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STUDY OF SERUM TOTAL CHOLESTEROL IN SEVERE FALCIPARUM MALARIA PATIENTS

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Abstract

Background: *Malaria is a potentially life-threatening disease, which is transmitted by the infectious bite of a female Anopheles mosquito. In Myanmar, malaria is a major public health problem. Various studies have found that hypocholesterolemia correlates with the severity of falciparum malaria.*

Method: *The aim of this study was to study serum total cholesterol in severe falciparum malaria patients. The study was a hospital based, cross sectional, descriptive study on 27 patients with severe falciparum malaria who attended at medical wards of No. (2) Military Hospital (500 Bedded) and No. (1) Defense Services General Hospital (1000 Bedded), Mingalardon. It included male and female patients with severe falciparum malaria with the mean age of 37.29 (SD ± 1.10) years.*

Results: All patients with severe falciparum malaria had low serum total cholesterol level. Among 27 severe falciparum patients, 21 (77.7 %) patients had serum total cholesterol level between 100 – 120 mg/dl, 5 (18.6%) patients were between 120 – 140 mg/dl, and remaining 1 (3.7 %) patient was < 100 mg/dl.

Conclusion: *This study illustrates the significant impact of severe falciparum malaria on serum total cholesterol level in adults.*

Keywords: *Severe falciparum malaria, serum total cholesterol, hypocholesterolemia*

1. Introduction

Malaria is a parasitic disease and major health problem in the tropics with a high morbidity and mortality. Being one of the world's biggest killers, it accounts for approximately one million deaths each year. According to WHO 2010 malaria report, population in malarious areas of Myanmar was 37.39 million and number of lab-confirmed malaria cases was 420,808 and number of

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malaria cases was 228,714 and number of deaths was 788 (reported). (WHO 2010)

Complicated *falciparum* malaria develops hematological complications and alterations in biochemical parameter. (Khan., *et. al*, 2002) *Plasmodium falciparum* was found to establish successful infection in human host by interacting with a variety of human proteins on the surface of the different cell type. Biochemical events that have been reported to occur in malaria include cellular changes in energy metabolism, hemo-metabolism, membrane lipid peroxidation, lipid composition changes and stress enzymes. The changes observed in lipid composition and cholesterol exchange in malaria patient could have a marked effect on the function of red cell membrane and may therefore be partly responsible for the increase in fluidity and permeability of *P. falciparum* infected erythrocyte. (Maquire and Sherman, 1990)

Recently malaria has been thought to have significant effect on the level of blood cholesterol and their relationships have raised some concern. It can also be a possible parameter for chemical diagnosis of malaria in the absence of a positive blood film. (Chukwuocha UM, 2011) In critical illness, low cholesterol levels are predictive of clinical deterioration. Severe persistent hypocholesterolemia, or extreme drop in cholesterol, is a strongly unfavorable prognostic sign. Progressive reversal of hypocholesterolemia is considered a marker of reversible of critical illness, and of patient recovery (Levine DM, et.al, 2001).

It has been postulated in various studies that hypocholesterolemia correlates to the severity of *falciparum* malaria. T study aimed to focus on serum total cholesterol level in cases with complicated *falciparum* malaria.

2. Material and method

This was a hospital based, cross-sectional descriptive study, conducted all complicated *falciparum* malaria patients admitted to medical wards of No. (1) Defense Services General Hospital (1000 bedded), Mingalardon and No. (2) Military Hospital (500 bedded), Yangon, Myanmar, from October 2012 to August 2014, after approval from the Ethical Review Committee of the Defense Services Medical Academy. All patients, above 18 years of age, and who meeting at least one or more features of confirmed complicated *falciparum* malaria according to WHO criteria, with positive peripheral blood film for the trophozoite forms of *falciparum*, were selected. Exclusion criteria were patients with Body Mass Index (BMI) ≥25 and (BMI) ≤18.5, patients taking lipid lowering drugs, patients with diabetes mellitus and known coronary artery diseases.

Patients presenting with symptoms indicative of complicated *falciparum* malaria admitted to two study sites were recruited after informed consent. Then peripheral blood films (Thin and Thick film) were done and interpreted by an expert microscopist. Patients with positive *falciparum* species of malaria were selected. In all patients, 2 cc of peripheral blood sample was collected into an EDTA container using venipuncture. Blood for serum total cholesterol, urea, creatinine, electrolytes, urine RE, chest X ray, liver function tests were done as required. All data were checked for completeness, errors and inconsistencies prior to the data entry and were entered into raw data-base sheet (Microsoft Office Excel). All data were analyzed by EPI INFO 2014 software. Numerical/Continuous data (Basic characteristics) were analyzed by using student t – test. Frequency data was analyzed by using Chi – square.

3. Results

This study included 27 patients (23 males, 4 females). Table (1) and figure (1) showed the demographic data of patients. The mean age was 37.29±1.10 years (25–62 years). The most common presenting symptoms, table (2) in this study were fever (92.6 %) and vomiting (74 %). Others were cough (55.5 %), headache (37 %), and reduced urine output (7.4 %). The most common presenting signs, figure (2), were pallor and jaundice. In this study population (n=27), 6 patients suffered neurological manifestations. Among these patients, 3 patients (11.1 %) suffered alter sensorium, 2 patients (7.4 %) suffered seizures and only 1 patient (3.7 %) had cerebellar signs. Among 27 severe *falciparum* malaria patients, 21(77.7 %) patients had serum total cholesterol level between 100 – 120 mg/dl, 5(18.6 %) patients were between 120-140 mg/dl and remaining 1(3.7 %) patient was<100 mg/dl. All patients had low serum total cholesterol level with minimum value 95 mg/dl, maximum 135 mg/dl and mean total cholesterol level was 117 mg/dl.

Age (Year)	Number	Percent
20-29	10	37
30-39	7	26
40-49	6	22
50-59	3	11
≥ 60	1	4
Total	27	100
Mean	37.29	
SD	1.10	
Minimum	25	
Maximum	62	

Table (1) Age distribution (n=27**)**

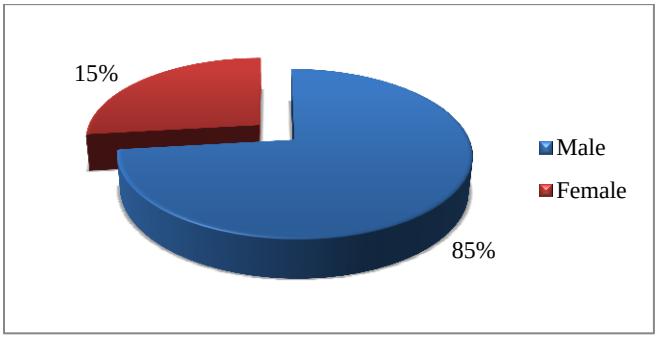

Figure (1) Gender distribution (n=27)

Symptom	Positive	Negative	Frequency of positive symptoms (%)
Fever	25	2	92.6
Vomiting	20	7	74
Cough	15	12	55.5
Headache	10	17	37

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Reduced urine output	2	25	7.4

Table (2) Distribution of symptoms in study populations(n=27)

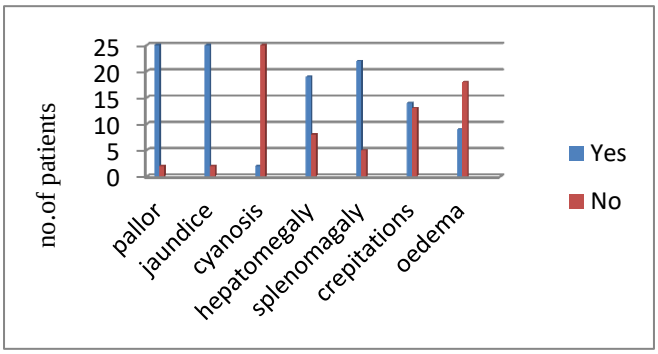

Figure (2) Distribution of signs in study populations (n=27)

CNS manifestations	Frequency	Percent of total
Alter sensorium	3	11.1
Seizures	2	7.4
Cerebellar signs	1	3.7

Table (3) Neurological manifestations in study population (n=27)

Total cholesterol (mg/dl)	Severe *falciparum* malaria patients	
	Number	Percent
<100 mg/dl	1	3.7
100 – 120 mg/dl	21	77.7
120 – 140 mg/dl	5	18.6
Total	27	100

Table (4) Percent distribution of total cholesterol in severe *falciparum* malaria patients (n=27)

	Number of patients	Minimum	Maximum	Mean
Urine output (cc/day)	27	150	1800	877.25
Hb(g/dl)	27	6.3	15.2	10.9
Platelets (per mm3)	27	23,000	140,000	62,640
Creatinine (mg/dl)	27	0.5	5.3	1.49
Urea (mg/dl)	27	36	160	37.29
RBS (mg/dl)	27	70	176	110
T. Bilirubin (mg/dl)	27	0.7	16	3.6
T. Cholesterol (mg/dl)	27	95	135	117

Table (5) Mean values of laboratory investigations (n=27)

	Severe anemia (n=25)	Hyperthermia (n=23)	Acute renal failure (n=2)	Acute pulmonary oedema (n=9)	Cerebral malaria (n=6)
Mean values of serum total cholesterol (mg/dl)	117	125	102	120	100

Table (6) Mean values of serum total cholesterol in different clinical severity of severe *falciparum* malaria patients (n=27)

4. Discussion

This study was carried out to determine the serum total cholesterol level in severe *falciparum* malaria patients. In this study, all severe *falciparum* malaria patients had hypocholesterolemia. Other studies done by Kitt et. al, hypocholesterolemia was found in severe *falciparum* malaria patients and these patients had cerebral malaria and respiratory distress. The most common combination of complications found in this study were thrombocytopenia and jaundice. In a study done by Tripathy et. al. the most common manifestations of severe malaria found in adults were complications like acute renal failure, respiratory distress and cerebral malaria. Another study done in Berhampur, Orissa showed that cerebral malaria alone or in combination with other complications is the still commonest form of malaria. The presence of 3 combinations such as cerebral malaria, acute renal failure and jaundice is more common than any other combinations. In this study, 6 patients had cerebral malaria and 2 had acute renal failure.

Hypocholesterolemia was present in all patients of this study. Previous studies done by Kittl et al, Djoumessi and Nilsson et. al have shown the same relation between severe malaria and serum cholesterol. The mechanisms involved in lipid changes related to malaria remain uncertain. They may be partly host related, i.e. related to an acute phase reaction, which is known to increase triglyceride values and to decrease both HDL and LDL cholesterol values. However, a selective uptake of HDL particles by Plasmodium *falciparum* has been speculated and further shown by in vitro experiments. It was an established fact that acute infection and inflammation produce moderate changes in plasma lipoprotein pattern in human, with a typical rise in serum triglyceride concentration and decline in HDL cholesterol. Such changes are basically due to increased VLDL production, increased mobilization of free fatty acids from adipose tissue in response to stress. Adipose tissue lipolysis, increases de novo hepatic fatty acid synthesis and suppression of fatty acid oxidation in severe infection are common. (Bentz MH, 2012)

5. Conclusion

The study was a hospital based cross-sectional descriptive study. One of the limitations of this study was the cross-sectional nature of the data, and another limitation was sample size. Large population and countrywide study can contribute more powerful and significant data. This study revealed that fever and vomiting

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were the most common symptoms while pallor and jaundice were most common signs. The most common combination of complications in this study group was thrombocytopenia and jaundice. All patients in this study had low serum total cholesterol level, and the mean level of serum total cholesterol level in this study was 117 mg/dl. This study might contribute some data to further research regarding the serum total cholesterol level of severe *falciparum* malaria patients in Myanmar.

Conflict of interest

The authors declare no conflict of interest.

Ethical approval

The study was ethically approved by the Ethical Review Committee of the Defense Services Medical Academy, Yangon, Myanmar.

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