



Original Research Article

Study of sodium and potassium ion disturbances in malaria at Ahmedabad, Gujarat, India

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Abstract

Background: Malaria is an endemic disease in Gujarat, caused by the bite of the female anopheles mosquito. Electrolyte disturbances particularly hyponatremia is a common complication in malaria.

Aim: To determine sodium and potassium ion disturbances in malaria cases at Ahmedabad, Gujarat.

Material and methods: Total 200 indoor and outdoor patients of malaria who came to tertiary care hospital, Ahmedabad during period of July – 2013 to June – 2014 were included in present study. Patients were diagnosed for malaria after the examination of both thick and thin film peripheral smears and malarial antigen detection rapid card test. All patients were subjected to relevant laboratory investigations like complete blood count and serum electrolyte (sodium and potassium ion).

Observation: Hyponatremia and hypokalemia were more common in both *P. Falciparum* and *P. Vivax* malaria. Severity of hyponatremia and hypokalemia were more in *P. Falciparum* than *P. Vivax*.

Conclusion: Serum electrolytes must be estimated in each malaria case to prevent grave complications.

Key words

Malaria, Hyponatremia, Hypokalemia, *P. Falciparum*, *P. Vivax*.

Introduction

Malaria is parasitic infection and it is an endemic disease in Gujarat, caused by the bite of the female anopheles mosquito. Almost half of world's population is vulnerable to malaria and

its life threatening complications [1]. Approximately 300-500 million cases of morbidity and 2-3 million cases of mortality were reported annually due to malaria [1]. Four species of *Plasmodium* like *P. Falciparum*, *P. Vivax*, *P. Malariae* and *P. Ovale* are known to cause malaria in humans. Out of these four, *P. Falciparum* is more responsible for mortality and severe complications [2], which include cerebral malaria, anaemia and renal failure [3].

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P. Falciparum and *P. Vivax* species are more prevalent in India [4]. Sodium ion plays a key role in the maintenance of the normal distribution of water and osmotic pressure in various fluid compartments [5] whereas potassium ion is a major intracellular cation [6]. Electrolyte disturbances particularly hyponatremia is a common complication in malaria. Increased secretion of vasopressin plays an important role in development of hyponatremia in malaria [7]. Aim of present study was to determine sodium and potassium ion disturbances in malaria cases at Ahmedabad, Gujarat.

Material and method

The present study was conducted at tertiary care hospital of Ahmedabad, Gujarat between period of July – 2013 to June – 2014. Total 200 indoor and outdoor patients of malaria were included in the study after obtaining their informed written consent. Patients were diagnosed for malaria after the examination of both thick and thin film peripheral smears and malarial antigen detection rapid card test. Demographic profile and complete history with vitals for each patient were noted. All patients were subjected to relevant laboratory investigations like complete blood count and serum electrolyte (sodium and potassium ion). Complete blood count was done by automated hematology analyser and serum electrolytes were measured by fully automated electrolyte analyser. Hyponatremia is defined as decrease in plasma sodium concentration to <135 m.mol/l [8]. Hypokalemia is defined as decrease in the plasma potassium level to <3.5 m.mol/l. Data were analysed and presented as mean \pm standard deviation.

Observation

Out of 200 patients of malaria, 94 were male and 106 were female. Among male patients, prevalence of *P. Falciparum* and *P. Vivax* malaria was 50% each. Among female patients, 58 were diagnosed for *P. Falciparum* malaria and 48 were diagnosed for *P. Vivax* malaria. Prevalence of *P. Falciparum* malaria was high in age group of 31-40 years in both male and female. Prevalence of *P. Vivax* malaria was high in age group of 31-40 years in male and 21-30 years in female as per **Table – 1**. Hyponatremia and hypokalemia were more common in both *P. Falciparum* and *P. Vivax* malaria. Severity of hyponatremia and hypokalemia were more in *P. Falciparum* than *P. Vivax* as per **Table – 2** and **Table – 3**.

Discussion

One of the major causes of mortality and morbidity in India is malaria. Approximately 300-500 million cases of malaria are noted every year and more than 1 million die each year [9]. *P. Falciparum* species of malaria is usually associated with the severe and complicated forms [10].

Mild hyponatremia in the acute stages of malaria did not usually affect the mortality and the morbidity as per Fryatt RJ, et al. [11]. Mild hyponatremia in the malaria patients were also noted by Kakkilaya [12]. There was a gradual decrease in the sodium and potassium ion levels within 12 hours of the parasite's occupancy as per Dworak et al. [13]. Ebele J Ikekeazu, et al. [14] also reported reduction in the sodium and potassium ion level in malaria. Cells lost up to 75-80 % of their potassium content during the course of the malaria attack as per Heindricks et al. [15].

Chairul Yoel, et al. [16] reported that the concentrations of sodium and potassium were within normal range in malaria. Information about changes in levels of electrolytes other



than sodium [7] in cases of falciparum malaria came from a study involving Thai adults [17]. Urinary potassium wasting and hypokalemia are common complications of severe malaria and potassium depletion becomes apparent only with correction of acidosis [18]. Sodium and potassium ions play vital role in water homeostasis, which is must for survival of all individuals, so it is advisable to determine their levels in all cases of P. Falciparum malaria as per Bradley, et al. [19].

Conclusion

Electrolyte disturbances like hyponatremia and hypokalemia are often to occur in both P. Falciparum and P. Vivax malaria. Severity of hyponatremia and hypokalemia are more common in P. Falciparum than in P. Vivax malaria. Serum electrolytes must be estimated in each malaria case to prevent grave complications.

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

Age (Years)	P. Falciparum		P. Vivax	
	Male	Female	Male	Female
<10	2	1	3	2
11-20	5	7	2	4
21-30	11	8	9	13
31-40	13	18	15	11
41-50	12	17	10	11
>50	4	7	8	7
Total	47	58	47	48

Table – 2: Mean ± SD of sodium and potassium ion in P. Falciparum and P. Vivax.

Gender	P. Falciparum		P. Vivax	
	Sodium ion	Potassium ion	Sodium ion	Potassium ion
Male	126.71 ± 1.46	3.02 ± 0.51	131.48 ± 1.62	3.24 ± 0.41
Female	126.52 ± 1.82	3.08 ± 0.68	131.76 ± 1.86	3.28 ± 0.32



Table – 3: Sodium and potassium ion level in malaria cases.

Electrolyte level		P. Falciparum	P. Vivax
Sodium ion	125-128	87	11
	129-132	15	72
	>132	5	12
Potassium ion	<3	31	11
	3-4	68	77
	>4	8	7