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Original Research Article

Type of Malarial Parasitaemia and Effect on Electrolyte Disturbance: A Study at Tertiary Care Centre

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Abstract

Introduction: Malaria is a common parasitic disease which has remarkable morbidity and mortality in all over the world. In malaria electrolyte imbalances and mineral disturbances are common clinical manifestations. Since Na+ (sodium) and K+ (potassium) are very important for the electrolyte homeostasis in human body. In malaria it is necessary to estimate the levels of these electrolytes in all cases for better management of patients. *Materials and methods:* The present cross sectional study was carried out over a period of 1 year in the tertiary care hospital, India. All the haematological and biochemical analysis were performed including examination of the thick and thin peripheral smears for malarial parasite. All the confirmed patients of malaria above 1year of age were included in study. The data from the study was analyzed statistically. *Results:* The incidence of P. falciparum was more than P. Vivax in the present study population. Serum sodium and potassium significantly decreased in falciparum malaria as compared to vivax malaria. Furthermore serum sodium and potassium level were significantly low in the age group of 1-15 years. *Conclusion:* We can conclude from the present study that serum sodium and potassium are good markers for the severity of the malarial infection. We can prevent complications in malaria patients of all ages by estimating serum electrolytes.

Keywords: Plasmodium Falciparum; Malaria; Plasmodium Vivax; Sodium; Potassium.

Introduction

Malaria is a common parasitic disease which has remarkable morbidity and mortality in all over the world. Approximately 500 million individuals become the victim of malaria each year. Malaria is caused by protozoa of genus *Plasmodium*. It is a highly devastating parasite and causing red blood cells lysis. In all over the world total four species of Plasmodium cause malaria in humans. *Plasmodium* falciparum, *Plasmodium* vivax, *Plasmodium* malariae and *Plasmodium* Ovale are the different species of Plasmodium. Two species of *Plasmodium*, *P. falciparum* and *P. vivax* are more responsible

for majority of morbidity and mortality. Among these, infections because of *P. Falciparum are* if left untreated might cause multi organ failure and even death [1,2].

The most common sign and symptoms of malaria are fever with chills and rigors, headache, vomiting and other flu-like symptoms. Treatment of malaria must be started as early as possible because the infection can progress rapidly to become life-threatening [3,4]. In so many infectious diseases electrolyte imbalances and mineral disturbances are common clinical signs. In most of the cases of malaria hyponatraemia, hyperkalaemia, hypocalcaemia and hypomagnesaemia are the common findings [5]. Since Na+ (sodium) and K+ (potassium) are very important for the electrolyte homeostasis in human body. In malaria it is necessary to estimate the levels of these electrolytes in all cases for better management of patients.

The aim of the present study is to find out the levels of Na+ and K+ in malarial patients infected with both *P. vivax* and *P. falciparum*.

Material and Methods

The present cross sectional study was carried out over a period of 1 year (January 2017 - December 2017) in the tertiary care hospital of India. All the indoor as well as Out Patient Department (OPD) patients with clinically suspected malaria (as per the WHO criteria) were included in the study. The written and informed consent was taken from the patient or patient's relatives in case of minor. The thick and thin peripheral smears were prepared and examined for malarial parasite by pathologists. All the confirmed patients of malaria above 1year of age were included in study. The demographic details of all the study population, their complete history with general and systemic examination with all haematological and biochemical laboratory investigations were entered in a preformed proforma. All the data was analyzed statistically and presented as mean ± SD.

Results

According to Table 1, the incidence of P. falciparum was more than P. Vivax in our study population. In the present study males were more prone to had malarial infection as compared to females. The cases of P. falciparum and P. Vivax were more in the age group of 30 to 45 years in the present study. According to Table 2, serum sodium and potassium significantly decreased in falciparum malaria as compared to vivax malaria. Furthermore serum sodium and potassium level were significantly low in the age group of 1-15 years.

Discussion

Many of the infectious diseases are creating havoc among the human beings. Malaria is playing a major role among all of them around the world. World Health Organization (WHO) estimated 198 million cases and 5,84,000 deaths due to malaria in 2013 [6]. Malaria is caused by the bite of the female anopheles mosquito. There are also chances of spread of malarial parasite via blood transfusion. In India infection by P. falciparum and P. Vivax are much more common out of all four species of plasmodium [7].

Table 1: Age and Sex wise distribution of cases of P. Falciparum and P. Vivax.

Age (Years)	Male		female		Total
	P. Falciparum	P. Vivax	P. falciparum	P. Vivax	
1-15	04	03	02	05	14
16-30	12	18	08	13	51
31-45	21	29	20	28	98
>45	10	13	05	09	37
Total	47	63	35	55	200

Table 2: Distribution of malarial patients according to age and serum sodium (Na+) and potassium (K+) levels.

Age (Years)	P. Falciparum		P. Vivax	
	Na + (m mol/L)	K + (m mol/L)	Na + (m mol/L	K + (m mol/L)
1-15	126.71 ±1.08	3.01± 0.52	129.26±2.01	3.14± 0.26
16-30	128.60 ±2.66	3.18± 0.61	130.51±2.05	3.23± 0.53
31-45	130.53±1.68	3.23± 0.05	131.27±2.48	3.39± 0.72
>45	127.18±1.47	3.11± 0.43	130.43±2.71	3.18± 0.61

Results showed as Mean ± SD. Reference ranges for sodium (Na+): 136-145 m mol/L and potassium (K+): 3.5-5 m mol/L

Patients of severe malarial infection always have electrolyte imbalance. In the current era of recent advance correction of fluid and electrolyte imbalance is essential element of the treatment of patients with severe malarial infection.

The important clinical signs of sepsis syndrome are disturbances in potassium, calcium, magnesium, and phosphate levels. Though it is very much important to treat fluid and electrolyte imbalance in patients of severe P.falciparum malaria, recommendations for the management at present is not defined [8].

In human body Potassium (K) is essential for accurate functioning of all body cells, tissues and organs. It is also helpful in balancing blood pH and water levels in the body. The main function of Potassium (K) is skeletal and smooth muscle contraction. Hypokalaemia is a common complication of severe malaria. In this way, Potassium (K) is very important for the normal physiology of human body [9].

In the present study findings showed that there was decline in K level due to *Plasmodium* infection. The studies by Yoel C and Ikekpeazu EJ, et al. showed the same results that malarial infections causes decrease in K level [10, 11]. In the study by Memon AU, et al. showed that because of malaria there was enhanced urinary removal of K and patient developed hypokalemia [12].

Sodium (Na) is known as the essential element of extracellular fluid. In various body fluids Sodium (Na) plays important role for normal distribution of water and osmotic pressure. Many abnormal clinical conditions are known because of Na+ ion disturbance. During malarial infection hyponatraemia are known to occur. Decreased level of Na exaggerates the disease symptoms and results in severe malaria.

In the present study results showed that malarial infection lead to a decrease in the levels of electrolytes (sodium and potassium). Serum sodium and serum potassium in the cases of P. falciparum malaria were markedly reduced as compared to those in the cases of P. vivax malaria. Hyponatraemia and hypokalaemia were more common in P. falciparum than in P. Vivax malaria. In contrast to our study Baloch S, et al. [13]. showed that there was increased level of sodium (Na) and potassium (K) in the patients of malarial infection. Baloch S, et al. [13]. also proved that there was decrease level of chloride in malarial patients.

The results of study by Fryatt RJ, et al. [14]. and Dworak, et al. [15]. supported the findings of our study. Both the study showed that hyponatraemia and hypokalemia could be present in the acute stages of malaria infection.

In the present study patients of 1-15 years of age was affected more by hyponatraemia and hypokalemia. We could not able to give explanation for this. Further study is warranted to explore this association between electrolyte imbalance and malaria infection. From the present study, we can use the serum Na+ and K+ level as prognostic marker for malarial infection and can prevent further complications.

Conclusion

We can conclude from the present study that serum sodium and potassium are good markers for the severity of the malarial infection. We can prevent complications in malaria patients of all ages by estimating serum electrolytes.

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