

Alterations in Hepatic Parameters Associated with Malaria Infected Patients in Oyigbo, Rivers State, Nigeria

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Abstract: Malaria is one of the greatest public health challenges in terms of morbidity and mortality, triggering about 216 million cases of malaria in 91 countries and 445 000 mortality all over the world as at 2016. It goes with periods of serious activity in the hepatocytes which could lead to changes in liver serum enzymes because of likely liver damage. This study was intended to determine the alterations in hepatic parameters associated with malaria infected patients in Oyigbo, Rivers State. One hundred and twenty males and females malaria patients respectively were divided into four groups made up of sixty malaria positive males, sixty malaria negative males, sixty malaria positive females and sixty malaria negative females. Diagnosis of malaria parasite was carried out using microscopic examination of thick and thin stained blood films. The hepatic parameters were assayed using standard biochemical techniques. Results displayed alterations in hepatic parameters associated with male and female malaria patients with significant increase ($p < 0.05$) in alanine aminotransferase (ALT), aspartate aminotransferase (AST) and total bilirubin (TB) and insignificant increase ($p < 0.05$) in alkaline phosphatase (ALP) level of both male and female patients compared to their controls. It also showed insignificant increase ($p < 0.05$) in total serum protein (TSP) and conjugated bilirubin (CB) level of the malaria positive female patients, insignificant decrease in total serum protein and significant increase in conjugated bilirubin of male malarious patients. Conclusion; the result of this study demonstrated that alterations in hepatic parameters studied are associated with malaria in both male and female and may lead to liver damage if unrestrained. The connection between malaria infection and hepatic parameters as revealed in this study could pave way for better understanding of malaria management which will lead to improved patient's care.

Key words: Malaria • Infection • Male • Female • Hepatic Parameters • Oyigbo

INTRODUCTION

Malaria is a life-threatening disease caused by infection with *Plasmodium* protozoa spread by an infective female *Anopheles* mosquito vector [1]. It accounts for nearly ninety-nine percent of deaths in Africa [1-3]. In Nigeria, nearly 0.25 million death of children below the age of five is caused by malaria every year [4]. Malaria infection is the most prevalent protozoal infection affecting humans worldwide, many efforts at dropping the rate of transmission have been extensively used but still all the efforts were fruitless though with

dropping tendencies in some parts of the endemic areas [5]. It was projected that 3.3 billion humans have malaria infection in 106 countries and 350 -500 million cases arise in African countries with 2 -3 million yearly deaths [6, 7]. Malaria occurs all over the world endemic areas and it is a major danger to the existence of the people in these locations.

It has phases of elevated activity in the liver cells and when the blood cells are affected it may lead to deteriorated immunity of individual and hence elevated chances for getting other infections [8]. The effects of malaria on liver cells will likely follow changes in liver

enzymes and serum protein because of hepatocellular damage [9]. Liver cells are likely to be infected by Plasmodium parasites because it has some phases of its life cycle inside the liver cells. The attack of the hepatocytes by malarial parasites may lead to organ congestion; blockade of sinusoids with related cellular inflammation which may lead to leakage of liver transaminases and lowered liver synthetic capability leading to low serum protein levels [8, 10-12]. Malaria infection may or may not decrease serum transaminases and the synthetic activities of the liver contingent upon the effect of the malarial parasite on the liver parenchyma. Liver dysfunction is well documented in malaria infection but information among the inhabitants of Oyigbo, Rivers State, Nigeria is scarce. Therefore, the aim of this study was to determine the alterations in hepatic parameters associated with male and female malaria infected patients in Oyigbo, Rivers State, Nigeria.

MATERIAL AND METHODS

Specimen Collection: The study was carried out in Cliniscan Diagnostics Center, Oyigbo Rivers State, Nigeria between 1st May and 14th June, 2019, Oral consent was obtained from all patients before the study. Ethical approval for this study was obtained from the ethical committee of Cliniscan Diagnostics Center, Oyigbo Rivers State, Nigeria. Blood specimens were obtained from consenting patients attending the clinic.

Slide Preparations: A sample of 3 ml of venous blood was obtained from each participant into Ethylene diaminetetra-acetic acid (EDTA) bottle for laboratory analysis. Malaria parasites detection was done by microscopic examination of thin and thick blood films stained with 3% Giemsa and thereafter, levels of liver enzyme parameters in serum were analyzed.

Study Participants: Two hundred and forty (240) participants were selected by simple random sampling of patients aged between 17 to 65 years, who has malaria caused by *P. falciparum* and whose level of parasitaemia was ++ and above. They were thereafter put into four groups made up of 60 malaria positive males (MPM), 60 malaria negative males (MNM), 60 malaria positive females (MPF) and 60 malaria negative females (MNF). Patients suffering from malnutrition and hepatitis, smokers, HIV/AIDS patients, those on anti-malaria drugs, typhoid fever, dengue fever and meningitis patients were excluded from the study and for the purpose of this study, malaria caused by *P. falciparum* was examined.

Evaluation of Hepatic Parameters: Aspartate and alanine aminotransferase activities were determined by spectrophotometric method according to Reitman and Frankel [13]. Alkaline phosphatase activity was determined by the p-nitrophenyl phosphate (PNPP) as reported by Armstrong [14]. Serum bilirubin was assayed by means of colorimetric method as reported by Jendressik and Grof [15] whereas protein level was determined by the Biuret method.

Data Analysis: The data obtained were pooled and analyzed for their central tendencies using descriptive statistic, values were given as mean±standard deviation of sixty (60) observations. Analysis of variance and least significant difference were used to examine the significant differences ($p < 0.05$) between treatment means. All analyses were done using SPSS for windows statistical software package version 20. The resultant output was shown in tables.

RESULTS

Hepatic Alterations Associated with Male Malarious Patients: The hepatic alterations associated with malarious male patients showed that Aspartate Aminotransferase (AST) and Alanine Aminotransferase (ALT) were increased from (9.93±2.63) to (23.53±2.74) and (5.80 2.70) to (16.07±3.15) respectively and both differences were statistically significant at ($p < 0.05$) compared to the controls (Table 1). Also, Alkaline Phosphatase (ALP) was increased form (78.40±10.78) to (85.53±17.86) and the difference was statistically insignificant at ($p \geq 0.05$) compared to the control. On the other hand, total serum protein (TSP) was decreased from (7.06±0.77) to (6.81±0.06) and the difference was statistically insignificant at ($p < 0.05$) compared to the control. Finally, total bilirubin (TB) and conjugated bilirubin (CB) were increased from (8.58±4.37) to (12.61±5.93) and (3.91±1.10) to (5.11±2.31) respectively and both differences were statistically significant at ($p < 0.05$) compared to the controls (Table 1).

Hepatic Alterations Associated with Female Malarious Patients: The hepatic alterations associated with malarious female patients showed that AST and ALT were increased from (13.00±4.71) to (24.25±2.30) and (8.66±3.74) to (17.27±5.52) respectively and both differences were statistically significant at ($p < 0.05$) compared to their controls (Table 2). Also, ALP and TSP were increased from (84.07±21.91) to (93.47±22.57) and (6.33±0.88) to (6.79±0.66), both differences were

Table 1: Hepatic Alterations Associated with Male Malarious Patients

Hepatic Parameters	Malaria Negative Males	Malaria Positive Males
AST (μ/l)	9.93±2.63 ^a	23.53±2.74 ^b
ALT (μ/l)	5.80±2.70 ^a	16.07±3.15 ^b
ALP (μ/l)	78.40±10.78 ^a	85.53±17.86 ^a
TSP (Mg/dl)	7.06±0.77 ^a	6.81±0.60 ^a
TB (μmol/l)	8.58±4.37 ^a	12.61±5.93 ^b
CB (μmol/l)	3.91±1.10 ^a	5.11±2.31 ^b

Values are given as Mean±Standard Deviation (N= 60). Mean values in the same row with different superscripts differ significantly (p < 0.05). KEY: AST= Aspartate aminotransferase, ALT= Alanine aminotransferase, ALP = Alkaline phosphatase, TSP= Total serum protein, TB = Total bilirubin, CB = Conjugated bilirubin.

Table 2: Hepatic Alterations Associated with Female Malarious Patients

Hepatic Parameters	Malaria Negative Females	Malaria Positive Females
AST (μ/l)	13.00±4.71 ^a	24.25±2.30 ^b
ALT (μ/l)	8.66±3.74 ^a	17.27±5.52 ^b
ALP (μ/l)	84.07±21.91 ^a	93.47±22.57 ^a
TSP (Mg/dl)	6.33±0.88 ^a	6.79±0.66 ^a
TB (μmol/l)	10.66±3.62 ^a	14.83±9.99 ^b
CB (μmol/l)	4.55±1.27 ^a	4.97±2.97 ^a

Values are given as Mean±Standard Deviation (N= 60). Mean values in the same row with different superscripts differ significantly (p < 0.05). KEY: AST= Aspartate aminotransferase, ALT= Alanine aminotransferase, ALP = Alkaline phosphatase, TSP= Total serum protein, TB = Total bilirubin, CB = Conjugated bilirubin.

Table 3: Comparative Effects of Hepatic Alterations Associated with Malarious Male and Female Patients

Hepatic Parameters	% Change in Malarious Male Patients	% Change in Malarious Female Patients
AST (μ/l)	+ 136.96*	+ 86.54
ALT (μ/l)	+ 177.07*	+ 99.42
ALP (μ/l)	+ 9.09	+ 11.18*
TSP (Mg/dl)	- 3.54	+ 7.27*
TB (μmol/l)	+ 46.97*	+ 39.12
CB (μmol/l)	+ 30.69*	+ 9.23

KEY: * indicated as superscript shows which sex was more affected in the parameters under consideration. -ve denotes negative percentage change (Decreased). +ve denotes positives percentages change (Increased). Changes were compared to the controls (Negative males and female patients).

statistically insignificant at (p < 0.05) compared to their controls. Also, TB was increased from (10.66±3.62) to (14.83±9.99) and the difference was statistically significant compared to the control (p < 0.05). Finally, CB was increased from (4.55±1.27) to (4.97±2.97) and the difference was statistically insignificant compared to the control (p < 0.05) (Table 2).

Comparative Effects of Hepatic Alterations Associated with Malarious Male and Female Patients: The comparative effects of malaria on hepatic parameters studied shows that four hepatic parameters that were AST, ALT, TB & CB were more affected in males than

females. The percentage changes were (+136.96 & + 86.54), (+ 177.07 & + 99.42), (+ 46.97 & + 39.11) and (+ 30.69 & + 9.23) respectively (Table 3). On the other hand, two hepatic parameters ALP & TSP were more affected in females than in males. The percentage differences were (+ 9.09 & +11.18) and (-3.54 & +7.27) respectively (Table 3). Finally, the males were more affected than the females as they recorded very high percentage changes compared to the females (+ 136.96 & + 86.54), (+ 177.07 & + 99.42), (+ 46.97 & + 39.11) and (+ 30.69 & + 9.23) (Table 3).

DISCUSSION

Hepatic parameters are significant indicators for the assessment of disease severity. The result of alterations in hepatic parameters associated with male and female malarious patients showed significant increase (p < 0.05) in ALT, AST and TB and insignificant increase (p < 0.05) in ALP level of both male and female patients compared to their controls. It also showed insignificant increase (p < 0.05) in TSP & CB level of the malarious positive female patients, insignificant decrease in total serum protein and significant increase in conjugated bilirubin of male malarious patients. The findings of this study are in agreement with that of Kim *et al.* [16] which showed increased levels of ALT, AST and ALP in the blood of malarial patient and the increment in these enzymes could lead to damaging of liver parenchyma. Individuals with elevated levels of AST and ALT are at an increased risk of mortality from liver damage [16]. Importance of liver in bilirubin metabolism cannot be overemphasized and as such, increased levels of TB and CB could lead to PBC (primary biliary cirrhosis) an autoimmune disease of the liver. Increased levels of bilirubin (CB and TB) in malarial patient as seen in this study is in line with the work of Kayode *et al.* [11] who reported high levels of bilirubin (CB and TB) in malarial patients. The insignificant decrease in TSP showed that malaria had no effect on TSP levels and may not lead to hyperproteinemia, a condition characterized by an abnormally elevated plasma protein concentration. Previous studies reported low total serum protein in malaria infection which is not in agreement with the present study [6].

CONCLUSIONS

The result of this study shows that alterations in examined hepatic parameters are associated with malaria in both male and female which may lead to liver damage if

unchecked. Another implication of this result is that malaria has little or no effect on TSP level of both male and female. Malaria affected AST, ALT, TB and CB levels of males more than females while it affected ALP and TSP of females more than males. Malaria affected hepatic parameters of both sexes and therefore hepatic parameters as an examining tool of early malaria infection may aid in detecting early complications related to malaria so as to avert the rate of mortality that may arise from such complications.

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