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Research Article

Study of serum electrolyte (Sodium and potassium) levels in malarial Patients at Tertiary Hospital, Jhalawar Medical College and associated group of hospitals, Jhalawar

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Introduction

Malaria is an important public illness in term of morbidity and mortality, causing more than 200 million cases each year[(1)]. Consistent with the WHO World Malaria report 2017, an estimated 216 million cases of malaria and 445 000 malaria deaths passed off in 2016 worldwide. Out of 216 million cases of malaria that befell worldwide in 2016, India account for six percentage. Seven percentage of all the malaria associated deaths happened in India in 2016. India recorded the most number of deaths in the Southeast Asian region. India stands third in the list of 15 countries that contributed to eighty percentage of the global malaria burden. About 4% of estimated cases globally have been triggered by using P. Vivax, but outside the African continent this percentage was once 36%. India was first among six nations, as opposed to Ethiopia, Afghanistan, Indonesia and Pakistan — that reported 85 percent of vivax malaria cases[(2)]. Malaria is a life-threatening parasitic disease transmitted through the bite of a female anopheles mosquito and rarely using blood transfusion. There are 4 species of Plasmodium which causes malaria in humans. The species are P.Falciparum, P.Vivax, P.Malariae and P.Ovale. Among these 4 species, P.Falciparum is more dangerous and more responsible for mortality and extreme problems, which include cerebral malaria, anaemia and renal failure[(3)].

It is a disease that can be treated in just 48 hours, yet it can cause fatal complications if the diagnosis and treatment are delayed[(4)]. Most adults living in malaria endemic areas have partial immunity and are at risk of chronic or repeated infections[(5)]. Many are asymptomatic carriers of the disease. Typically, malaria produces fever, headache, vomiting and other flu-like symptoms. If drugs are not available for treatment or the parasites are resistant to them, the infection can progress rapidly to become life-threatening[(6)]. Malaria parasites are developing unacceptable levels of resistance to one drug after another and many insecticides are no longer useful against mosquitoes transmitting the disease[(7)].

Sodium (Na) is a predominant cation within the plasma. It forms about ninety percent of 154 mmol/L of inorganic cation within the ECF. It is accountable for keeping normal distribution of water and osmotic pressure within the ECF. The normal concentration of Na in the body is 135-145mmol/L. Potassium is abundantly found within the ICF. The normal concentration is 3.5-5.5mmol/L. The excessive concentration in ICF is

due to the fact that potassium diffuses slowly outward through the cell membrane asNa+ - K+ ATPase pump proceed to transport potassium into the cell. The physiologic role of potassium is in the regulation of muscular movements through generation of action potentials and nerve impulse transmission[8]. Disorders of water and electrolyte balance comprise hyponatreamia, hypernatraemia, hypokalaemia and hyperkalaemia, which also arise in severe malaria infection. Kakkilaya, et al. Showed inhis study that malaria is usually related to abnormalities of fluid, electrolytes (Na and K) and acid-base balance[9].These can occur in any person but are extra customary in severe falciparum malaria, extremes of age and inpatients with high degree of fever and vomiting[10]. Electrolyte imbalance correction in most of the circumstances of malaria is of great significance in management of patient. Timely intervention may reduce the morbidity and mortality of the patients. Many studies have been performed on sodium and potassium levels in complicated malarial sufferers and results showed that there are disturbances in electrolyte levels in them. On the other hand very few studies have been done on uncomplicated malarial sufferers and results published are contrasting so we determined to undertake this study.

Aims and Objective

To determine sodium and potassium ion disturbances in malaria cases at tertiary care hospital, Jhalawar medical college, Jhalawar.

Material and Method

The present study was conducted at tertiary care Hospital Jhalawar Medical College between period of 1 July-2019 to 30 November-2019 indoor patients of malaria was included in the study after obtaining their informed written consent.

Diagnosis of malaria was done by 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 was noted. All patients were subjected to relevant laboratory investigations like complete blood count and serum electrolyte (sodium and potassium), Complete blood count was done by automated hematology analyser and serum electrolytes was measured by fully automated electrolyte analyser.

Hyponatremia is defined as 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. Two specimen bottles were used for each subject. Anticoagulant bottle containing K2 EDTA for malaria parasite test and plain bottle for electrolyte assay. 5ml blood sample was accrued by way of sterile vene-puncture. Prior to the commencement, ethical clearance was received from Institutional Ethics Committee, Medical College Jhalawar.

Inclusion Criteria

1. The patients of both sexes age group 1 to 60 years.
2. Patients admitted with conformed case of malaria by either card test or thick and thin film, are included in the study.

Exclusion Criteria

1. Patients aged below 1 year and above 60 years
2. Unwillingness in giving an informed consent.
3. Patients with chronic kidney disease and other illness which affect serum electrolyte levels.

Cases with other comorbid conditions like Congestive cardiac failure, Cirrhosis of liver, Nephrotic syndrome, Addison's disease, Cushing syndrome, Diabetes mellitus, Diabetes insipidus, Diabetic Ketoacidosis (DKA), Hyperglycemia Hyperosmolar State (HHS), Chronic Renal Failure, patients on diuretic therapy, likely to affect electrolyte status were excluded from the study.

Results

Total 85 cases were admitted at Jhalawar Medical College during study period. In which 45 were

male and 40 were female. Total case of p. falciparum malaria was 45(52.94%) and p. vivax was 40(47.05%). Hyponatremia was found in 43 (50.85%) of cases. Among hyponatremic cases contribution of p. falciparum was 28 (65.11%) and p. vivax was 15 (34.88%). Hypokalemia found in 29 (34.11%) cases. Among hypokalemic patients contribution of p. falciparum was 18 (62.06%) and p. vivax was 11 (37.93%).

Table 1: Sex wise distribution

sex	No. of cases	%
Male	45	52.94%
female	40	47.05%

Table 2: Distribution according to plasmodium species

Total case	No. of cases	%
P. falciparum	45	52.94%
p. Vivax	40	47.05%

Table 3: Age wise distribution of patients (pediatric and adult)

Age group	No. of case	%
Pediatric(<17 yrs)	35	41.17%
Adult (> 17 yrs)	50	58.83

Table 4: Effect of malaria parasite on sodium level.

(In mEq/l)	P. falciparum	P. Vivax	Total (n=85)
<135	28	15	43 (50.85%)
135-145	15	22	37 (43.52%)
>145	2	3	5 (5.85%)

Table 5: Effect of malaria parasite on potassium level

(In mEq/l)	P. falciparum	P. Vivax	Total (n=85)
<3.5	18	11	29 (34.11%)
3.5-50	21	26	47 (55.29%)
>5	6	5	11 (18.96%)

Table 6: Mean + SD of sodium and potassium ion in P. Falciparum and P. Vivax

Tests name	Electrolytes (mmol/L)		P value
	Falciparum malaria (n=85)	Vivax malaria (n=85)	
Sodium (Na^+)	133.03 ± 2.39	136.37± 4.64	0.0005
Potassium (K^+)	3.75± 1.13	4.27± 1.06	0.0005

Discussion

Malaria is life threatening disease, estimated 2-3 million deaths annually and it is also responsible for the high morbidity and mortality of patients. Approximately 300 -500 million people annually die due to this disease[11]. P. falciparum is the species which is most commonly associated with the severe and complicated forms of this disease[12].

This prospective was done to investigate the effects of malarial infections on electrolytes. Total 85 samples were included in this study, out of which 45 were P. falciparum, 40 P. vivax. Our study showed that the malarial infection led to a decrease in the levels of electrolytes (sodium and potassium). Hyponatraemia and hypokalaemia were more common in falciparum malaria than in the vivax malaria (P value <0.005)

Similar study reported by Jasmin H. Jasani et al[13]. serum sodium and serum potassium in the cases of P. falciparum malaria were significantly 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. Another study reported by Uzuegbu UE[14], also showed significant increase in serum sodium level. (p<0.05)

O. E. Etim et al[15]. reported a significant (P<0.05) decrease in the levels of sodium and chloride in compared to those of normal controls. Maitland K. et al[16]. reported severe hyperkalemia in complicated falciparum malaria. Hypokalemia and hypophosphatemia were developed after admission to hospital. Ikekpeazu EJ et al[17] reported that there is significant lowering of the sodium and potassium levels in malaria infection.

Hyponatraemiahas been identified as a common outcome of malaria[18,19]. Ikekpeazu et al. also observed reduction in the Na level of malaria patients[20]. Hyponatraemia has been reported to occur frequently in patients suffering from *P. falciparum* malaria than in *P.vivax* malaria [18, 21].

Decline in the level of K has been reported in various studies[19, 20]. Enhanced urinary removal of K and hypokalemia has been reported as common

outcomes of malaria. (*Plasmodium* presence may lower the K levels and aggravates the complications associated with malaria disease. *P. falciparum* infected individuals were frequently observed with hypokalaemia as compared to *P. vivax* infected individuals[18]

Conclusion

Our study showed that the hyponatraemia and hypokalaemia are common in malaria. Hyponatraemia and hypokalaemia are highly associated with the falciparum malaria than vivax malaria. We reported that there is a need to manage the electrolyte level by estimating the serum sodium and potassium and according to that given supplement to falciparum malaria patients will be useful. Hyponatraemia and hypokalaemia could be a good marker for the severity of the disease.

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