

Study of electrolyte abnormalities in patients with dengue infection at a tertiary hospital

Praveen Naik¹, V Rajesh Reddy Komatla^{2*}

^{1,2}Assistant Professor, Department Of Medicine, Kamineni Institute Of Medical Sciences, Narketpally, Nalgonda(Dist) Telangana, INDIA.
Email: praveendr1986@gmail.com

Abstract

Background: Dengue infection is an important arthropod-borne disease worldwide, with an average of 50 - 100 million infections that occur every year. Electrolyte disturbances takes place in dengue infection. Hypokalemia and hyponatremia is commonly found in dengue patients. In the present study serum sodium, potassium, calcium and chloride were estimated to find the electrolyte abnormalities in dengue patients. **Material and Methods:** This study was a prospective, observational study conducted department of medicine, in patients of age more than 18 years admitted and tested with NS1/IgM antigen positive for dengue virus infection. **Results:** During study period, total 138 patients satisfying inclusion and exclusion criteria were considered for present study. 19 – 39 years age group was most common (41%) followed by 40 – 59 years age group (34 %) and > 60 years age group (25 %). Male patients (54 %) were more than female patients (54 %). Mean age in present study was 41.5 ± 12.4 years. Serum electrolyte mean values were 137.04 ± 6.31 mEq/L, 3.82 ± 0.66 mEq/L and 106.04 ± 3.24 mEq/L for sodium, potassium and chloride respectively. According to WHO classification we had 45 % patients of dengue fever and 55% patients of dengue haemorrhagic fever. Serum chloride levels were normal in all patients. In present study hyponatremia was noted in 22% patients while hypernatremia was noted in 2% patients. 75% patients had normal serum sodium levels. Mild, moderate and severe hyponatremia was noted in 15 %, 4 % and 3 % patients respectively. Hypokalemia was noted in 26% patients while hyperkalemia was noted in 1% patient. 73% patients had normal serum sodium levels. Mild, moderate and severe hyponatremia was noted in 20 %, 4 % and 2 % patients respectively. **Conclusion:** Hyponatremia and hypokalemia are the commonest electrolyte disturbances seen in dengue fever. Considering the variations in serum electrolyte levels in patients of dengue and high incidence of dengue in India, it is necessary to have a degree of suspicion in patients of dengue about electrolyte disturbances and treat them accordingly.

Key Words: Hyponatremia, Hypokalemia, Dengue Fever, Electrolyte Disturbances.

*Address for Correspondence:

Dr Praveen Naik, Assistant Professor, Department Of Medicine, Kamineni Institute Of Medical Sciences, Narketpally, Nalgonda(Dist) Telangana, INDIA.

Email: praveendr1986@gmail.com

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INTRODUCTION

Dengue infection is an important arthropod-borne disease worldwide, with an average of 50 - 100 million infections that occur every year.¹ The frequent epidemics of dengue

in India are due to multiple factors that include the ever-increasing population, increased urbanization, and ineffective vector control especially in the rainy season.² In a developing country like India, with an exploding population, an epidemic of dengue causes a severe manpower and resource crunch. The presence of NS1 antigen positivity, IgM positivity or IgG seroconversion by rapid tests in a clinical setting consistent with dengue fever, cases are treated as positive. Dengue infection is characterized by increase in temperature, headache, nausea, vomiting, abdominal pain, arthralgia, and myalgia, and also develops rashes at times. In recent years, it has changed its course of the presentation by a range of variety of manifestations and outcome from self-limiting to severe illness and fatal outcomes with increasing frequency of outbreaks.³ Electrolyte disturbances takes place in dengue

infection. Hypokalemia is a known electrolyte abnormality in patients of dengue fever, its prevalence has been found to vary from 14% to 28%.⁴ In general, dengue infection leads to mild hypokalemia due to poor intake and an increase in renal excretion due to activation of rennin-angiotensin and aldosterone system secondary to volume depletion. Several other mechanisms have been postulated that include transient renal tubular defects, intracellular shift of potassium in response to release of cytokines, insulin and catecholamine in infection induced stress and inflammation.⁵ Hyponatremia (serum sodium level < 130 meq/L) is commonly found in dengue patients which causes convulsions.⁶ In the present study serum sodium, potassium, calcium and chloride were estimated to find the electrolyte abnormalities in dengue patients.

MATERIAL AND METHODS

This study was a prospective, observational study conducted in patients with dengue infection (NS1/ IgM antigen positive). Study done in indoor patients at department of medicine, Kamineni Institute Of Medical Sciences, Narketpally a tertiary care hospital. Study period

was from April 2019 to March 2019 (1 year duration). Institutional ethical committee approval was taken for study.

Inclusion criteria

Patients of age more than 18 years admitted and tested with NS1/ IgM antigen positive for dengue virus infection

Exclusion criteria

Patients who were dengue serology negative or case of any other febrile illness or with dual infection (like Dengue and malaria, Dengue and typhoid fever, etc) and patients with pre-existing renal and hepatic dysfunction were excluded.

A written informed consent was taken from patients for participation. The data collected include demographic details, clinical history, and blood investigations (hemoglobin, white blood cell count, platelet count, hematocrit value, blood urea nitrogen, serum creatinine, serum level of sodium, potassium, chloride). Blood investigations were sent at the time of admission and repeated whenever required. Serum samples were used for further estimation of Sodium, Potassium, and Chloride. Sodium, potassium and Chloride were estimated by Electrolyte Kit method by using semi-auto analyser.

Sodium- Normal levels	136-145 meq/L	Potassium - Normal levels	3.5-5 meq/L
Mild Hyponatremia	125-135 meq/L	Mild Hypokalemia	3 - 3.50 meq/L
Moderate Hyponatremia	120-125 meq/L	Moderate Hypokalemia	2.50 to 3.0 meq/L
Severe Hyponatremia	< 120 meq/L	Severe Hypokalemia	2.50 meq/l
Hypernatremia	>145 meq/L	Hyperkalemia	5.0 meq/L
Chloride Normal levels			96-105 mEq/L

Collected data was analysed statistically. Statistical analysis was done using descriptive statistics.

RESULTS

During study period, total 138 patients satisfying inclusion and exclusion criteria were considered for present study. 19 – 39 years age group was most common (41 %) followed by 40 – 59 years age group (34 %) and > 60 years age group (25 %). Male patients (54 %) were more than female patients (46 %). Mean age in present study was 41.5 ± 12.4 years.

Table 1: Age and sex distribution of the study population

Age (in years)	Male	Female	Total
19 - 39	33 (24%)	23 (17%)	56 (41%)
40 - 59	26 (19%)	21 (15%)	47 (34%)
≥60	16 (12%)	19 (14%)	35 (25%)
Total	75 (54%)	63 (46%)	138
Mean±SD (in years)	38.9 ± 11.9	40.5 ± 13.1	41.5 ± 12.4

Serum electrolyte mean values were 137.04 ± 6.31 mEq/L, 3.82 ± 0.66 mEq/L and 106.04 ± 3.24 mEq/L for sodium, potassium and chloride respectively.

Table 2: Laboratory parameters of patients

Laboratory parameter	Mean ± standard deviation
Serum Sodium	137.04 ± 6.31 mEq/L
Serum Potassium	3.82 ± 0.66 mEq/L
Serum Chloride	106.04 ± 3.24 mEq/L

According to WHO classification we had 45 % patients of dengue fever and 55% patients of dengue haemorrhagic fever. Serum chloride levels were normal in all patients. In present study hyponatremia was noted in 22% patients while hypernatremia was noted in 2% patients. 75% patients had normal serum sodium levels. Mild, moderate and severe hyponatremia was noted in 15 %, 4 % and 3 % patients respectively.

Table 3: Severity of dengue infection and serum sodium levels

	Total patients	Serum Sodium				
		Normal levels	Hyponatremia			Hypernatremia
			Mild	Moderate	Severe	
Dengue Fever	62 (45%)	49 (36%)	9 (7%)	2 (1%)	1 (1%)	1 (1%)
Dengue Haemorrhagic Fever I	15 (11%)	9 (7%)	3 (2%)	1 (1%)	1 (1%)	1 (1%)
Dengue Haemorrhagic Fever II	55 (40%)	42 (30%)	8 (6%)	3 (2%)	2 (1%)	0
Dengue Haemorrhagic Fever III	5 (4%)	3 (2%)	1 (1%)	0	0	1 (1%)
Dengue Haemorrhagic Fever IV	1 (1%)	1 (1%)	0	0	0	0
Total	138	104 (75%)	21 (15%)	6 (4%)	4 (3%)	3 (2%)

Hypokalemia was noted in 26% patients while hyperkalemia was noted in 1% patient. 73% patients had normal serum sodium levels. Mild, moderate and severe hyponatremia was noted in 20 %, 4 % and 2 % patients respectively.

Table 4: Severity of dengue infection and serum potassium levels

	Total patients	Serum Potassium				
		Normal levels	Hypokalemia			Hyperkalemia
			Mild	Moderate	Severe	
Dengue Fever	62 (45%)	46 (33%)	11 (8%)	4 (3%)	1 (1%)	0
Dengue Haemorrhagic Fever I	15 (11%)	12 (9%)	1 (1%)	1 (1%)	1 (1%)	0
Dengue Haemorrhagic Fever II	55 (40%)	40 (29%)	13 (9%)	1 (1%)	1 (1%)	0
Dengue Haemorrhagic Fever III	5 (4%)	2 (1%)	2 (1%)	0	0	1 (1%)
Dengue Haemorrhagic Fever IV	1 (1%)	1 (1%)	0	0	0	0
Total	138	101 (73%)	27 (20%)	6 (4%)	3 (2%)	1 (1%)

DISCUSSION

Dengue viral infection has emerged as one of the most important arboviral disease in India. Dengue fever is a viral exanthematous febrile illness emerged as a major public health problem in India. The World health Organization (WHO) estimated that 50 to 100 million dengue infections occur in the world including 500,000 DHF and 22,000 deaths mostly among children. Assessment of serum electrolytes is routinely done in patients admitted to the hospital with dengue fever (DF) and dengue haemorrhagic fever (DHF). Hyponatraemia is defined as plasma Na⁺ concentration below 135 mEq/ l and hypokalaemia is defined as K⁺ concentration below 3.5 mEq/l3. Electrolyte disturbances and renal dysfunction have been reported in dengue infection. Sodium is an essential nutrient in humans; regulates blood volume, blood pressure, osmotic equilibrium and ph. Hyponatremia is frequent in dengue, which can cause central nervous system dysfunction. In our study, the mean value of serum sodium observed was 137.04 ± 6.31 mEq/L. This is more than in the study done by Mekmullica *et al.*⁸, which had a mean of 132 mEq/L and Lumpaopong *et al.*⁹, found that serum sodium level in dengue patients in Thailand was 133meq/L. we noted 22% cases of dengue with hyponatremia. In a study done with dengue fever in a tertiary care centre in Mumbai found the prevalence of hyponatraemia to be 40.3%.¹⁰ A study done in Salem, Tamil Nadu in 2014 among patients with dengue fever showed the prevalence of hyponatraemia to be 58%, but hypokalaemia was not found among the study patients.⁶ In

study by Reddy AA *et al.* noted that, with the decreasing serum sodium levels, there is an increasing incidence of associated complications. Also bleeding and the CNS complications are more common as compared to respiratory, hepatobiliary and other complications.⁷ Hypokalaemia is also common in Dengue which can lead to acute neuromuscular weakness including respiratory muscle paralysis. The possible mechanisms postulated are redistribution of potassium into the cells or transient renal tubular abnormalities leading to increased urinary potassium wasting. Increased catecholamine levels in response to stress of the infection and secondary insulin release can result in intracellular shift of potassium and hypokalemia.¹³ In present study mean serum potassium levels were 3.82 ± 0.66 mEq/L and incidence of hypokalemia was 26%. Khandelwal Vinay *et al.*, studying electrolyte disturbances in dengue fever in adults where 55.44% patients had normal serum potassium levels, 33.16% patients had mild hypokalemia, 5.94% patients reported moderate hypokalemia and 2.97% patients reported severe hypokalemia while 2.47% patients also reported hyperkalemia in this study. The mean value of serum potassium was 3.62 mEq/L.¹⁴ Coexistent magnesium deficiency complicates hypokalemia and renders it refractory to potassium supplementation. A decrease in intracellular magnesium, resulting from magnesium deficiency releases the magnesium-mediated inhibition of renal outer medullary K⁺ channels and increases potassium secretion in the distal tubules thus aggravating hypokalemia.¹⁵ A significant increase in the incidence of hyperkalemia than in secondary dengue

infection is also noted. The reason for the increase in potassium level in secondary dengue patients could be severe hemolysis leads to the release of intracellular potassium into extracellular space, other causes of increased potassium in dengue patients could be rhabdomyolysis and renal dysfunction, needs further studies to confirm. No specific treatment is available for dengue infection, and the mainstay of treatment is careful fluid management, specific organ support and correction of metabolic and electrolyte derangement. Many studies recommended early screening for electrolyte imbalance to identify the high-risk patients, which in turn could prevent the serious complications associated with dengue virus infection and initiation of appropriate fluid therapy with close monitoring.¹⁷

CONCLUSION

Hyponatremia and hypokalemia are the commonest electrolyte disturbances seen in dengue fever. They may be associated with poor treatment outcomes. Routine screening of dengue patients for electrolytes may help the clinicians in risk stratification of patients. Considering the variations in serum electrolyte levels in patients of dengue and high incidence of dengue in India, it is necessary to have a degree of suspicion in patients of dengue about electrolyte disturbances and treat them accordingly. Careful monitoring of electrolytes, acid-base status, and renal function are mainstay for patient care.

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