

## A note on the serum potassium level among Thai hospitalised patients with falciparum malaria

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Potassium is an important metal and is the seventh most abundant and makes up about 2.4% by weight of the earth's crust. Potassium is an essential constituent for plant growth and is found in most soils. It is an element that is essential for the body's growth and maintenance. It is necessary to keep a normal water balance between the cells and body fluids. Potassium also plays an essential role in the response of nerves to stimulation and in the contraction of muscles. Cellular enzymes need potassium to work properly. Potassium is the major positive ion within cells and is particularly important for maintaining the electric charge on the cell membrane, which is necessary for neuromuscular communication and for transporting nutrients into cells and waste products out of the cell. The concentration of potassium inside cells is about 30 times that in the blood and other extracellular fluids. Small changes in the potassium concentration outside cells can have substantial effects on the activity of nerves and muscles. Therefore, measurement of serum potassium is one of the important tests in laboratory medicine. Low levels of potassium cause increased activity, whereas high levels cause decreased activity. Episodic muscular weakness, commonly associated with alterations of serum potassium, is the cardinal feature of periodic paralysis.

The aberrant of the serum potassium has been mentioned in several diseases including malaria<sup>1–2</sup>, an important tropical infectious disease. Indeed, the combination of transient hyperkalemia (high serum potas-

sium level) and rigours occurring during febrile episodes of malaria is suggested as the underlying cause, which can precipitate the muscular paralysis in the infected subjects. The present communication deals with the correlation of the serum potassium level and the characteristics of patients with falciparum malaria. Of interest, no specific correlation between the serum potassium level and the malarial infection rate was found.

The medical records of the inpatients who had been diagnosed as cases of falciparum malaria, at the King Chulalongkorn Memorial Hospital, Bangkok, Thailand, at some time between January 1997 and December 2001, were retrospectively reviewed. The medical records are available after asking the permission from the hospital. Since this is a retrospective study on the medical records, not an experimental study, there is no ethical problem. The inclusion criteria are: (i) the cases with falciparum malaria; and (ii) the cases with complete medical records for further analysis. The total numbers of subjects (sample size) in this study are equal to the number of all recruited cases for further study. In each case, the malaria was diagnosed on the basis of the detection of the organism in the thick or thin film examination. The data collected from the records included sex and age of each patient, the symptoms and signs, and the percentage of parasitaemia. The results from laboratory investigations were reviewed as well. The multiple logistic regression analysis was used for determining the correlation

between the serum potassium and the patients' characteristics. All the statistical analyses were performed using SPSS 7.0 for Windows Program. A total of 93 patients, 48 males and 45 females (age range 1–82 yr) with falciparum malaria were included in this study. Average duration of illness was  $6.61 \pm 4.94$  days. Range of parasitaemia was equal to 2 to 12%. None of the infected cases developed renal failure and there was no reported change of ECG.

In the present analysis, serum potassium level showed no significant correlation to the percentage of parasitaemia. On admission, the average serum potassium was  $3.80 \pm 0.47$  mg/dL (range, 3.3 to 4.7 mg/dL). Concerning the multiple logistic regression analysis, no significant correlation was found between serum potassium level and the other parameters (Table 1).

**Table 1. Results from regression analysis between serum potassium level and the patients' characteristics**

Patients' characteristics	Correlation coefficient (r)	p-value
Age	0.34	0.27
Sex	0.25	0.20
Duration of present illness	0.32	0.42
Duration of hospitalisation	0.27	0.11
Occurrence of complication	0.48	0.24
White blood count	0.27	0.42
Haematocrit (%)	0.14	0.46
Haemoglobin (g/dL)	0.18	0.34
Platelet count	0.24	0.42

Malaria is an important potentially deadly mosquito-borne disease characterised by cyclical bouts of fever with muscle stiffness, shaking and sweating in the tropical countries<sup>3–4</sup>. A wide spectrum of this disease has been reported. Malarial parasites reproduce asexually inside the erythrocytes of their vertebrate host. However, relatively little is known about the interaction between host cell and parasite metabolism. According to the study of Ginsburg *et al*<sup>5</sup>, compart-

ment analysis of infected cells revealed that host cell cytosol is poor in potassium and rich in sodium while in the parasite and the serum this relationship is reversed, indicating that the parasite is able to regulate its ionic composition independently. Sherman & Tanigoshi<sup>6</sup> reported this similar pathophysiology change in the *Plasmodium lophurae* model.

The aberrant in serum potassium level is one of the common laboratory abnormality seen in the patients with malaria. According to the study of Sowunmi<sup>2</sup>, 7 of 51 patients with severe malaria presented the hyperkalemia. The periodic paralysis complicating malaria had been reported and mentioned for its correlation to the abnormal high level of serum potassium<sup>1</sup>.

Brooks *et al*<sup>7</sup> reported the correlation of the serum potassium and the haemolysis of red blood cell in the patients infected with malaria, which brought the complications. Acidosis is now recognised as an important component of the severe malaria syndrome and a predictor of fatal outcome<sup>8</sup>. Alterations in plasma potassium concentrations are commonly associated with acidosis<sup>8</sup>. However, Maitland *et al*<sup>8</sup> noted that the abnormality of potassium was often not apparent on admission. Of interest, no previous study on the correlation of the serum potassium and the percentage of parasitaemia was established. Here, we performed a retrospective study to find whether there was any correlation between the serum potassium and the percentage of parasitaemia of the patients with falciparum malaria.

According to the present study, serum potassium level showed no significant correlation to the percentage of parasitaemia and also other characteristics of the patients such as age, sex, duration of present illness, duration of hospitalisation, white blood count, haematocrit and platelet count as well. In conclusion, we could not demonstrate the correlation between the serum potassium level and the patients' characteristics or the percentage of parasitaemia among study

subjects. Based on the author's setting, the derived model can reflex that the serum potassium level on admission is not useful for prediction for the fate of falciparum infection.

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