

Original Research Article

Study of effect of malaria parasitemia on serum electrolytes in south-east Rajasthan

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Abstract

Background: Malaria is a life threatening disease caused by Plasmodium parasites that are transmitted to people through the bites of infected female Anopheles mosquitoes.

Aim: To study of effect of malaria parasitemia on serum electrolytes in south east Rajasthan.

Materials and methods: It was a hospital based study done on malaria indoor patients from June 2017 to March 2018 in Jhalawar Medical College, Jhalawar in South East Rajasthan. The relevant history, systemic examinations and thick and thin peripheral blood smear, malaria antigen detection rapid card test was performed and serum electrolytes like sodium, potassium and calcium level were done for all patients. All patients were categorized into three groups like P.falciparum, P.vivax and mixed infection (both P.falciparum, P.vivax).

Results: We observed that female was out numbered than male. Most common affected age group was 35-45 years and most of the patients came from the rural region. Severe dyselectrolytemia was noted in mixed infection (both P.falciparum and P.vivax) and P.falciparum cases.

Conclusion: Serum electrolytes level are influenced by the presence of all types of malaria severely with mixed infection and P.falciparum positive cases so severe dyselectrolytemia in malaria infections should be treated timely to prevent grave complications.

Key words

P.falciparum, Mixed infections, Dyselectrolytemia, Malaria, P.vivax.

Introduction

Malaria is a life threatening disease caused by Plasmodium parasites that are transmitted to

people through the bites of infected female Anopheles mosquitoes. Six major species of Plasmodium cause nearly all cases of human disease: P.falciparum, P.vivax, two

morphologically identical sympatric species of *P. ovale*, *P. malariae*, and *P. knowlesi* [1]. Approximately 300-500 million cases of morbidity and 2-3 million cases of mortality were reported annually due to malaria [2]. *P. falciparum* is more responsible for mortality and severe complications [3], which include cerebral malaria, dyselectrolytemia, anemia and renal failure [4]. Electrolytes plays important role in the normal functioning of human body. Electrolyte imbalance and mineral disturbances is the common clinical manifestation in severe malaria.

Materials and methods

It was a hospital based cross sectional study conducted at tertiary care hospital in Jhalawar in south east Rajasthan between period of June 2017 to March 2018. Total 256 patients of malaria were enrolled for this study after obtaining informed consent. All the patients were asked about demographic data's (age, sex, and region). Patients were diagnosed for malaria after examination of both thick and thin peripheral blood smear and malaria antigen detection Rapid card test. All the patients underwent through systemic examination and vital were recorded for each patient. Serum electrolytes like sodium, potassium and calcium was done for all indoor patients. All data's were compiled and analyzed by SPSS software.

Results

A total 256 patients were examined and observed that out of 256 patients, 153 (59.76%) were females and 103 (40.24%) were males. There was female preponderance with sex ratio 3:2. Out of 256, majority - 215(83.98%) was from rural and remaining - 41(16.02%) were from urban region. In aspect of age group, 48(18.75%) patients were between 15-25 years, 75 (29.29%) were between 25-35 years, 91 (35.54%) were between 35-45 years, 30(11.72%) were between 45-55 years and remaining 12 (4.68%) were more than 55 years (**Table – 1**). Out of 256 patients, 144 (56.25%) were *P. falciparum* positive and 86 (33.59%) were *P. vivax* positive and 26 (10.15%)

were mixed (both *P. falciparum* and *P. vivax* positive) (**Graph – 1**). Serum electrolytes results showed that hyponatremia, hypokalemia and hypocalcemia is more common in mixed and *P. falciparum* positive patients. 84 patients of *P. falciparum* positive cases and 36 *P. vivax* patients and 17 mixed infections patients had hyponatremia (<135 mEq/l) and 52 patients of *P. falciparum* and 46 *P. vivax* patients and 7 mixed had normal sodium level (135-145 mEq/l) and 8 patients of *P. falciparum* and 4 *P. vivax* patients and 2 mixed infections patients had hypernatremia (>145 mEq/l) (**Table - 2, Graph – 2**). After doing serum potassium we found that in *P. falciparum* positive cases 76 patients, and 34 *P. vivax* patients and 15 mixed infections patients had hypokalemia (<3.5 mEq/l). 62 patients of *P. falciparum*, 49 *P. vivax* patients and 9 mixed infections patients had potassium level in range of 3.5-4.5 mEq/l. 6 patients of *P. falciparum* and 3 patients of *P. vivax* patients and 2 mixed infections patients had potassium level in between 4.5-5.5 mEq/l (**Table - 3, Graph – 3**). Measurement of calcium level showed that 94 patients of *P. falciparum*, 43 patients of *P. vivax* patients and 18 mixed infections patients had hypocalcemia (<9 mg/dl) and 45 patients of *P. falciparum*, 41 patients of *P. vivax* and 7 mixed infections patients had normal calcium level (9-11 mg/dl) and 5 patients of *P. falciparum*, 2 patients of *P. vivax* and 1 patients of mixed infections had hypercalcemia (>11 mg/dl) (**Table - 4, Graph – 4**).

Discussion

One of the major causes of mortality and morbidity in India is malaria. Two species of Plasmodium, *P. falciparum* and *P. vivax* are widespread and responsible for majority of deaths. Among these, infections resulting from *P. falciparum* if untreated might cause kidney and brain complications and even death [5].

Electrolytes are important for the normal physiology of life. These are the ionized salts (minerals) present in human body fluids and blood stream. The whole body acts like a

bioelectric organism and electrolytes are both the switch and the energy source for our body [6]. Electrolyte disturbance is known to be common complication in severe malaria and acts as an indicator of severity of disease [7], because they are usually associated with the severe *P. falciparum* and *P.vivax* malaria or mixed infection.

Table - 1: Effect of age, gender and region on the prevalence of malaria.

Variables	No. of patients	%
Age (in years)		
15-25	48	18.75
25-35	75	29.29
35-45	91	35.54
45-55	30	11.72
>55	12	4.68
Gender		
Male	103	40.24
Female	153	59.76
Region		
Rural	215	83.98
Urban	41	16.02

Table - 2: Effect of malaria parasite on sodium level.

(In mEq/l)	<i>P. falciparum</i>	<i>P. Vivax</i>	Mixed
<135	84	36	17
135-145	52	46	7
>145	8	4	2

Table - 3: Effect of malaria parasite on potassium level.

(In mEq/l)	<i>P. falciparum</i>	<i>P. Vivax</i>	Mixed
<3.5	76	34	15
3.5-4.5	62	49	9
>4.5	6	3	2

Table - 4: Effect of malaria parasite on calcium level.

(In mg/dl)	<i>P. falciparum</i>	<i>P. vivax</i>	Mixed
<9	94	43	18
9-11	45	41	7
>11	5	2	1

Mild hyponatremia in the acute stages of malaria did not usually affect the mortality and the morbidity as per Fryatt RJ, et al. [8]. Mild hyponatremia in the malaria patients were also noted by Kakkilaya [9]. There was a progressive decrease in the sodium and potassium ion levels within 12 hours of the parasite's occupancy as per Dworak, et al. [10]; Ebele J Ikekpeazu, et al. [11] also reported reduction in the sodium and potassium ion level in malaria.

Heindricks, et al. reported that Host Cells loose up to 75-80 % of their normal potassium content during the course of the malaria attack [12]. Enhanced urinary removal of potassium and hypokalemia has been reported as common outcomes of malaria.

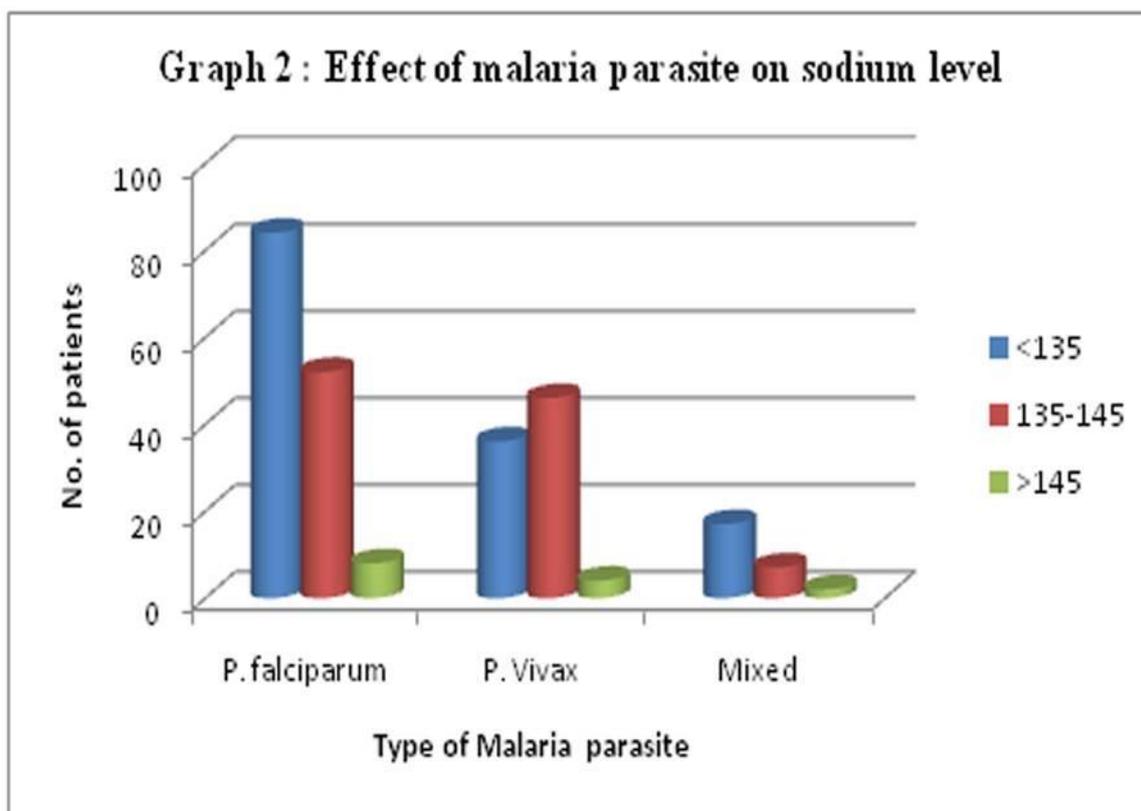
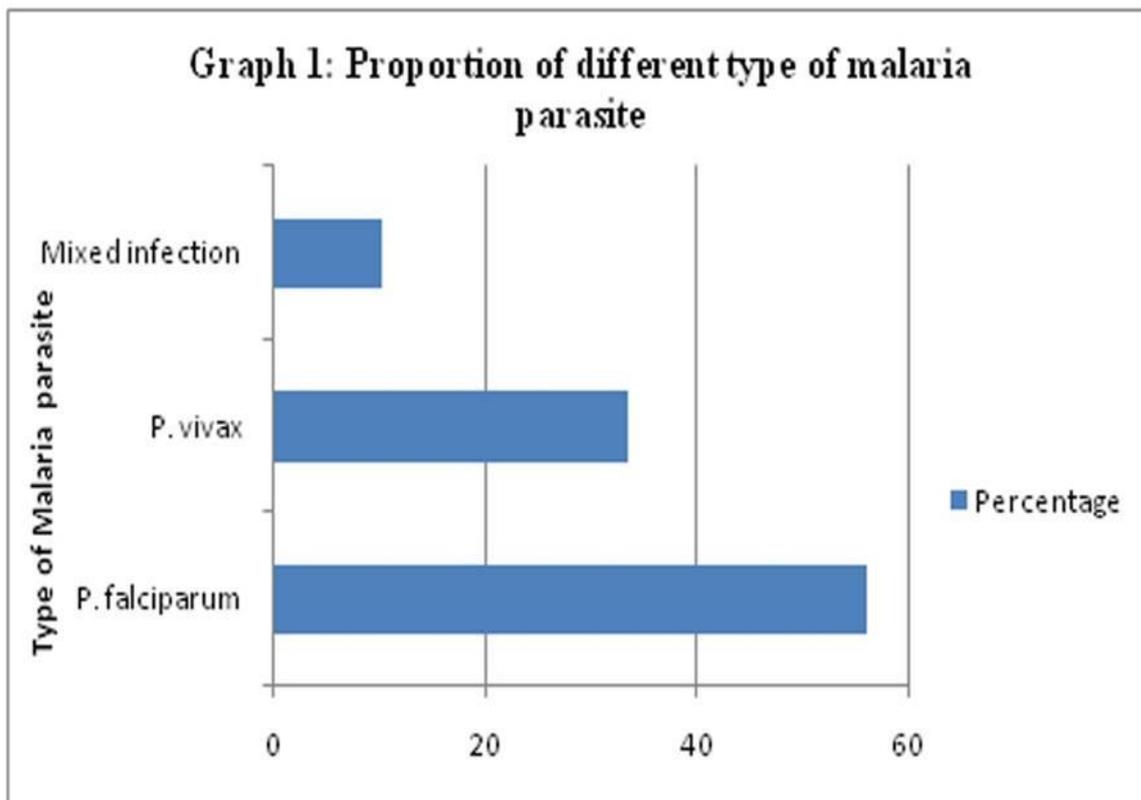
Several studies have reported that an increased secretion of vasopressin (ADH), either appropriately or inappropriately, plays an important role in the low level of sodium in malaria because sodium may enter into the infected cells and result in loss of blood [13]. Ikekpeazu, et al. also observed reduction in the Na level of malaria patients [14]. Hyponatremia has been reported to occur frequently in patients suffering from *P. falciparum* malaria than in *P. vivax* malaria [15, 16].

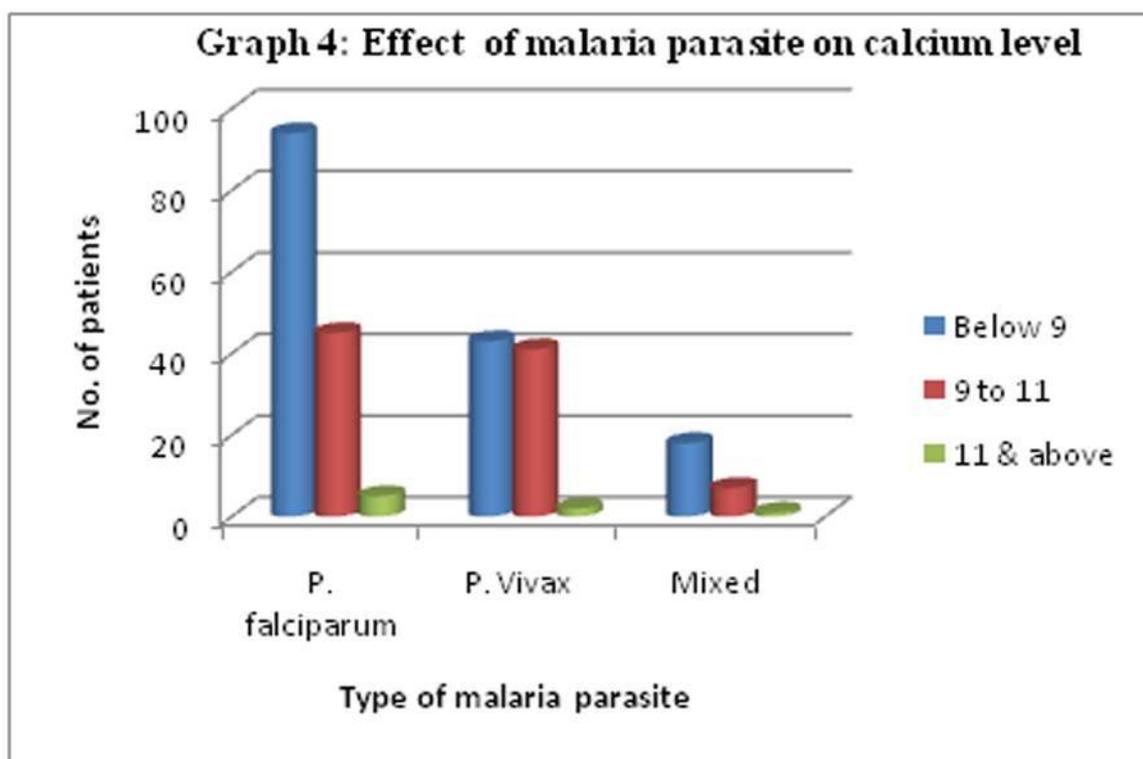
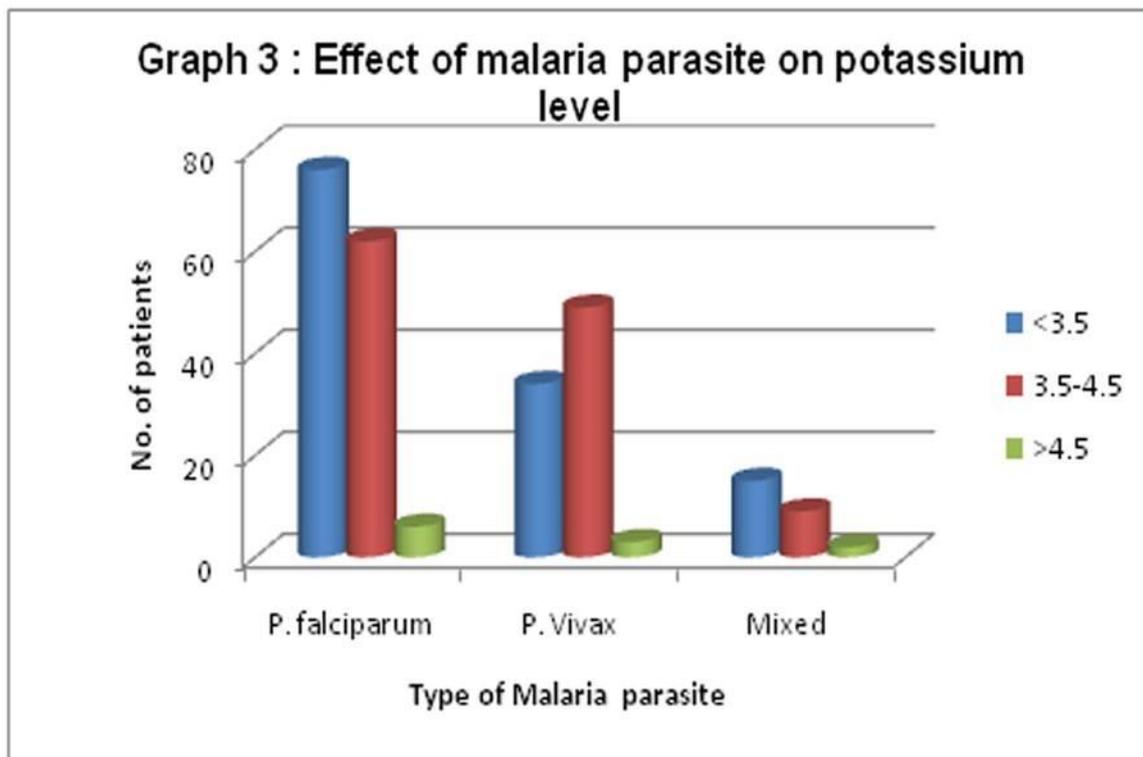
Various studies reveal Hypocalcemia in malaria patients. Trophozoites concentrate calcium in their internal compartment for metabolism. Parasites may adhere in the glomerular capillaries causing renal insufficiency [17]. This might result in increased urinary Losses of calcium following malaria. Plasmodium infection may change the cell permeability for calcium [18]. Infected cells increased calcium permeability, which led to reduction of calcium in blood of malarial patients.

Conclusion

Levels of electrolyte are influenced by the presence of malaria parasites which is more severe in mixed infection than in *P. falciparum* or *P.vivax* infection. There is a need to timely

correction of electrolytes imbalance in malaria infection to prevent the grave complications. Mineral supplementation may help to prevent disease severity.





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