SERUM CHOLINESTERASE ACTIVITY IN PATIENTS WITH MALARIA INFECTION

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INTRODUCTION

Cholinesterases are enzymes which hydrolyse choline esters and produce free choline and the corresponding acid. These enzymes are classified into two main types, i.e., acetylcholinesterase or true cholinesterase which is predominant in nervous tissue, erythrocytes and striated muscle and cholinesterase or pseudo-cholinesterase which is found in plasma, skin and other tissues.

Much evidence has been accumulated to support the concept that the serum cholinesterase molecule is synthesized in the liver (Kunkel and Ward, 1947; Sawyer and Everett, 1947). When the hepatic parenchyma is diseased, the serum cholinesterase activity is almost invariably depressed. The depression of this enzyme tends to be more marked in patients with chronic liver disease such as cirrhosis than in patients with acute conditions such as viral hepatitis and acute anoxic hepatomegaly.

Malaria is an acute infection which may affect the liver. The liver is usually somewhat enlarged with gross congestion of the sinusoids and centrilobular veins by parasitized erythrocytes. The disturbance of liver enzymes such as serum glutamic oxaloacetic transaminase (SGOT), serum glutamic pyruvic transaminase (SGPT) and lactate dehydrogenase (LDH) have been reported in patients with malaria infection (Sadun *et al.*, 1965; 1966;. Jervis *et al.*, 1968; Schnell *et al.*, 1969). However, data on serum cholinesterase level in such patients were not available. The objective of the present study was to record changes in serum cholinesterase activity in patients with *Plasmodium falciparum* malaria.

MATERIALS AND METHODS

The study was carried out on 87 patients of both sexes with *P. falciparum* malaria who were admitted into the Bangkok Hospital for Tropical Diseases. Their ages ranged from 18 to 45 years. Seven of 87 patients were followed up for this study for 6 weeks after admission. Venous blood samples were taken from antecubital vein of non-fasting patients for the determination of haemoglobin, haematocrit, serum albumin and serum cholinesterase levels. The study was also performed on 80 non-fasting blood donors of both sexes for comparison.

Serum cholinesterase levels were determined by the micro-method of Garry and Routh (1965) using acetylthiocholine as a substrate. The cholinesterase activity is expressed in international units (I.U.). One I.U. is equivalent to the micromoles of sulfhydryl groups liberated in one minute from 1 ml of serum. Serum albumin concentration was determined by the biuret method (Hawk *et al.*, 1954).

Haemoglobin concentration was determined using the cyanmethaemoglobin method and haematocrit values were obtained after centrifuging the blood for 5 minutes at 10,000 g.

RESULTS

Results of serum cholinesterase and serum albumin levels in patients during the acute attack with *P. falciparum* malaria and at the convalescent stage are shown in Table 1. During the acute attack with malaria, patients had significantly lower serum cholinesterase and albumin concentrations than those of the normal subjects. However, after treatment, these values returned to the normal levels. The alteration of these serum cholinesterase activities in 5 patients with *P. falciparum* malaria during treatment in the hospital are illustrated in Fig. 1. It is apparent from this figure that the depressed serum cholinesterase level increase progressively and return to the high or normal level within 4 - 6 weeks after treatment.

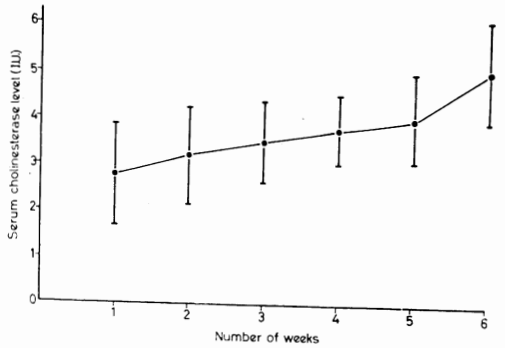

Fig. 1—Alteration of serum cholinesterase activity in 7 patients with *P. falciparum* during treatment in the hospital.

There was a direct relationship between serum albumin concentrations and serum cholinesterase levels in these patients as illustrated in Fig. 2. This finding indicated that the low serum albumin concentration during the acute attack of malaria increased in parallel with the elevated serum cholinesterase activity during the convalescent stage.

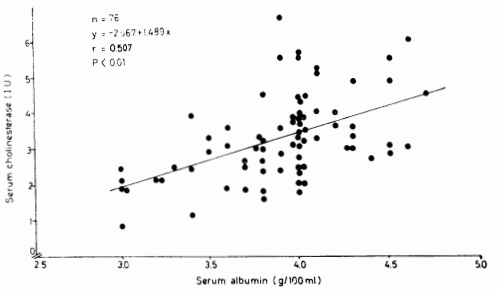

Fig. 2—Showing the relationship between serum albumin concentration and serum cholinesterase level in 76 patients with malaria.

DISCUSSION

Results in the present study showed that serum cholinesterase level in patients with acute attack of *P. falciparum* malaria was significantly lower than that of normal subjects and these values returned to normal after treatment. As serum cholinesterase is synthesized in the liver and as acute malaria is usually associated with profound liver

Table 1

Serum cholinesterase and serum albumin levels in patients with malaria infection.

	No.	Serum cholinesterase Level (I.U.) Mean ± S.D.	Serum albumin level (gm/100 ml) Mean ± S.D.
Malaria patients			
- acute infection	32	2.69±0.87	3.37±0.37
- convalescent stage	55	3.40±1.16	4.00±0.37
Normal subjects	80	3.16±0.62	4.50±0.38

T-test : Serum cholinesterase and serum albumin concentration in patients with acute infection *vs* normal subjects, $P < 0.01$; patients at convalescent stage *vs* normal subjects, $P > 0.05$.

involvement, it is therefore likely that the malarial parasites affected the synthesis and/or metabolism of this enzyme in the liver. This finding is in accordance with results of the alteration of liver enzymes in malarial infection previously reported. Alterations of many liver function tests indicating early inhibition of certain important liver functions has been observed during the acute phase of *P.berghei* infection in mice, chimpanzees infected with *P.falciparum* and man infected with *P.falciparum* (Sadun *et al.*, 1965, 1966; Jervis *et al.*, 1968; Schnell *et al.*, 1969).

Results in the present study also showed that serum albumin concentration in patients with *P.falciparum* malaria is significantly lower than that of the normal subjects. This finding confirmed the results reported earlier. It has been shown that malarial patients had a significantly smaller amount of total proteins due to a decrease in albumin and the increase in beta and gamma globulins (Sadun *et al.*, 1966).

Many authors reported the close correlation between levels of serum albumin and serum cholinesterase in some conditions. All available evidence suggested that cholinesterase is produced in parallel with the albumin molecule and its synthesis seems to be stimulated or inhibited by factors which stimulate or inhibit albumin production (Levine and Hoyt, 1950; Hunt and Lehman 1959). Findings of decreased serum cholinesterase level in parallel to the lower serum albumin concentration in these patients indicated that acute malaria infection could bring about the disturbance of certain liver function even in the absence of clinical evidence of hepatic insufficiency.

As the physiologic function of serum cholinesterase enzyme is not yet known, it is therefore difficult to assess the significance of the low serum cholinesterase activity in patients with malaria infection. The temporary low serum cholinesterase activity in malarial patients during the acute attack stage as shown in the present study indicated the feasibility of staging the malarial attack on the basis of the cholinesterase activity.

SUMMARY

Serum cholinesterase activities were determined in 87 patients of both sexes with *P.falciparum* malaria in comparison to those of 80 blood donors. Patients with acute *P.falciparum* malaria had significantly lower serum cholinesterase activity than those of the control group. After treatment, their serum cholinesterase levels returned to the normal level. Serum albumin concentration also showed the same pattern and had a direct relationship to those of serum cholinesterase levels. These findings indicated that malarial parasites had some effect on the liver cells which resulted in impaired hepatic synthesis of serum cholinesterase and albumin concentrations. This result therefore add new information that there was a disturbance of enzyme cholinesterase among many liver enzymes that have been shown to be altered during an acute malarial attack.

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