Indian J Physiol Pharmacol 2009; 53 (3) : 271–274

VARIATION IN COMMON LIPID PARAMETERS IN MALARIA INFECTED PATIENTS

KRISHNA A. P.[1], CHANDRIKA[2], SUCHETHA KUMAR[3], MANASA ACHARYA[4] AND SHRIKANT L. PATIL[1]

*Departments of [1]*Physiology, [2]Pathology, [3]Biochemistry*
K. S. Hegde Medical Academy,
Mangalore – 575 018

(Received on January 14, 2009)

Abstract : The heart is remarkably resilient even in the face of heavy parasite sequestration and other vital organ dysfunction, and deaths from cardiac arrhythmias in severe malaria are rare. Malaria may prove fatal for patients with pre-existing cardiac failure due to valvular stenosis or myocardial disease. High grade fever, parasitaemia, and fluid overload can all contribute to the problem. Cardiac arrhythmias are very rarely observed in severe falciparum malaria. An attempt has been made to evaluate the risk factors for cardiovascular diseases in malaria infected patients. In the present study the levels of total cholesterol, low density lipoproteins, triglycerides were high and the levels of high density lipoproteins were low in malaria infected patients compared to controls. The markers of free radical induced injury i.e. malondialdehyde were high. The study therefore suggests the importance of assessing these markers of oxidative stress along with the other routine investigations in malaria infected patients for initiating therapy in addition to primary and secondary preventive measures to mitigate the devastating consequences hyperlipidemia in malaria infected patients leading to cardiovascular diseases.

Key words : malaria, total cholesterol, low density lipoproteins, high density lipoproteins

INTRODUCTION

Malaria is a major public health problem in tropical areas, and it is estimated that malaria is responsible for 1 to 3 million deaths and 300–500 million infections annually. The vast majority of morbidity and mortality from malaria is caused by infection with *P. falciparum*, although *P. vivax*, *P. ovale*, and *P. malariae* also are responsible for human infections (1). Severe malaria is a medical emergency requiring immediate hospitalization with prompt initiation of appropriate parenteral therapy to rapidly reduce and eliminate parasitaemia. Myocardial function is generally well preserved in severe falciparum malaria. The cardiac index may be elevated with low peripheral vascular resistance and low-to-normal ventricular filling pressures.

*Corresponding Author

Transitory changes in the plasma levels of lipids, cholesterol and triglycerides have been observed since a long time by many authors in different acute infections (2, 3). Hypocholesterolemia, hypertriglyceridemia and extreme decrease in HDL and LDL fractions were obsevered in complicated and uncomplicated malaria. (1, 2, 8). The magnitude of these changes seems related to the severity of malaria (8). Hyperlipidemia, a hallmark of malarial infection which may results in depletion of natural antioxidants and facilitates the production of reactive oxygen species (ROS) which has the ability to react with all biological molecules like lipids, proteins, carbohydrates, DNA etc and exert cytotoxic effects on cellular components (4). Thus increased ROS and impaired antioxidant defense contributes for initiation and progression of micro and macro vascular complications in malaria (5, 6). Hence a systematic approach has been made in the present study to focus on the cardiovascular risk factors in cases with malarial infection.

It was found difficult to establish correlation between the severity of malaria and extent of decline in levels of high density lipoprotein cholesterol in plasma. Earlier reports have shown that the pattern of plasma lipoprotein during acute malaria differs from that observed in other infective and inflammatory states. In this study we have monitored the different lipoprotein classes in patients during acute malaria and after treatment.

MATERIALS AND METHODS

The subjects of the present study were 110 patients diagnosed for different types of malarial infection. All the subjects, after obtaining their consent were examined clinically and information pertaining to age, sex, habits and health status was recorded in special case proforma. Blood samples were collected from both controls and patients for a series of laboratory investigations using standard protocols for estimation of lipid profiles, levels of MDA. The study has the approval of the institutional ethical committee, for biomedical research.

Patients diagnosed for malaria within age group of 15–55 years were included, treatment for malaria was continued during the study period. Diabetic and hypertensive patients, patients with past history of liver disease, myocardial infarction and renal diseases were excluded.

Estimation of lipid profiles: EDTA plasma was obtained from all subjects. Plasma cholesterol and triglyceride concentration were determined by enzymatic methods. HDL cholesterol concentration was determined from the clear supernatant obtained after precipitation of chylomicrons, VLDL and LDL adding phosphotungstic acid and magnesium ions.

Estimation of Lipid peroxidation: Estimation of plasma malondialdehyde (MDA) levels was carried out by the method of Gavino *et al.* (8). MDA is formed as an end product of lipid peroxidation, which reacts with TEA (Thiobarbuturic acid) to form a faint pink colored product. 0.5 ml of plasma was made up to 1 ml with saline and an equal volume of trichloroacetic acid (TCA) was added and

incubated at 37°C for 20 min. and centrifuged at 500 g. To 1 ml of TCA extract (the supernatant) 0.25 ml TEA was added and heated in a water bath at 95°C for 1 hour till a faint pink color appeares. After cooling the color was extracted in 1 ml butanol and the intensity was read at 532 nm using Shimadzu UV-240 spectrophotometer. 1,1,3,3 tetra ethoxypropane (1–100 n mol/ml) was used as the standard.

RESULTS

It was found that at the time of admission there was hypertriglyceridemia, hypocholesterolemia, decrease in HDL and LDL fractions. It was noted that blood samples of MP (Malaria Patients) positive patients showed lower concentration of HDL, LDL when compared to the samples of control group (Table I). Increase in VLDL fractions of lipoproteins and malondialdehyde (MDA) was also observed. This type of dyslipoproteinemia was present in most of the cases of PV (*P. vivax*), PF *(P. falciparum)* (Table II).

TABLE I: Comparison of lipid profiles of control group and malaria patients.

Mg/dl (Mean±SD)	*Control group (Mean±SD)*	*MP positive (Mean±SD)*
T. cholesterol	130±28.6	199.4±27.2*
HDL	43.25±12.15	36.16±5.04*
LDL	92.5±8.3	135.56±32.57*
VLDL	76.9±8.8	79.6±3.6*
TG	148.25±16.59	190.21±31.47*
Malondialdehyde (MDA) (nmoles/ml)	1.43±0.32	3.78±1.2*

Significant at *P<0.05.

TABLE II: Comparison between lipid profiles of two types of malaria.

Mg/dl (Mean±SD)	*P. falciparum (Mean±SD)*	*P. vivax (Mean±SD)*
T. cholesterol	171.8±9.9	122.7±9.7*
HDL	36.4±7.1	32±3.3*
LDL	93.2±1.8	56.6±6.3*
VLDL	30.1±3.8	34±4.6*
TG	162.8±15.9	170.1±23.1*
Malondialdehyde (MDA) (nmoles/ml)	4.02±0.582	4.12±0.32*

Significant at *P<0.05.

DISCUSSION

It was an established fact that acute infection and inflammation produce a moderate changes in plasma lipoprotein pattern in man, 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. In addition to this there is some impairment in lipoprotein lipase system also. The present study also made an attempt to estimate the levels of malondialdehyde, a marker of lipid peroxidation and found that the levels of MDA were higher in diabetics compared to respective groups.

The mechanism involved in lipid changes related to malaria remains still uncertain. They may be partly host related, i.e. related to an acute phase reaction. (Rosenson 1993) A selective uptake of HDL particles by P. falciparum has been speculated (Maurois et al 1978).

The present study extends the observation of earlier studies and clearly demonstrates that acute malarial infection produces a unique perturbation of plasma lipoprotein metabolism and reflects a multiple alterations in lipid and lipoprotein profiles in plasma. This further justifies the hypothesis looking for plasma lipid profiles in the diagnosis of malarial infection. In malaria, the lipoproteins are oxidatively modified, and the degree of oxidation is related with severity. Oxidized LDL from malarial patients increases the endothelial expression of adhesion molecules. These suggest the role of oxidized lipoproteins, especially LDL, on the pathogenesis of disease.

The most important risk factors contributing to the development of cardiovascular disorder include lipid disorders. Elevated levels of cholesterol, LDL and triglycerides as the risk factors in malaria have been demonstrated in several studies (9–11). In the present study the estimated levels of cholesterol, LDL, triglycerides were found to be significantly high compared to controls and the levels of HDL were lower than the controls.

This study highlights peculiarities in clinical presentation and outcome, as well as in some pathophysiological parameters of malaria patients. This will be helpful to a better understanding of the immunologic interactions incidental to malaria. Furthermore it could be very important in the early recognition and proper management of the occurrence of this deadly form of the disease.

ACKNOWLEDGMENTS

We are grateful to Indian Council of Medical Research, New Delhi for granting a Short Term Studentship (STS) to one of the author. We express our special gratitude to Dean, K. S. Hegde Medical Academy and President of Nitte Education Trust for their support and facilities extended to us.

REFERENCES

1. Nilson L–Ehle, Nilsson P–Ehle. Changes in Plasma lipoproteins in acute malaria. *Journal of Internal Medicine* 1990; 227: 151–155.
2. Gallin JI, Kaya DO, Leasy WM. Serum lipids in infection. *Engl Journal Med* 1953; 281: 1081–1096.
3. Jean-francois faucher, Edonard Ngou-Milaura Michael Anoumon Missinon Raphael Ngoma Maryvonne Kombila Peter G. Kremsher. Impact of malaria on common lipid parameters. *Parasitol Res* 2002; 88: 1040–1043.
4. Veerapan Khovidhunkit, Min-sun Kin, Reaz A, Memon, Judy K Shigenaga, Arthur H Moser, Kanneth R, Fingold, Carl Grunfeld. Thematic review series. The pathogenesis of atherosclerosis affects of infection and inflammation on lipid and lipoprotein metabolism, mechanism and consequences to the host. *Journal of Research Vol.* 2004; 45: 1169–1196.
5. Khovidhunkit V, Memon RA, Feingold KR, Grunfeld C. Infection and inflammation induced proatherogenic changes of lipoproteins. *J Infect Dis* 2000; 181: 8462–8472.
6. Sinnis P, Willow TE, Briones MR, Herz J, Nussenzweig V. Remnant lipoproteins inhibit malaria sporozoite invasion of hepatocytes. *JEM* 1996; Vol. 184: 945–954.
7. Kittl EM, Diridl G, Lenhart V, Neuwald C, Tomasits J, Pichler H, Bauer K. HDL–cholesterol as a sensitive diagnostic criterion in malaria. *Wein Klin Wochenschr* 1992; 104: 21–24.
8. Gavino VC, Miller JS, Ikharebha SO, Milo GE, Cornwall DG. Effects of polyunsaturated fatty acids and antioxidants on lipid peroxidation in tissue cultures. *J Lipid Res* 1981; 22: 763–769.
9. Mohanty S, Mishra SK. Das BS, Satpathy SK, Mohanty D, Patnaik JK, Bose TK. Altered lipid pattern in falciparum malaria. *Ann Top Med Parasitol* 1992; 86: 601–606.
10. Grellier P, Rigomier D, Clavey V, Fruchart JC, Schrevel J. Lipid traffic between high density lipoproteins and plasmodium falciparum infected red blood cells. *J Cell Biol* 1991; 122: 267–277.
11. Rosenson RS, Myocardial injury. The acute phase response and the lipoprotein metabolism. *J Am Coll Cardiol* 1993; 22: 933–940.