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Evaluation of Liver Function Tests among Sudanese Malaria Patients

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Abstract

Background: Malaria is a major public health problem in tropical areas. It is responsible for infecting 300-500 million people and 1-3 million deaths annually. The liver takes part in malaria parasite live cycle, this leads to the destruction of liver cells and leads to liver function tests abnormalities.**Objective:** To assess liver function tests in Sudanese adult patients infected with malaria parasite compared with a healthy control group. **Methods:** In a case-control study, 150 malaria patients were recruited to assess liver function tests compared to another 50 healthy people as control group. **Results:** The study showed that malaria-infected patients have significant elevation in total bilirubin, direct bilirubin, indirect bilirubin, alanine amino transferase (ALT), aspartate amino transferase (AST) and lactate dehydrogenase (LDH). Tests also show a significant decrease in albumin level, whereas there is no significant difference in total protein levels between malaria patients and control group. **Conclusion:** malaria infection affects liver parameters, for it increases levels of direct bilirubin, indirect bilirubin, total bilirubin, AST, ALT, and LDH also decrease the level of albumin but the level of total protein is not affected.

Keywords: ALT, AST, LDH, Malaria, bilirubin, albumin

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Introduction

Malaria, a major public health problem in tropical areas is responsible for infecting 300-500 million people and 1-3 million deaths annually. Majority of deaths occur due to severe malaria, having one or more complications in a patient of Falciparum infection [(1)].

Malarial transmission to the human host is established by sporozoites infection to the liver [(2)]. Malaria causes symptoms that typically include fever, fatigue, vomiting, and headaches. In severe cases, it can cause yellow skin, seizures, coma or death [(3)].

The liver is a bilobed largest organ in the body situated in the upper part of the abdominal cavity. The cell constituents of the liver are arranged as hepatic lobules. The lobules are central in the organized functions of the liver being ushered with important vessels as portal vein, hepatic artery and a bile duct [(4)]. Important functions of the liver include: metabolism of fat, carbohydrate, protein, iron, hormones and drugs. It is also

characterized with vascular function e.g. storage and filtration of blood and the synthesis of blood coagulation factors.

The excretory and secretory functions of the liver are emphasized in drugs and hormones and the notable drugs are sulphonamides, penicillin, and erythromycin, while the hormones include; thyroxin, estrogen, and aldosterone [5].

The liver also forms and secrets bile, excrete bilirubin particularly the conjugation of it to arrest a disease situation; jaundice in excess circulation. It is also involved in protection function against foreign particle invasion e.g. bacteria through hepatic macrophages activities.

The liver is therefore very strategic in the overall body physiology and any harmful effect will impair the aforementioned activities. Several types of infections may affect the liver functions, among those is malaria infection. It has been emphasized through many reports that malaria infection is the cause of increased levels of total bilirubin, direct bilirubin and indirect bilirubin due to the consequent hemolytic anemia. [6] On other hand the increase in ALT, AST and LDH levels as a result of the destruction of liver cells by malaria parasite is evident. Through the desttructin of hepatic cells Malaria parasite is responsible for low albumin level due to decreased synthesis of albumin.

Liver involvement in malaria is common in patients of severe malaria and may manifest as jaundice (Hyperbilirubinemia), hepatomegaly and elevated liver enzymes like aspartate aminotransferase, alanine aminotransferase and lactate dehydrogenase iso enzyme[7]. Hyper-bilirubinemia, mainly unconjugated , is a common feature of falciparum malaria and is attributed to hemolysis of both parasitized and non-parasitized erythrocytes and partly due to liver damage.[8] Although hyperbilirubinemia has been linked with increased malaria-related mortality , it is often seen in association with other complications such as acute renal failure or cerebral malaria. [9,10]

Materials and methods:

Study design: this is an analytical case control–based study to assess liver function tests in 150 malaria patients compared to 150 healthy as control group.

Study population: adults Sudanese infected with malaria.

Ethical consideration: this study was approved from the scientific community and department of clinical chemistry and any individual in this was informed by the importance of this study.

Exclusion criteria: patients with preexisting liver diseases.

Methodology: malaria was diagnosed using thin and thick blood film reference method. The degree of parasitaemia is classified into mild (+), moderate (++) and severe (+++) according to the numbers of parasites per blood film. Estimation of liver function tests was performed by Cobas c-311 automated chemistry analyzer**.**

Data analysis: The results were analyzed using the Statistical Package of Social Science (SPSS) version 16.0

Results

Table (1) shows that, total bilirubin, direct bilirubin, indirect bilirubin, ALT, AST and LDH levels were significantly increased in malaria patients as compared control group. There was no significance difference in total plasma protein between malaria patient and control group .

Albumin levels were significantly decreased by about 17.6 % in malaria patient as compared to control group. There was no significant difference in total plasma protein between malaria patient and control group.

Table (2) shows, there were no significant differences in the mean levels of plasma total protein, albumin, total bilirubin, direct bilirubin, indirect bilirubin, ALT, AST and LDH between different age groups of malaria patients

Table (3) shows, a significant difference in the mean levels of albumin, total protein, direct bilirubin, indirect bilirubin, total bilirubin, AST, ALT, and LDH between the degree of parasitaemia of malaria groups (mild, modrate and severe).

Table (1): Liver function test in malaria patients and control group.

Parameters	Malaria Patient	Control group	P.value
Total protein (g/dl)	7.6	7.5	0.515
Albumin (g/dl)	3.4	4.0	0.000
Total bilirubin (mg/dl)	3.46	1.12	0.000
Direct bilirubin (mg/dl)	1.34	0.18	0.000
Indirect bilirubin (mg/dl)	2.12	0.94	0.000
ALT (IU/L)	74.70	26.26	0.000
AST (IU/L)	59.66	25.98	0.000
LDH (IU/L)	338.1	135.9	0.000

Table (2): LFTs in malaria patients according to age groups

Age group in years	*Total protein (g/dl)*	*Albumin (g/dl)*	*Direct bilirubin (mg/dl)*	*Total bilirubin (mg/dl)*	*Indirect bilirubin (mg/dl)*	*ALT (IU/L)*	*AST (IU/L)*	*LDH (IU/L)*
15-20	7.6	3.3	1.46	3.54	2.09	72.6	60.1	*268*
21-25	7.6	3.5	1.28	3.45	2.17	76.7	59.8	*364.5*
>25	7.6	3.9	0.80	2.00	1.20	59.0	47.0	*341*
P-value	0.649	0.101	0.615	0.830	0.844	0.752	0.855	*0.45*

Table (3) Comparison of LFTs parameters according to the severity of malaria

Test	*Severity of malaria (No of patients)*	*Mean ±SD*	*P.Value*
Albumin (g/dl)	mild (63)	3.61±0.21	0.000
	modrate (39)	3.33±0.09	
	Severe (48)	3.00±0.05	
	Total (150)	3.34±0.29	
Total protein (g/dl)	mild	7.85±0.09	0.000
	modrate	7.63±0.04	
	severe	7.35±0.37	
	Total	7.63±0.30	
Total Bilirubin (mg/dl)	mild	1.90±0.31	0.000
	modrate	3.22±0.40	
	severe	6.81±2.72	
	Total	3.82±2.63	
Direct Bilirubin (mg/dl)	mild	0.80±0.14	0.000
	modrate	1.22±0.09	
	severe	2.26±0.85	
	Total	1.38±0.79	
ALT (U/L)	mild	57.09±6.33	0.000
	modrate	69.76±4.00	
	severe	116.38±28.22	
	Total	79.36±30.79	
AST (U/L)	mild	53.33±5.92	0.000
	modrate	58.69±0.48	
	severe	70.79±27.00	
	Total	60.31±17.17	
LDH (U/L)	mild	226.86±15.35	0.000
	modrate	308.23±18.91	
	severe	508.38±35.12	
	Total	338.10±124.77	

Discussion

This analytical case-control study was primarily designed to evaluate LFT's parameter in Sudanese patients infected with malaria compared to healthy individuals in an attempt to determine the effect of malaria infection on these parameters.

There was high elevation in the levels of total bilirubin, direct bilirubin, indirect bilirubin, ALT and AST in patients samples when compared to the control group and the differences were significant (p-values < 0.000), whereas highly reduction in albumin level was found in malaria patient when compared to the control group by about 17.6% and the difference was significant also (p-value = 0.000) .

Total protein was not different in malaria patient compared to control group (p-value = 0.515).

The increase in levels of total bilirubin, direct bilirubin, indirect bilirubin, and LDH may be due to haemolytic anemia which caused by the malaria parasite. While the Increase in ALT and AST levels may be due to destruction of liver cells by malaria parasite also. Low albumin level may be due to decreased synthesis of albumin by hepatic cells which are destructed by malaria parasite, too.

The normal level of protein may be due to an increase in globulins fractions due to the production of antibodies (IgG, IgM, IgA) against sporozoites, sexual and asexual forms of malaria.

Several studies showed that the levels of total bilirubin, direct bilirubin, ALT, AST, and LDH were elevated in malaria patients these results were obtained by Godse RR. 2013(11), and Kochar DK (2003) (12), and it agrees with these results. Whereas several studies show that the level of total proteins in plasma decreased after the infection with *P. Falciparum* malaria, Abdelgadir NE (13), Adebisi SA, (1998)(14), Adeosun OG (2007) (15), and these results were not in agreement with this study results. On the other hand, Mu AK et al, (16) found that the level of albumin was decreased in patients infected with malaria and this agrees with this study results also.

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Conflict of interest statement

We declare that we have no conflict of interest.

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