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Original Research Article

Role of Liver Enzymes in Patients Infected with *Plasmodium vivax* and *Plasmodium falciparum*

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ABSTRACT

Background: Malaria is a mosquito born disease caused by protozoa belonging to family Plasmodium. The disease still causing high morbidity and mortality and poses a threat to the health of residents and travellers in tropical countries. According to the world health organization (WHO), liver participate in *Plasmodium falciparum* malaria is not an uncommon feature and presence of jaundice (bilirubin ≥ 3 mg/dl) is one of the suggestive markers of malaria. Participation of liver in malaria is a common mechanism and may leads to jaundice, hepatomegaly and elevated liver enzymes like aspartate and alanine transferase. **Materials and Methods:** This was a retrospective and hospital-based study, which was carried out at Department of Microbiology and Central Hospital Laboratory, MGM Medical College and Hospital, Navi Mumbai. Total 120 malaria positive (80 *P. vivax*, 40 *P. falciparum*) samples were included in this study. **Results:** Out of 120 malaria positive samples 90 (75%) were diagnosed with abnormal value of liver function test, while 30 were showing normal value. Abnormal value found in *P. vivax* i.e. total bilirubin, SGOT, SGPT and ALP were 48.75%, 68.75%, 56.25% and 33.75% respectively. Abnormal value found in *P. falciparum* i.e. total bilirubin, SGOT, SGPT and ALP were 42.5%, 68.75%, 56.25% and 33.75% respectively. **Conclusion:** Our study showed that dysfunction of liver due to malarial parasites may lead from mild elevation of liver enzymes and serum bilirubin (≥3 mg/dl) to acute hepatitis. The morbidity and mortality rate due hepatic dysfunction is more common in *P. falciparum* malaria than *P. vivax* malaria.

INTRODUCTION

Malaria is a mosquito born parasitic disease caused by parasitic protozoan which belongs to the family Plasmodium. Female anopheles mosquito is responsible for spreading malaria among human. After the mosquito bites parasites are transferred from its saliva into the blood of person [1]. Five species of Plasmodium are responsible for causing malaria in human; these are Plamodium vivax, Plasmodium falciparum, Plasmodium ovale, Plasmodium malariae and Plasmodium knowlesi [2]. Malaria is a major health problem in developing countries accounting for 2-3 million deaths per year. Malaria a tropical protozoan disease transmitted through female Anopheles mosquitoes. It is mainly caused by various species of plasmodium parasite [3]. Four species of intracellular protozoa of the genus Plasmodium cause malaria in humans. They include Plasmodium falciparum, P. vivax, P. ovale, and P. malariae. P. falciparum and P. vivax cause the most serious forms of the disease. [4]. Blood is a tissue that circulates in a virtually closed system of blood vessels. It is composed of solid elements-red, white blood cells, and platelets, suspended liquid medium-plasma. Therefore, the plasma is an extracellular fluid confined within the vascular system. The water and electrolyte composition of plasma is particularly the same as that of

intracellular fluid, made up of water, electrolytes, metabolites, nutrients, proteins and hormones. [5] Physicochemical properties of the blood are constant but may undergo slight variations under normal physiologic conditions. However, the relative constancy in the internal environment of the blood system exhibits wide and profound perturbation and distortions under clinically defined patho-physiologic states. Some of these conditions include malignancy, genetic defects, malnutrition, parasitic infections etc. Studies have revealed that haematologic and biochemical alterations occur in malaria infected blood and there are common complications associated with this disease. Haematologic alterations that are associated with malaria infection include anaemia, thrombocytopenia, and disseminated intravascular [6-11]. Alterations in physicochemical parameters of P. falciparum infested blood may vary with level of malaria endemicity, presence of haemoglobinopathies, nutritional status, demographic factors and level of malaria immunity [12-13]. Therefore, well-informed alterations in blood parameters in malaria infection enable the clinician to establish reliable diagnosis and therapeutic interventions.

Malaria pathogenesis is based mainly on extensive changes in biochemical and haematological parameters. [14] The World health Organization (WHO) criteria acknowledged that some biochemical and haematological features should raise the suspicion of severe malaria [15]. Therefore, the present study was undertaken to determine the profile of liver function tests and renal function tests in Plasmodium falciparum and Plasmodium vivax infected malaria.

MATERIALS AND METHODS

This retrospective study was carried out at Department of Microbiology and Central Biochemistry laboratory, MGM Medical College and Hospital, Navi Mumbai, India, over a period of one year six months from July 2013 to December 2014. Total 120 samples were taken confirmed malaria patient (40 Plasmodium falciparum and 80 Plasmodium vivax) after confirm by microscopic examination and rapid malarial antigen test.

Sample collection:

The patient's name, age, sex, details of history and clinical examination findings were recorded in requisition form. After obtaining informed consent, 5 ml blood was collected in EDTA Vaccutainer tube (2.5 ml) and Plain tube (2.5 ml) from each patient using sterile precaution. Thick and thin smear was prepared. Thick smears were dehaemoglobinized and stained with Leishman's stain and focused under 100x oil emersion lens.

Biochemical tests

Patient's blood samples were collected in plain tube and keep it for 5-10 minutes for clotting once the blood samples become clot, centrifuged the blood samples using Laboratory centrifuge R-4C (REMI, India), serum was separated and proceed for the tests. Liver function test and renal function test was done using Beckman Coulter-Au480 (USA) by trained technicians under the supervision of Senior Biochemist.

RESULTS

The present study was undertaken to study the effect of malaria on biochemical liver function parameter and renal function. Total 120 malaria positive samples were included in this study (40 P. falciparum and 80 P. vivax).

In our study T. Bilirubin, I. Bilirubin, SGOT, SGPT, are statistically significant difference seen in Plasmodium vivax and Plasmodium falciparum. Plasmodium falciparum affect more than Plasmodium vivax.

Out of 120 malaria positive samples, 90 (75%) were reported with abnormal liver function test while rest 30 (25%) were having normal liver function test. Out of 70 abnormal LFT samples 51 (69.86%) were male and 39 (82.98%) were female. (Table 1).

It was found that out of 80 cases of Plasmodium vivax, 55 (68.75%) patients were having abnormal liver function test and out of 40 cases of Plasmodium falciparum, 35 (87.5%) cases were having abnormal liver function test (Table 2).

In our study, out of 120 malaria positive samples 56 (46.67%) samples showed abnormal value of Total bilirubin, 90 (75%) samples showed abnormal value of SGOT, 78 (65%) samples showed abnormal value of SGPT while abnormal value of ALP is showed by 52 (43.33%) samples. Out of 56 abnormal value of Total Bilirubin 39 (48.75%)

cases were of Plasmodium vivax and 17 (42.5%) cases were of Plasmodium falciparum. Out of 90 abnormal value of SGOT 55 (68.75%) cases were of Plasmodium vivax and 35 (87.5%) cases were of Plasmodium falciparum. Out of 78 abnormal value of SGPT 45 (56.25%) cases were of Plasmodium vivax and 33 (82.5%) cases were of Plasmodium falciparum. It was also observed that out of 52 abnormal value of ALP 27 (33.75%) cases were of Plasmodium vivax and 25 (62.5%) cases were of Plasmodium falciparum (Table 3).

Mean values and standard deviation of Total bilirubin, SGOT, SGPT, ALP patients affected with Plasmodium vivax were 4.3± 3.03, 86.5± 50.45, 80.23 ± 46.88 and 110.84 ± 76.23 respectively while mean values and standard deviation of liver markers. While in Plasmodium falciparum Total bilirubin, SGOT, SGPT and ALP were 8.34± 4.03, 120.32± 70.26, 105.26± 43.41 and 180.60 ± 132.45 respectively (Table 4).

DISCUSSION

The present retrospective study was conducted at Microbiology Department and Central Biochemistry laboratory over a period of one year from January 2014 to December 2014, for to study the alteration in biochemical parameters during malaria by Plasmodium vivax and Plasmodium falciparum.

In this study we included total 60 confirmed malaria positive samples, out of which 30 samples were Plasmodium falciparumand 30 samples were Plasmodium vivax.

In our study we found statistically significant difference between Plasmodium vivax and falciparum species effects on liver function tests and renal function tests. [Table 1]

Our study showed that the malarial infection affects more biochemical parameters in Plasmodium falciparum than Plasmodium vivax.

Elnoman Elbadawi NE et al. [16] reported higher level of AST, ALT, total bilirubin and indirect bilirubin, while the level of total protein, albumin and globulin was significantly dropped. A significant positive correlation using Pearson's correlation coefficient, was found between liver enzymes, age, hemoglobin, bilirubin level ($p<0.005$); a negative insignificant correlation with albumin and total protein $p>0.005$. Godse RR [17] reported that there was significant increase in the level of SGOT, SGPT, ALP and bilirubin. Chikezie Paul Chidoka et al. [18] they reported serum albumin decreases in malarious subjects whereas serum creatinine concentrations of malarious subjects were increases. Subjects with moderate malaria infection showed symptoms of anaemia, alterations in nitrogen and carbohydrate metabolism and exemplified by raised serum level of urea. Adeosun, O. G. et al. [19] they reported that the urea, creatinine and bilirubin levels were significantly elevated in the acute falciparum malarious children than in the non-parasitaemic controls. Acute falciparum malaria resulted in significant reduction of total protein, albumin and glucose levels in the malarious children. [19]

CONCLUSION

Our study concluded that malaria has a significant impact on liver function test therefore it must be correlates with other malarial diagnosis in case of acute febrile patients with more abnormalities including spleenomegaly and hepatomegaly. Our study showed that the dysfunction of liver is more common in falciparum malaria than vivax malaria.

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Table-1: Sex wise distribution of total malaria positive patients

Sex	Malaria Positive	%	Liver Function Test			
			Normal value	%	Abnormal value	%
Male	73	60.83%	22	30.14%	51	69.86%
Female	47	39.17%	8	17.02%	39	82.98%
Total	120	100%	30	25%	90	75%

Table-2: Species wise distribution with deranged and normal LFT of total malaria positive cases

Species	Patient	%	Normal value	%	Abnormal value	%
P. vivax	80	66.67%	25	31.25%	55	68.75%
P. falciparum	40	33.33%	5	12.5%	35	87.5%
Total	120	100%	30	25%	90	75%

Table 3: Showing abnormal value of liver function test in patients infected with *Plasmodium vivax* and *Plasmodium falciparum*.

Tests	*P. vivax*		*P. falciparum*		Total	
	(n=80)	%	(n=40)	%	(n=120)	%
T. Bilirubin	39	48.75%	17	42.5%	56	46.67%
SGOT	55	68.75%	35	87.5%	90	75%
SGPT	45	56.25%	33	82.5%	78	65%
ALP	27	33.75%	25	62.5%	52	43.33%

Table-4: Showing LFT parameters in *Plasmodium vivax* and *Plasmodium falciparum*.

Tests	Normal Range	MEAN ± SD	
		P. vivax	*P. falciparum*
Total Bilirubin	0.3 – 1.2 mg/dl	4.3± 3.03	8.34± 4.03
SGOT	Upto 35 IU/L	86.5± 50.45	120.32± 70.26
SGPT	Upto 35 IU/L	80.23 ± 46.88	105.26± 43.41
ALP	50-126 IU/L	110.84 ± 76.23	180.60 ± 132.45

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