International Journal of Biomedical And Advance Research

ISSN: 2229-3809 (Online)
Journal DOI:10.7439/ijbar
CODEN:IJBABN

Research Article

Assessment of serum bilirubin and hepatic enzymes in malaria patients

Sudha Jha[*1], Shailaza Shrestha[1], Sheetal G. Gole[2] and Gagan Deep[3]

[1]*Department of Biochemistry, Goldfield Institute of Medical Sciences & Research, Chhainsa, Ballabhgarh, Faridabad-121004 (Haryana), India*
[2]*Department of Pathology, Goldfield Institute of Medical Sciences & Research, Chhainsa, Ballabhgarh ,Faridabad-121004 (Haryana), India*
[3]*Department of Medicine, Goldfield Institute of Medical Sciences & Research, Chhainsa, Ballabhgarh ,Faridabad-121004 (Haryana), India*

***Correspondence Info:**
Dr. Sudha Jha
Department of Biochemistry
Goldfield Institute of Medical Sciences & Research
Chhainsa, Ballabhgarh, Faridabad-121004 (Haryana)
E-mail: sudha.j78@gmail.com

Abstract

Objectives:-The present study was conducted on malaria patients to observe the correlation between liver enzymes (SGOT, SGPT & ALP) and bilirubin.

Material & Methods:-The study population contained 100 subjects divided into two groups, 60 malaria patients and 40 healthy control subjects of varying age groups and both sex. All biochemical parameters Total bilirubin, Direct bilirubin, Indirect bilirubin, SGOT (aspartate transaminase), SGPT (alanine transaminase) & ALP (alkaline phosphatise) were analyzed by semiautoanalyser. Statistical analysis was done by, science (SPSS 16) Software

Results: - In our study we have found that (Mean ± SD) of Total serum bilirubin in malaria patients were 1.63±2.27 & controls were 0.67±0.08, Direct bilirubin in malarial patients were 0.92±1,3 & control were 0.37±0.07, Indirect bilirubin in malarial patients was 0.68±0.95. We observed that (Mean ±SD) of SGOT in malaria patients was 48.29±28.89 & in control were 29.28±7.44, the level of SGPT in malarial subjects were 44.9±27.15 & control subjects were 29.98±7.77 & the level of ALP in malarial patients were 98.47±60.67 & in control 71.4±25.12. We also found that both aminotransferases (SGOT & SGPT) showed significance positive correlation with serum total bilirubin levels whereas in case of ALP, significance correlation could not be obtained.

Conclusion: Our study indicates that liver enzymes SGOP, SGPT and ALP significantly increases in malaria patients as compared to control subjects Therefore these enzymes may be useful in diagnosis of malaria subjects.

Keywords: Total bilirubin, Metabolic syndrome, Antioxidant

1. Introduction

Malaria is a devastating parasite transmitted by the bite of infected Anpheles mosquitoes[1]. It is responsible for infecting 300-500 million and 1-3 deaths annually[2]. In humans malaria is caused by *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium ovale*, *Plasmodium malariae*, and rarely *Plasmodium Knowlesi*[3]. *Plasmodium vivax* is the most common of the malaria species[1]. Malaria can be transmitted by three known ways; vector transmission, blood transfusion and congenital transmission. The malaria parasite interferes with 3 major organs in the body, namely: the brain, kidney and liver[4].

Malarial transmission to the human host is established by sporizoites infection to the liver. The malarial sporozoite once injected into the blood by the bite of female anopheles mosquitoes is attached to the hepatocytes through the receptor for thrombospondin and properdin. Here these sporozoites become mature to form tissue schizonts or become dormant hypnozoites. Tissue schizoints amplify the infection by producing large number of merozoites[5]. Merozoite infects and ruptures the liver cells in an attempt to escape back into the circulation and continues the infection. The infection of liver cells by the sporozoites form of the malarial parasite can cause organ congestion, sinusoidal blockage and cellular inflammation. These changes in hepatocytes can lead to the leakage of parenchymal (transaminases) and membranous (alkaline phosphatise) enzymes of the liver to the circulation. Hence increase in liver enzymes AST, ALT and ALP observed in malaria infected patients also demonstrated that the serum activities of these liver enzymes increased with the increase in malarial parasite density and confirmed that the hepatic stage of the parasite's life cycle in human host is accompanied by significant perturbation in the hepatocyte's parenchyma and membrane leading to leakage of liver enzymes into the general circulation[6,7]. Jaundice is also one of the common manifestations of severe malaria in adults causing high mortality rate and incidence of jaundice vary from 10-45% in different regions[8].

In India, the epiodemiology of malaria is complex because of geo-economical diversity, multiethnicity and wide distribution of nine anopheline vectors transmitting three Plasmodial species: *P. falciparum*, *P. vivax* and *P. malariae*. *Anopheles culcifacies* is widely distributed and is the principal vector of rural malaria. The proportion of *P. vivax* and *P. falciparum* varies in different parts of India. Mostly indo-gangatic plains and northern hilly states, north-western India and southern Tamil Nadu state have <10% *P. falciparum* and rest are *P. vivax* infections. In the forested area inhabited by the ethnic tribes, the situation is reversed with *P. falciparum* proportion 30-90% whereas in the remaining areas it is between 10-30%. [9,8].

Malaria causes catastrophies such as maternal/infant death and abortion. Pregnant women are also especially vulnerable. Susceptible groups are children and adults who have lost or never acquired immunity. Morbidity and mortality due to malaria have remained unabated primarily as a result of the unavailability of suitable vaccines and the spread and intensification of drug resistant *Plasmodium* parasites. Thus it is

rational to assess the current status of malaria related complications in order to estimate the burden among biologically risked groups, children and endemic areas.

2. Materials and methods

The subjects included in the study were 60 clinically diagnosed patients suffering from malaria of both sex and varying age groups, attending the out-patients department (OPD), emergency ward and from indoor patients, admitted in the ward of department of Medicine Gold Field Institute of Medical Sciences & research Village Chhainsa, Ballabgarh, Faridabad, Haryana. Fourty healthy controls were selected for the study from volunteers such as paramedical staff, healthy relatives / attendants of patients. The patients comprised 42 males and 18 females. The control group comprised of 18 males and 22 females.

Patients selection criteria: Patients whose case history showed a concomitant presentation with the following conditions; pregnancy, renal diseases, liver diseases including cirrhosis, hepatitis, obstructive jaundice, alcoholism, cancer, metabolic bone diseases, gastrointestinal tract infection, protein energy malnutrition, diabetes, heart failure, infectious mononucleosis and magnesium /vitamin D deficiencies, were excluded from the study. This is because these conditions are associated with significant changes in serum alkaline phosphatase, alanine and aspartate transaminases activities. Similarly, patients on self-medication with any antimalarial drug prior to presentation were also excluded from the study. Blood samples were collected by clean veinpuncture and centrifuged. Sera was collected and analysed for serum bilirubin and enzyme activity of ALP, SGOT and SGPT using kit method by erba chem semiautoanalyzer.

2.1 Statistical analysis

Statistical analysis was done, using the statistical package for social science (SPSS 16) for Windows Software. Differences in the parameters between the groups were analyzed by means of the t test. Variables were presented as mean ± standard deviation (S.D.). The accepted level of significance for all statistical analyses used in the study was $P \leq 0.05$.

3. Results

Levels of serum bilirubin and liver enzymes (SGOT, SGPT, and ALP) were increased in the patients with malarial infection as compared to the controls and the increase was statistically highly significant ($p<0.01$). (Table-1)

Table-1: Comparison of serum bilirubin and liver enzymes among controls and malaria patients

Variables	Controls	Malaria patients	p value
Total bilirubin (mg/dl)	0.67±0.08	1.63±2.27	0.001*
Direct bilirubin (mg/dl)	0.37±0.07	0.92±1.3	0.001*
Indirect bilirubin (mg/dl)	0.3±0.02	0.68±0.95	0.001*
SGOT (IU/L)	29.28±7.44	48.29±28.89	<0.0001**
SGPT (IU/L)	29.98±7.77	44.9±27.15	<0.0001**
ALP (IU/L)	71.4±25.12	98.47±60.67	<0.0001**

*→significant, **→highly significant

Significant increase in serum bilirubin & liver enzymes was obtained in malarial female patients as compared to the control (Table 2).

Table 2: Comparison of serum total bilirubin and liver enzymes among female controls and female malarial patients

Parameters	Control	Test	p value
Total bilirubin	0.67±0.07	1.25±0.76	<0.01*
SGOT	29.17±7.67	51.67±23.67	<0.01*
SGPT	29.61±7.58	48.65±22.95	<0.01*
ALP	71.81±19.27	104.87±95.85	<0.01*

*→significant

Significant increase in bilirubin and hepatic enzymes levels was obtained in malarial male patients as compared to the controls (Table 3).

Table 3: Comparison of serum total bilirubin and liver enzymes among male controls and male malarial patients

Parameters	Control	Test	p value
Total bilirubin	0.68±0.09	1.84±2.66	<0.01*
SGOT	29.41±6.93	47.17±30.43	<0.01*
SGPT	30.24±7.84	43.37±28.28	<0.01*
ALP	72.61±31.4	95.17±36.54	<0.01*

*→significant

Significant difference was not obtained in liver function parameters. (Table 4)

Table 4: Comparison of serum total bilirubin and liver enzymes among male and female malarial patients

Parameters	Male	Female	p value
Total bilirubin	1.84±2.66	1.25±0.76	0.19
SGOT	47.17±30.43	51.67±23.67	0.54
SGPT	43.37±28.28	48.65±22.95	0.45
ALP	95.17±36.54	104.87±95.85	0.68

Both aminotransferases (SGOT and SGPT) showed statistically significant positive correlation with serum total bilirubin levels whereas in case of ALP, significant correlation could not be obtained. (Table 5)

Table 5: Pearson correlation coefficient among bilirubin and liver enzymes

Enzymes	Bilirubin	p value
SGOT	0.642*	<0.001**
SGPT	0.673*	<0.001**
ALP	0.037	0.39

**→highly significant

4. Discussion

Investigations into the effects of *Plasmodium* parasites on the levels of serum enzymes have gained recognition as an important area of research in the pathogenesis of malaria. Malaria involves the liver where infective sporozoites invade and multiply in the hepatocytes and in the erythrocyte stage the merozoites cause the destruction of infected red blood cells[10]. Malyneux *et al* suggested that jaundice, which may be deep, is usually accompanied by only moderate elevation of hepatic enzymes and results more from hemolysis than from hepatic damage[11]. The role of liver injury or hepatocellular damage in the malarial patients has been proposed by many workers especially in the Indian subcontinent. Raised serum bilirubins, hepatomegaly along with increase in liver enzyms are important denominator of liver injury in these patients[12].

In our study, level of serum total bilirubin ranged from 0.5-15.2 mg/dl. Mean serum total bilirubin was significantly higher as compared to controls ($p<0.01$). Out of 60 malarial patients, 23.3% had increased serum total bilirubin level. Of these 78.6% patients had mild jaundice (2-5 mg/dl), 14.3% had moderate jaundice (5-10 mg/dl) and 7.1% had severe jaundice (>10mg/dl). Our finding was in accordance with Kocher *et al* who showed that 70.6% of children suffering from malaria (p. vivax) had mild jaundice where moderate and severe jaundice was present in 23.5% and 5.9% of the children respectively[13]. Patwari *et al* observed jaundice in only 8.7% on p. vivax malarial cases[14].

We observed statistically significant increase in levels of enzymes SGOT, SGPT and ALP in malarial patients ($p<0.001$) as compared to controls. These enzyme activities were also significantly higher in test males and test females as compared to their respective controls ($p<0.01$). But we could not find the significant difference in the mean enzyme activities in both male and female malarial patients ($p>0.05$). Our finding was supported by that of Jigam AA *et al*. According to them transaminases and ALP activities were significantly higher in patient groups but when com ($p<0.05$)[15]. Mohmad Ali *et al* showed increased activities of SGOT, LDH, ALP and CPK in patients with P. vivax malaria where in cases of *P. falciparum* malaria, enzymes ALP, SGOT and CPK activities decreased and LDH activity increased significantly[1]. The increase in serum levels of hepatic enzymes; transaminases and alkaline phosphatise are the markers of liver damage. SGPT is a specific enzyme of liver. In this study we found that serum SGOT, SGPT and Alp levels were increased in 53%, 50% and 11.7% of the malarial patients. The mean level of AST was higher than that of ALS. It was similar to the findings of Kocher *et al*[13]. Study of Noppadon *et al* showed that AST levels were increased in 26% of *P vivax* infection, 31% of *P. malariae* infection and 40% of *P. ovale* infection. Similarly, increased ALT levels was observed in 21% *P vivax*, 30% *P. malariae* and 40% of *P. ovale* infections.ALP was increased in 20%, 22% and 20% of *P. vivax, malariae* and *ovale* infections respectively[16].

Both the aminotransferases (AST, ALT) showed statistically significant positive correlation with bilirubin ($p<0.001$) whereas it was not significant in case of ALP ($p>0.05$). Kauser MW *et al*, in their study obtained significant positive correlation of serum transaminases and ALP with serum bilirubin (2). Kocher *et al* also showed an excellent positive correlation of SGOT with bilirubin ($p<0.01$)[13].

5. Conclusion

Malaria is a disease whose pathogenesis is not clearly defined as it is species-specific and of geographical variability. Thus the assessment of bilirubin and liver enzymes (like SGPT, SGOT and ALP) in malaria patients could represent additional and useful parameters in determining the clinical and prognostic aspects of the disease.

References

1. World Health Organization. Communicable diseases. WHO Malaria facts and figures. World Health Organization, Europe. 2011.
2. Casals PC and Roberts D.*et al* Malaria and the red cell. *Vox Songuinis* 2004; 87(2): 115-119.
3. I Mueller, PA Zimmerman, JC Reeder, *Trends Parasitol.* 2007, 23 (6) 278 – 283.
4. I. Onyesom and N. Onyemakonor, Levels of Parasitaemia and Changes in Some Liver Enzymes among Malarial Infected Patients in Edo-Delta Region of Nigeria. *Current Research Journal of Biological Sciences* 2011; 3(2): 78-81.
5. Kausar MW, Moeed K, Asif A, Rizwi F and Raza S. Correlation of Bilirubin with Liver Enzymes in Patients of Falciparum Malaria. *International Journal of Pathology* 2010; 8(2): 63-67.
6. Onyesom, I, Activities of some liver enzymes in serum of *P. falciparum* malarial infected humans receiving artemisinin and non-artemisinin-based combination therap. *Annals of Biological Research* 2012; 3 (7):3097-3100.
7. C Burtis, E Ashwood, B Border: Liver functions. In: Tietz Fundamentals of Clinical Chemistry, 5th (ed.), Saunders Company, Philadelphia, 2001; pp 748-770.
8. Trang TT, Phu NH, Vinh H, Hien TT, Cuong BM, Chau TT *et al*. Acute renal failure in patients with severe *falciparum* malaria. *Clin Inf Dis* 1992; *15:* 874–80.
9. Kumar A, Valecha N, Jain T and Dash AP. Burden of malaria in India: Retrospective and Prospective view. *Am. J Trop. Med. Hyg*; 2007; 77(suppl 6); pp 60-78.
10. Miller LH, Baruch DI, Marsh K and Doumbo OK *et al*. The pathogenic basis of malaria. *Nature* 2002; 415: 673-679.
11. Molyneux ME, Looareesuwan S, Menziee IS and Grainger SL *et al*. Reduced hepatic blood flow and intestinal malabsorption in severe *falciparum* malaria. *Am J Trop Med Hyg* 1989; 4- (5):470-476.
12. Kochar DK, Kaswan K, Kochar SK, Sirohi P, Pal M, Kochar A, *et al*. A comparative study of regression of jaundice in patients of malaria and acute viral hepatitis. *J Vect Borne Dis* 2006; pp. 123–129.
13. Kochar DK, Tanwar GS, Khatri PC , Kochar SK , Sengar GS, Gupta A *et al*. Clinical Features of Children Hospitalized with Malaria—A Study from Bikaner, Northwest India. *Am. J. Trop. Med. Hyg.*I 2010; 83(5), pp. 981–989.
14. Patwari A, Aneja S, Berry AM and Gosh S; Hepatic dysfunction in childhood malaria. *Archives of disease in childhood* 1979; 54, 139-141.
15. Jigma AA and Niwoye AA; Assessment of some enzyme and haematological parameters in malaria patients resident in Minna; *IJBPAS* 2013; 2(1): 125-137.
16. Tangpukdee N, Thanachartwe V, Krudood S, Luplertlop N, Pornpininworakij K, Chalermrut K *et al*. Minor liver dysfuncyions in *Plasmodium vivax*, *P. malariae* and *P ovale* patients and normalisation after treatment. *Korean journal of parasitology* 2006; vol 44, no 4, 295-302.