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A STUDY OF SERUM LIPIDS IN MALARIA

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ABSTRACT

Background and objectives: This study aims at finding a relationship between serum triglycerides, HDL, LDL, VLDL and severity of malaria.

Methods: 150 patients were included in the study both males and females with majority being males. Out of which 75 were cases and 75 controls. A detailed history was taken including presenting complaints with history of diabetes mellitus, hypertension and chronic renal failure. General physical examination including vitals, purpura, BMI and systemic examination was done. Laboratory investigations important ones included MP smear, fasting lipid profile. Others included chest X-RAY, ECG and USG abdomen and pelvis.

Results: Among 150 cases, 75 patients were controls and 75 were cases of malaria out of which, the number of patients suffering from complicated malaria were found to be 3 (4 %), complicated mixed malaria was 1 (1.3%), mixed malaria was 8 (10.7%), *Plasmodium falciparum* was 3 (4%) and those with *Plasmodium vivax malaria* was 60 (80%). Our study showed that out of the 150 patients studied, all had total cholesterol within the normal reference range. Out of this, the mean total cholesterol levels were 182.93 mg/dl in the control group with a standard deviation of 30.867 and the malaria group was found to have a mean total cholesterol level of 134.85 mg/dl and standard deviation of 29.838.

Conclusions: The study revealed that there is reduction in total cholesterol level in patients suffering from malaria infection, however there is significant reduction seen in patients having complicated malaria and complicated mixed malaria. Hence the results of our study are in close agreement with other similar studies showing that there is hypocholesterolemia, hypertriglyceridemia, decreased HDL and LDL levels.

Introduction:

Malaria is a common and life-threatening disease in many tropical and subtropical areas. There are currently over 100 countries and territories where there is a risk of malaria transmission, and these are visited by more than 125 million international travellers every year. Malaria transmitted by infectious bite of female anopheles mosquito. In India malaria has been a major public health problem since ages.[1]

Parasitic protozoa and helminthes are responsible for some of the most devastating and prevalent diseases of humans, threatening the lives of nearly one-third of the worldwide human population leading to more than 2 million deaths annually. Habitats of parasites are extremely varied and common parasites of man (protozoa, helminthes and arthropods) normally inhabit the intestine, blood, liver, lungs brain, muscles and lymphatic tissues[1]. Many species of parasites have complex life cycles involving developmental stages that live in soil or water, or use various kinds of intermediate hosts, including vertebrates and invertebrates and cold and warm-blooded animals. In such varied environments, parasites have become adapted to using/tolerating widely differing oxygen, carbon dioxide, hydrogen ion concentrations and temperatures. Their nutritional requirements and their means of obtaining and utilizing the nutrients required for growth, motility and reproduction are also varied.

The requirement of cholesterol for internalization of eukaryotic pathogens under such variable circumstances is poorly understood.

Cholesterol is a major constituent of eukaryotic membranes and plays a crucial role in cellular membrane organization, dynamics, function and sorting. It is often found distributed non-randomly in domains in membranes.[2] Recent observations suggest that cholesterol exerts many of its actions by maintaining a specialized type of membrane domain, termed "lipid rafts" in a functional state. Lipid rafts are enriched in cholesterol and sphingolipids and have been thought to act as platform through which signal transduction events are coordinated and pathogens gain entry to infect host cells.[3]

Relationship of serum cholesterol levels in man infected with parasites has drawn the attention of various workers. Since it has been shown in-vitro studies that parasites like *Giardia* and *Entamoeba* can grow in lipid rich media in the absence of serum; it would be interesting to determinate the mechanism of lipid/cholesterol utilization Recent studies have shown elevated levels of lipoproteins like high density lipoprotein (HDL), low density lipoprotein (LDL) and total cholesterol in patients suffering from parasitic infection.[4]

Hence in this study we aimed to find out the relationship between serum triglycerides, HDL, LDL, VLDL and severity of malaria.

Materials and Methods:

150 patients were included in the study both males and females. Out of which 75 were cases and 75 controls. A detailed history was taken including presenting complaints with history of diabetes mellitus, hypertension and chronic renal failure. General physical examination including vitals, BMI was performed and any bleeding manifestations were noted. Systemic examination was done.

Laboratory investigations like CBC, RFT, LFT, MP smear, fasting lipid profile was performed. Others included chest X-RAY, ECG and USG abdomen and pelvis.

Data collection: A total of 150 patients who were admitted in the Department of General Medicine in Yenepoya Medical College

from January 2015 to October 2016 were studied of which 75 patients had acute malaria infection and 75 were taken as age and gender matched controls. Pregnant women were not included

Statistical Analysis: Discrete data was expressed in frequencies and percentages and continuous data was expressed in mean ±SD [Range]. An independent-samples t-test was conducted to compare Control group and Malaria patients. Data was analyzed using the software SPSS version 22.0. P<0.05 is considered significant.

Results:

In this study total 150 patients were taken, among them 124(82.7%) were males and 26(17.3%) were females. Among 150 cases 75 patients were controls and 75 were malaria positive. In that patients suffering from complicated malaria found to be 4 %, complicated mixed malaria 1.3%, mixed malaria 10.7%, Plasmodium falciparum 4% and Plasmodium vivax malaria found to be 80%.

An independent-samples t-test was conducted to compare Control group and Malaria patients. There is statistically significant difference in the Control (M=182.93, SD=30.867) and Malaria (M=134.85, SD=29.838); t=9.699, p <.001 of Total Cholesterol. Similarly there was statistically significant difference between the control group and malaria group in triglycerides (TG), HDL, LDL and VLDL

Table 1: Comparison of Lipid Profile in Cases and Controls

	Group	N	Mean	SD	t-test for Equality of Means						
					t	df	p-value Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% CI of the Difference	
										Lower	Upper
TC	Control	75	182.93	30.867	9.699	148	.000	48.080	4.957	38.284	57.876
	Malaria	75	134.85	29.838							
TG	Control	75	107.73	33.429	-2.689	148	.008	-16.853	6.267	-29.239	-4.468
	Malaria	75	124.59	42.761							
HDL	Control	75	39.96	10.338	8.844	148	.000	13.067	1.478	10.147	15.986
	Malaria	75	26.89	7.540							
LDL	Control	75	112.39	33.979	3.407	148	.001	15.96	4.684	6.703	25.217
	Malaria	75	96.43	22.160							
VLDL	Control	75	37.56	17.669	4.873	148	.000	11.667	2.394	6.935	16.398
	Malaria	75	25.89	10.851							

In our study it was found that the mean total cholesterol levels were 182.93 mg/dl in the control group with a standard deviation of 30.867 and the malaria group was found to have a mean total cholesterol level of 134.85 mg/dl and standard deviation of 29.838 which shows significant hypercholesterolemia in the malaria group.

The mean triglyceride levels in the control group was found to be 107.73 mg/dl with a standard deviation of 33.429 and in the malaria group the mean was found to be 124.59 mg/dl and a standard deviation of 42.761 which is suggestive of significantly higher levels of triglycerides in the malaria group as compared to the control group. The HDL levels were significantly lower in the malaria group as compared to the control group. The LDL values in the control group was found to have a mean value of 112.39 mg/dl and a standard deviation of 33.979 and the control group had a mean value of 96.43 mg/dl and a standard deviation of 22.160. The VLDL levels were low in the malaria group as compared to the control group.

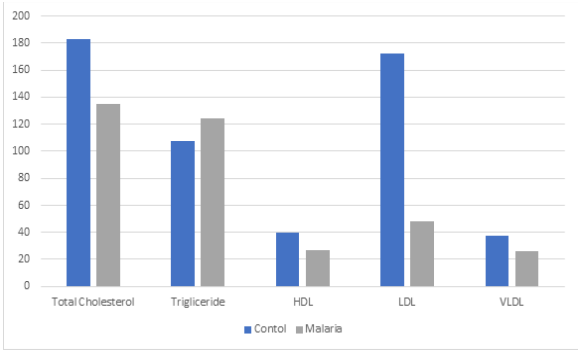

Figure 1: Graphical representation of fasting lipid profile in cases and controls

The triglyceride levels measured within the different subgroups of the malaria group showed that the maximum number of patients with malaria had triglyceride levels within the normal range, i.e. 72 out of the total 75 patients. Majority of patients i.e., 59 had plasmodium vivax malaria. However all 75 patients had normal measured total cholesterol and LDL levels. In the malaria study group it was found that 74 out of the 75 patients studied were found to have abnormal HDL levels and only 1 had HDL levels within the normal range. The VLDL levels were found to be within normal limits in 53 of the 75 in the malaria study group and abnormally elevated in 22 of the remaining with a maximum of 17 elevated in the plasmodium vivax malaria subgroup.

DISCUSSION

Patients with malaria often exhibit laboratory abnormalities due to an acute phase response, but little is known about serum lipid profile changes in malaria. In 1978, Lambrecht et al.1 reported transient lipid profile changes in six returning travellers with malaria caused by Plasmodium vivax and suggested for the first time that changes in high-density lipoprotein (HDL) and very low-density lipoprotein (VLDL) in human serum are related to the lipid metabolism of the parasite.

It was hypothesized that the malaria parasite uses cholesterol and phospholipids from its host, resulting in a decrease of serum HDL. Subsequently, several clinical studies showed lipid profile changes in the setting of both uncomplicated and complicated malaria[5-10]. Although the magnitude of changes seems to be related to the severity of malaria in several studies[11,12], these transient lipid profile changes in the parasitaemic phase have been suggested by some researchers as a potential adjuvant diagnostic tool for malaria[13,14,15].

In our study we compared the fasting lipid profile including serum total cholesterol, serum triglyceride, serum HDL, serum LDL and serum VLDL levels in 75 patients with malaria and 75 patients were selected in the control group. The number of patients suffering from complicated malaria were found to be 3 (4 %), complicated mixed malaria was 1 (1.3%), mixed malaria was 8 (10.7%), Plasmodium falciparum was 3 (4%) and those with Plasmodium vivax malaria was 60 (80%).

Our study showed that out of the 150 patients studied, all had total cholesterol within the normal reference range. Our study revealed that there is reduction in total cholesterol level in patients suffering from malaria infection, however there is significant

reduction is seen in patients having complicated malaria and complicated mixed malaria. The independent-samples t-test conducted to compare Control group and Malaria patients showed that there is statistically significant difference in the Control (M=182.93, SD=30.867) and malaria (M=134.85, SD=29.838); t=9.699, p <.001 of Total Cholesterol. This is in accordance with the majority of the other studies (5-10) which also showed significant hypercholesterolemia in patients with malaria as compared with the control group.

The triglyceride levels measured in our study showed mildly elevated levels in the control group. In a study by Parola et al16 studied a total of 278 febrile patients returning from the tropics were hospitalized. The patients included in the study were 15-75 years with mean age of 35.7 years. A total of 222 patients were diagnosed to be positive for malaria of which 198 (89%) were due to P.falciparum, 14 (6%) due to P.vivax, 8 cases (4%) due to P.ovale and 2 (2%) due to P.Malariae. the mean value of plasma triglyceride levels were found to be higher in those patients with malaria. Mean values of plasma triglycerides were similar in mild falciparum and non falciparum groups but were found to be clearly higher in patients with severe malaria than in those with mild malaria.

The HDL levels showed a significant decrease in values in the malaria group as compared to the control group. The LDL values in the control group was found to have a mean value of 171.97 mg/dl and a standard deviation of 180.534 and the control group had a mean value of 48 mg/dl and a standard deviation of 14.413. The VLDL levels measured in the control group was found to have a mean value of 37.56 mg/dl and a standard deviation of 17.669 and the malaria group was found to have a mean value of 25.89 mg/dl and a standard deviation of 10.851 which was suggestive of a significantly low VLDL values measured in the malaria group as compared to the control group. It is also reported that in the absence of serum, HDL in low concentration (0.75 mg/ ml) supported growth of *P. falciparum* in vitro, whereas at high concentration (3 mg/ml), it was toxic to the parasite[17]

There are few studies which suggest that there are changes in lipid plasma or serum levels in-vivo after infection. But, no significant changes were seen in the plasma cholesterol during and after infection of malaria[18]. However, low levels of the cholesterol in patients infected with malaria as compared to normal healthy controls have been reported.[19] In another study changes in plasma lipoprotein was seen in acute malaria resulting decreased levels of HDL and LDL and moderately increased triglycerides.[20] In malaria endemic areas, when plasma levels of cholesterol, triglycerides, HDLc and LDLc were analyzed in children infected with *Pl. falciparum*, investigators have found significantly low levels of lipid profile.[21]

The study of serum lipid profiles in those patients with malaria has shown alterations in the values corresponding to malaria infections which are in accordance with our study. But the exact pathophysiology for the same has yet to be confirmed.

Conclusions:

The results of our study are in close agreement with other similar studies showing that there is hypocholesterolemia, hypertriglyceridemia, decreased HDL levels and LDL levels. This goes to show that although a definite link with the pathogenesis of malaria cannot yet be demonstrated; a possible hypotheses of biological mechanisms involving host lipid alterations and the pathogenesis of malaria exist. An increased research effort to demonstrate the precise pathways is indicated, since this could lead to better understanding of the pathophysiology of the malaria parasite and consequently to newer and improved treatment approaches which could significantly reduce the mortality and the morbidity of malaria infections which is presently faced by most of the underdeveloped and tropical nations of the world.

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