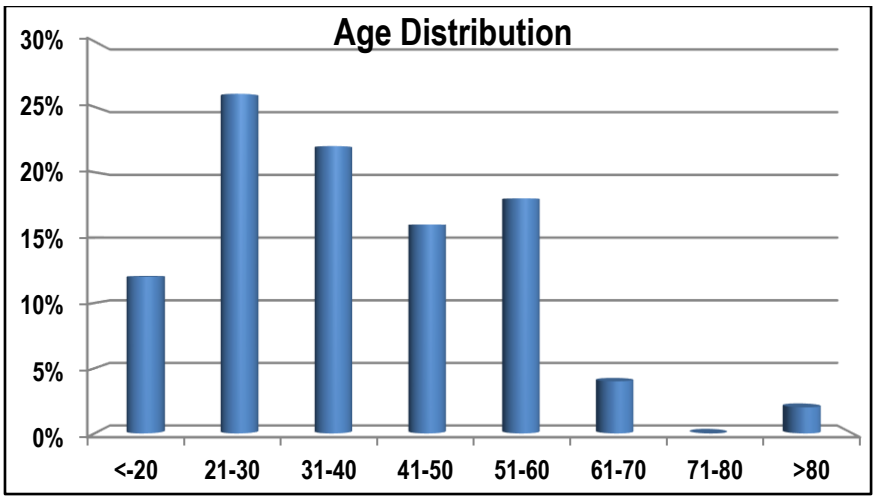

Fig 2: Age distribution

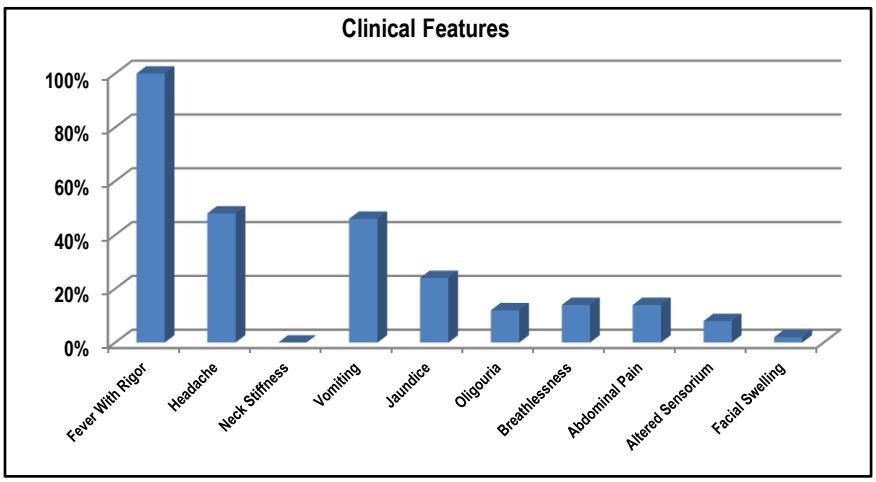

Fig 3: Clinical features in P Falciparum malaria patients.

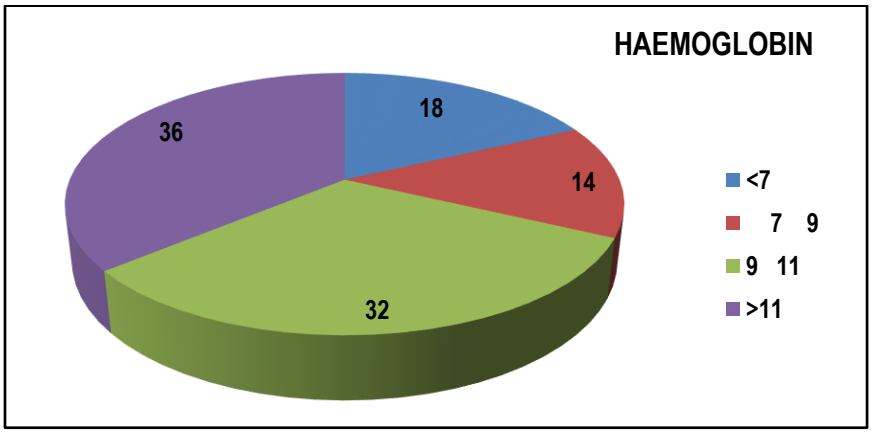

Fig 4: Haemoglobin

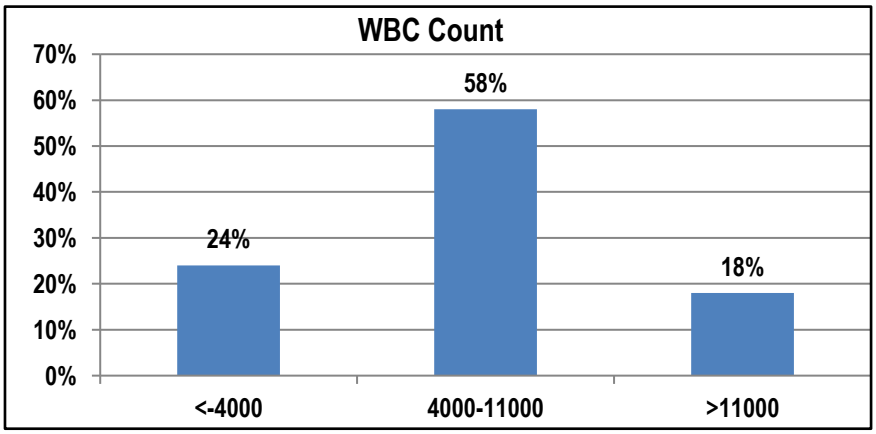

Fig 5: WBC Count

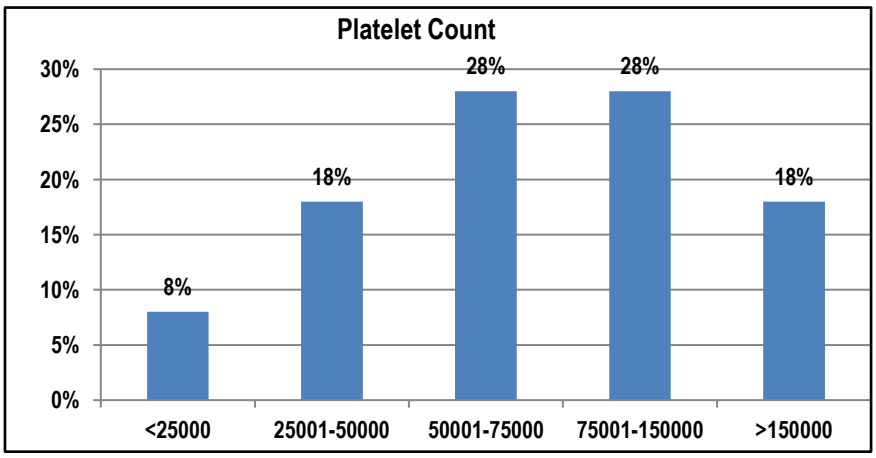

Fig 6: Platelet count

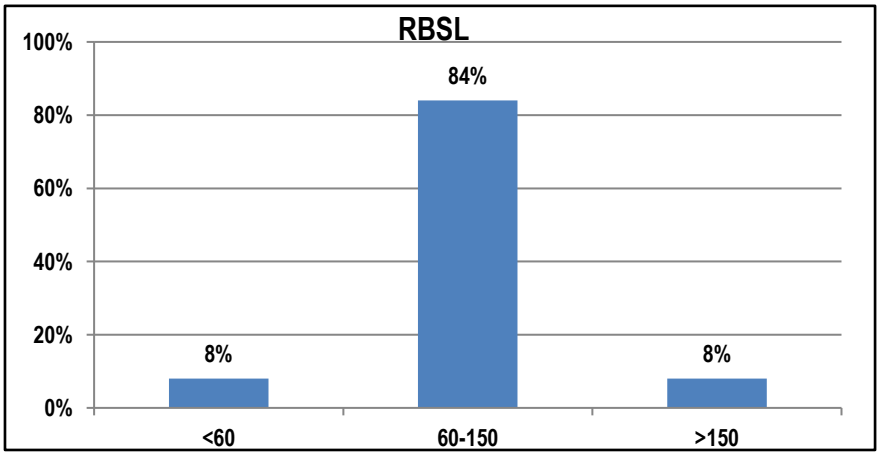

Fig 7: Random blood sugar

Table 1: Comparisons of sex distribution in various studies

STUDY	Males N (%)	Female N (%)	Total	M:F ratio
Manan et al (2006) [5]	36(78.26%)	10(21.74%)	46	3.6
Abro et al (2009) [6]	94(91.5%)	9(8.5%)	103	10.44
Singh et al (2010) [7]	56(68.29%)	26(31.71%)	82	2.15
Present study(2013)	34(68%)	16(32%)	50	2.12

Table 2: Comparison of age distribution in various studies

Study	Age range (years)	Mean±SD (years)
Manan et al (2006) [5]	16-65	32+/- 12.61
Ahsan et al (2008) [8]	14-70	33.74+/-14.89
Abro et al (2009) [6]	14 -68	31+/- 9.39
Singh et al (2010) [7]	16-57	28+/-7.23
Present study (2013)	13-85	38+/- 16.74

Table 3: Comparison of Clinical features in various studies

STUDY	Manan et al (2006)[5]	Rasheed et al (2009)[9]	Present study (2013)
Fever With Rigor	43(93.48%)	99.04%	50(100%)
Headache	Not Specified	73.63%	24(48%)
Vomiting	Not Specified	52.73%	23(46%)
Neck Stiffness	Not Specified	Not Specified	0(0%)
Jaundice	33(71.73%)	Not Specified	12(24%)
Oliguria	35(76.09%)	Not Specified	6(12%)
Breathlessness	Not Specified	Not Specified	7(14%)
Bleeding Diathesis	Not Specified	Not Specified	0(0%)
Altered Sensorium	29(63.04%)	Not Specified	4(8%)
Abdominal Pain	Not Specified	11.58%	7(14%)
Facial Swelling	Not Specified	Not Specified	1(2%)

Table 4: Comparison of haemoglobin in various studies

STUDY	RANGE (gm/dl)	MEAN+/- SD
Rasheed et al(2009) [9]	5.8-18	12.43±2.24
Ansari et al (2009)[10]	Not Specified	12.7 ±1.4
Hussine et al (2012)[11]	6.7-13.5	9.58 ± 0.2
Present study (2013)	2.5-15	09.69±2.95

Table 5: Comparison of leucocyte count in various studies.

STUDY	RANGE (-/mm^3)	MEAN ± SD(-/mm^3)
Rasheed el al (2009)[9]	1700-11500	5900± 1690
Ansari et al (2009)[10]	NOT SPECIFIED	12600±450
Present study (2013)	1200-17800	7074±4049.48

Table 6: Comparison of platelet count in various studies.

STUDY	>25000	25000-50000	50000-75000	75000-150000	>150000
Khan et al (2012)[12]	-	22(18%)	30(25%)	30(25%)	-
Present study (2013)	4(8%)	9(18%)	14(28%)	14(28%)	9(18%)

Table 7: Platelet count in Asari et al study

STUDY	<20000	20000-50000	>50000 but <150000
ANSARI et al[10]	39 (10.5%)	180 (48.6%)	37 (10%)

Table 8: Comparison of random blood sugar level in various studies.

STUDY	RANGE	MEAN ±SD
Rasheed et al (2011)[16]	54.54- 189	98.17±23.96
Hussain et al (2012)[18]	55-145	87.57±3.2
Present study (2013)	54 - 190	98.30 ± 23.47

OBSERVATION AND DISCUSSION

Present study (2013) comprised of 50 patients with P Falciparum malaria, of which 34 are males and 16 are females with M:F ratio 2.12.Similarly, in Manan et al (2006)[5] studied 46 patients with P Falciparum malaria out of that 36 were males and 10 were females with M:F ratio 3.6 ; Abro et al (2009)[6] studied 103 patients with P Falciparum malaria out of that 94 were males and 9 were females with M:F ratio 10.44; Singh et al (2010)[7] studied 82 patients with P Falciparum malaria out of that 56 were males and 26 were females with M:F ratio 2.15. M: F ratio of present study (2013) i.e 2.12 correlates with Singh et al study (2010)[7] (M:F ratio=2.15). It was lower than Abro et al (2009)[6] ie 10.44 and Manan et al (2006)[5] i.e 3.6.

In Present study (2013), age range between 13-85 years with mean ± SD is 38 ± 16.74 years. Similarly, Manan et al (2006)[5] study mean age ± SD was 32 ± 12.61 years and age range between 16-65 years. Ahsan et al (2008)[8] study range age between 14-70 years with mean ± SD was 33.74±14.89 years, Abro et al (2009)[6] study age range between 14- 68 years with mean ± SD was 31±9.39 years, Singh et al (2010)[7] study age range between 16-57 years with mean ±SD was 28 ±7.23 years. Age range and mean ±SD of present study (2013) i.e 13-85 years and 38±16.74 years respectively was higher than Manan et al (2006)[5] (age range 16-65 years, mean ± SD 32± 12.61 years) and Ahsan et al (2008)[8] (age range 14-70 years, mean ±SD 33.74±14.89 years). It was also low in Abro et al (2009)[6] (age range 14 -68 years and mean ± SD was 31± 9.39 years) and Singh et al (2010)[7] (age range 16-57 years and mean ± SD 28+/- 7.23 years.)

Present study (2013) of P Falciparum malaria showing most common clinical symptoms of fever with rigor [50(100%)] followed by headache[24(48%)] and vomiting [23(46%)]. Manan et al (2006)[5] studied acute renal failure associated with malaria. Study comprised of 237 patients with acute renal failure (ARF) of which 46(19.4%) had malarial acute renal failure. Plasmodium Falciparum was responsible for all cases of malarial ARF. Fever was the leading symptom. 43(93.48%) patients were febrile at the time of admission while the remaining 03(6.52%) had a history of fever in the preceding one week. Oliguria (76.09%), jaundice (71.73%), hepatomegaly (67.39%), and impaired consciousness (63.04%), were the most common presenting abnormalities. Although impaired consciousness was present in 29 patients, only 09 fulfill the WHO criteria for cerebral malaria. Rasheed et al (2009)[9] studied 311 patients of P Falciparum showing most common clinical symptoms of fever with rigor (99.04%) followed by headache (73.63%) and vomiting (52.73%).Present study (2013) correlates with Rasheed et al(2009)[9] showing most common clinical symptoms of fever with rigor followed by headache and vomiting. Present study(2013) of P Falciparum malaria having haemoglobin range between 2.5 – 15 gm/l with mean ±SD of 9.69± 2.95gm/l. 64% patients having haemoglobin less than 11 and 32% patients having haemoglobin 9-11 gm%. Rasheed et al (2009)[9] study comprised of 311 patients with P Falciparum malaria showed haemoglobin ranged between 5.8 – 18 gm/l with mean±SD of 12.43 ± 2.23 gm/l. Anaemia was observed in 54.5% patients. Ansari et al (2009)[10] studied malarial association with reduced blood cell counts & mild to moderate thrombocytopenia. Study comprised of 370 patients of P Falciparum with mean ±SD of haemoglobin was 12.7±1.4g%. Haemoglobin less than 10 was seen in 76 patients (out of 256) showing thrombocytopenia and 104 patients (out of 114) showing non thrombocytopenia. Hussein et al (2012)[11] study comprised of 42 patients with P Falciparum malaria with haemoglobin range between 6.7 – 13.5 gm/l with mean ± SD of 9.58±0.2 gm/l. Present study (2013) having haemoglobin range between 2.5 – 15 gm/l with mean±SD of 9.69±2.95gm/l correlates with Hussain et al (2012)[11] having haemoglobin concentration range between 6.7 – 13.5 gm% with mean ± SD of 9.58±0.2 gm%.

In present study (2013) WBC count range between 1200-17800/mm^3 with mean± SD was 7074±4049.48/mm^3. 24% patients were having WBC counts less than 4000/mm^3. Rasheed et al*(2009)*[9] study comprised of 311 patients with P Falciparum malaria showed WBC count range between 1700 – 11500/ mm^3 with mean ±SD was 5900±1690/mm^3. Leucopenia (less than 4000) was seen 22.1% patients. Ansari et al (2009)[10] studied malarial association with reduced blood cell counts & mild to moderate thrombocytopenia. He found WBC count more than 11000 in 180 patients (out of 256) of thrombocytopenia and 10 (out of 114) of non-thrombocytopenic patients. Mean±SD was 12600±450/ mm^3. Present study (2013) i.e 7074±4049.48/mm^3 has higher mean±SD concentration than Rasheed el al(2009)[9] i.e 5900±1690 mm^3 but lower than Ansari et al(2009)[10] i.e 12600±450/ mm^3.

In present study (2013)**,** maximum patients i.e 14(28%) having platelet count between 50000-75000/dl and 75000- 150000/dl each. Mean ± SD was 94872 ± 71425.22/dl and range of 2000 – 310000 /dl. Khan et al (2012)[12] study comprised of total 228 patients with thrombocytopenia, 121 patients (53%) proved to be suffering from malaria. Of them 82 patients (68%) had falciparum malaria while 39 patients (32%) had vivax infection. In these 121 patients, platelet counts ranged between 25,000 to 150,000/dL with a mean value of 101,000/dL and median of 75,000/dL. Patients with P Falciparum showed maximum number of patients having platelet count between 50000 – 75000/dl and 75000 – 150000/dl i.e 30(25%) each. Ansari et al(2009)[10] studied malarial association with reduced blood cell counts & mild to moderate thrombocytopenia. He classified according to the degree of thrombocytopenia into 3 group mild, moderate and severe i.e <20000/dl, 20000-50000/dl and >50000 but <150000/dl. The mild, moderate and severe thrombocytopenia were found in 39 (10.5%), 180 (48.6%) and 37 (10%) respectively. The mean platelet count was 170,000±56,500/µL (range 18000- 380.0000/µL). Present study (2013) correlates with Khan et al (2012)[12] study having maximum number of patients having platelet concentration between 25000-50000 and 50000 – 75000 /dl each.

Present study (2013) comprised of 50 patients with P Falciparum malaria with blood sugar level (BSL) range between 64 – 190 mg% with mean±SD was 98.3 ±23.47 mg%. 4(8%) patients were having BSL less than 60mg%. Rasheed et al(2011)[9] study comprised of 311 patients with P Falciparum malaria having BSL ranged between 54.54 – 189 mg% with mean ±SD was 98.17 ± 23.96 mg%. Hussain et al(2012)[11] study comprised of 42 patients with P Falciparum malaria having BSL ranged between 55 – 145 mg% with mean±SD was 87.57 ±3.2 mg%. Present study (2013) correlates with Rasheed et al (2011)[9] in terms of mean±SD of BSL (98.17±23.96 mg%) .

Present study (2013) also showed 2 patients with coagulation abnormality and none of them showed bleeding diathesis. Kausal

et al (2010)[13] study comprised of 48 patients with P Falciparum malaria, 4 patients had deranged coagulation profile but none of them showed any bleeding diathesis. Present study (2013) and Kausel et al(2010)[13] study both of them showed coagulation abnormality without any bleeding diathesis.

CONCLUSION

Most common symptoms of P Falciparum malaria is fever with rigor. Anaemia and thrombocytopenia are most common in P Falciparum malaria. .P Falciparum malaria associated with coagulation abnormality with or without bleeding diathesis having bad prognosis.

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