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# **Original Research Article**

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# Study on electrolyte disturbances in dengue fever in a tertiary care centre

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#### **ABSTRACT**

**Background:** Dengue is a mosquito borne disease of significant morbidity and mortality. Dengue viral infection has been shown to be associated with electrolyte abnormalities and renal dysfunction. It is necessary to have a thorough understanding about electrolyte disturbances in Dengue, so as to predict, diagnose and treat them accordingly. The aim and objective of this study is to study electrolyte disturbances in dengue fever and its correlation with severity of dengue fever.

**Methods:** This study was performed in a tertiary care centre in Bangalore , India. The study was a prosspective observational study. 200 Patients diagnosed with Dengue were enrolled for the study. Patients demographic data, clinical history, electrolyte values were recorded and analysed.

**Results:** In our study majority of patients belonged to 5-12 years age group ie 47%. Fever was found to be the most common presentation in 196 patients (98%) followed by myalgia in 142 patients (71%), headache in 102 patients (51%), skin rash in 43 patients (21.5%). The mean value of serum sodium observed was 133.69 mEq/L and of serum potassium was 3.58 mEq/L and there was positive and significant correlation between difference in serum sodium and potassium levels with severity of dengue fever.

**Conclusions:** Dyselectrolytemia is more common in dengue fever. Serum electrolytes testing early is very important in dengue patients during management so that if abnormalities are found, they can be appropriately managed as some of these abnormalities may lead to increased severity as well as mortality.

**Keywords:** Dengue fever, Dyselectrolytemia, Serum Electrolytes

## INTRODUCTION

Dengue is a viral hemorrhagic fever caused by Flaviviridae. It is a mosquito-borne infection transmitted by Aedes aegypti and Aedes albopictus, it has 4 genotype DEN. <sup>1,2,3,4</sup> It is the most common cause of arboviral disease globally. <sup>1</sup> The number of cases reported increased from 2.2 million in 2010 to over 3.34 million in 2016.

Clinical spectrum of dengue infection in humans include, 1) mild flu like illness comprising fever, headache, nausea, vomiting, abdominal pain, arthralgia, and myalgia, rashes, 2) dengue fever with warning signs like abdomen pain, persistent vomiting, clinical fluid accumulation, mucosal bleeds, lethargy, restlessness, hepatomegaly and raising haematocrit which was previously known as dengue haemorrhagic fever (DHF) and 3) severe dengue which comprises of severe organ impairment ,shock and severe plasma leakage leading to dengue shock syndrome (DSS). Dengue Hemorrhagic Fever (DHF) and Dengue Shock Syndrome (DSS) are

severe forms of dengue infection, characterized by evidence of plasma leakage.<sup>1</sup>

Dengue viral infection has been shown to be associated with electrolyte abnormalities and renal dysfunction due to several proposed mechanisms, one among which is direct action of immune complexes on glomeruli leading to AKI and deranged electrolytes.<sup>2,3</sup>

Hyponatemia and hypokalemia are the commonest electrolyte disturbances seen in dengue fever. 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.<sup>4</sup> Other mechanisms proposed for hyponatremia include it occurs as a consequence of salt depletion, excess water from increased metabolism, transient inappropriate antidiuretic hormone or the influx of sodium in the cells as a result of dysfunction of sodium potassium pump.<sup>5</sup> Dengue infection also leads to mild hypokalemia due to poor intake and an increase in renal excretion due to activation of renin angiotensin and aldosterone system secondary to volume depletion.

Hypokalaemia is also common in Dengue which can lead to acute neuromuscular weakness including respiratory muscle paralysis.<sup>6</sup>

Considering the occurrence of dyselectrolytemia in patients of dengue and high incidence of dengue in India, it is necessary to have a greater degree of suspicion in patients of dengue about electrolyte disturbances and treat them accordingly.

#### **METHODS**

This study was a prospective observational study performed in the department of Paediatrics in a tertiary care hospital, Bangalore from September 2018 to February 2019 for a period of 6 months. A total of 200 patients of age< than 18 years admitted and tested with dengue fever by rapid qualitative solid phase immunochromatographic test were included in the study. 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.

The data collected include Patient's 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). Serum electrolytes was sent at the time of admission.

Hyponatremia was defined as serum sodium levels less than 135 meq/L; and hyponatremia was graded as Mild between 125-135 meq/L; Moderate - between 120-125

meq/L; Severe Hyponatremia- less than 120 meq/L7; and hypernatremia as more than 145 meq/L Similarly Hypokalemia was defined as Serum potassium levels less than 3.5 meq/L; and graded as Mild Hypokalemia-between 3.00 to 3.50meq/L; Moderate Hypokalemia: between 2.50 to 3.0 meq/L; Severe Hypokalemia- less than 2.50 meq/l. Hyperkalemia: Serum potassium level more than 5.0 meq/L.8 Normal range of chloride was 96-105 mEq/L.

Descriptive statistical analysis was done using tables and charts. Correlation between Dengue infection severity and serum electrolyte levels was measured using Spearman's correlation coefficient. Strength of correlation was read as correlation coefficient (r).

#### RESULTS

Of the patients studied majority of patients i.e. 47% belonged to the age group of 5-12 years. 53 children ie 26.5% belonged to 1-5 years age and 42 patients i.e. 21% belonged to 12-18 years of age. Dengue infection in less than 1 year was 5.5 % as (Table 1). The Average age group observed in our study was 7.5 years.

Table 1: Age Distribution of the Patients Studied.

Age group(years)	Number(n)	Percentage (%)	
< 1	11	5.5	
1-5	53	26.5	
5-12	94	47	
12-18	42	21	
Total	200	100	

The patients with dengue fever have been grouped into 3 groups named dengue fever without warning signs ,with warning signs and severe dengue as per WHO guidelines. 68% patients belonged to dengue fever without warning signs, 22% belonged to with warning signs and only 10% of patients had severe dengue. (Table 2)

Table 2: Clinical Category of the Patients studied.

Clinical category	Number(n)	Percentage (%)
Dengue fever without warning signs	136	68
Dengue fever with warning signs	44	22
Severe dengue	20	10
Total	200	100

From the clinical history and presentation studied fever was found to be the most common presentation in 196 patients (98%) followed by myalgia in 142 patients (71%), headache in 102 patients (51%), skin rash in 43 patients (21.5%).

In our study, serum electrolyte levels of Dengue patients were analysed on the day of admission. The mean value of serum sodium observed was 133.69 mEq/L and of serum potassium was 3.58 mEq/L. In our study of the 200 patients studied majority of them ie 98 (49 %) of them had mild hyponatremia, 74 (37%) patients had serum sodium levels within normal limits, 16 (8%) patients reported moderate hyponatremia and 2 (1%) patients had severe hyponatremia. The mean sodium levels observed in each category of dengue fever was 134.66±2.48, 129.55±6.05, 117.66±9.89 respectively.

In our study majority of patients had potassium level within normal range i.e. 120 (60%), 54(27%) had mild

hypokalemia, 20 patients (10%) had moderate hypokalemia, 4 patients (2%) had severe hypokalemia and only 2(1%) patients had hyperkalemia. The mean potassium levels of various category of dengue fever observed in our study was 3.54±0.42, 3.19±0.72, 2.63±0.18 respectively. All patients included in our study had normal chloride levels.

Mild hyponatremia and mild hypokalemia were more common amongst DF compared to DHF and DSS whereas moderate and severe hyponatremia and hypokalemia were more common amongst DHF and DSS (Table 3).

Table 3: Comparison of serum sodium and potassium levels among the various category of dengue fever.

Commo alactualista lavala	Number of cases (n)	T-4-1		
Serum electrolyte levels (mEq /L)	Dengue fever without warning signs	Dengue fever with warning signs	Severe dengue	Total n(%)
Serum sodium levels				
Normal	73	22	9	104(52%)
Mild hyponatremia	53	6	9	68 (34%)
Moderate hyponatremia	10	6	0	16 (8%)
Severe hyponatremia	0	0	2	2 (1%)
Hypernatremia	0	0	0	0 (0%)
Mean±SD sodium levels	134.66±2.48	129.55±6.05	117.66±9.89	133.69±42
Serum potassium levels				
Normal	84	25	11	120 (60%)
Mild hypokalemia	38	14	2	54 (27%)
Moderate hypokalemia	11	3	6	20 (10%)
Severe hypokalemia	2	1	1	4 (2%)
Hyperkalemia	1	1	0	2 (1%)
Mean±SD potassium levels	3.54±0.42	3.19±0.72	2.63±0.18	3.62±0.62
Serum chloride levels				
Normal	136	44	20	200 (100%)
Mean±SD chloride levels	102±0.2			
Total	136	44	20	200 (100%)

The differences between serum sodium and potassium levels with the three groups of dengue fever ie dengue fever without warning signs, dengue fever with warning signs and severe dengue was compared using Spearman's correlation methods to find relationship between both the variables. There exists a positive and significant correlation between difference in serum sodium (r=0.34) and potassium levels (r=0.39) with Dengue clinical syndrome (DF, DHF, and DSS) which implies that if the difference between the serum levels increases, greater are chances of the severe Dengue.

#### DISCUSSION

In the present study from the demographic details of the patients studied, majority of the patients belonged to 5-12 years ie 47%. Dengue infection in less than 1 year was minimal comprising only 5.5%. In our study the most common presentation was fever present in 98% followed by myalgia in 142 patients (71%), headache in 102 patients (51%), skin rash in 43 patients (21.5 %). This is similar to a study done by Khandelwal Vinay et al <sup>9</sup>, in adults where fever was the most common presenting complaint found in 96.53 % and 78.71% with myalgia, 62.87% had headache and 43.06% patients had skin rash. Similarly, Rahul Unnikrishnan et al stated that among Dengue fever cases, fever (ear temperature >38°C) was found in 98.1% patients. The two leading symptoms other than fever and myalgia (43.4%) among the 53 elderly

were headache (18.9%) and arthralgia (13.2%). Only four patients (7.5%) of these patients presented with overt bleeding manifestations.<sup>10</sup>

In our Majority of patients were diagnosed with dengue fever without warning signs i.e. 68%. 22 % had with warning signs and only 10% of patients had severe dengue. This is similar to study done by Khandelwal Vinay et al, where 84.65% patients belonged to Dengue fever without warning signs 14.35% patients with warning signs and 0.99% patients belonged to severe dengue.9

In our study, the mean value of serum sodium observed was 133.69 mEq/L this is Similar to the study done by Mekmullica et al., (2005) which had a mean of 132 mEq/L and Lumpaopong et al.,(2010) found that serum sodium level in dengue patients in Thailand was 133meg/L.<sup>3,4</sup> Of the 200 patients 98 (49 %) of them had mild hyponatremia, 74 (37%) patients had serum sodium levels within normal limits, 16 (8%) patients reported moderate hyponatremia and 2 (1%) patients had severe hyponatremia. The mean sodium levels observed in each category of dengue fever was 134.66±2.48,129.55±6.05, 117.66±9.89 respectively. Mekmullica J et al<sup>4</sup> cited that hyponatremia was 9.7 times more common in Dengue patients, the mean serum sodium level was significantly lower in shock patients compared to non-shock patients (p-value = 0.003).

In our study majority of patients had potassium level within normal range i.e. 120 (60%), 54 (27 %) had mild hypokalemia, 20 patients (10%) had moderate hypokalemia, 4 patients (2%) had severe hypokalemia and only 2(1%) patients had hyperkalemia. The mean potassium levels of various category of dengue fever observed in our study was 3.54±0.42, 3.19±0.72, 2.63± 0.18 respectively, this is similar to study by 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.9 Similarly Widodo et al, stated that prevalence of hypokalemia in 23% of the hospitalized patients with Dengue fever. 11 Kalita et al, observed hypokalemia in association with infectious diseases, particularly in Dengue fever.<sup>12</sup>

There was positive and significant correlation between difference in serum sodium and potassium levels with Dengue clinical syndrome (DF, DHF, and DSS) which implies that if the difference between the serum levels increases, greater are chances of the severe Dengue. Arun Gogna et al, stated that levels were significantly reduced among cases with severe dengue presented with warning signs. <sup>13</sup>

Hence the present study proves the correlation between electrolyte levels and severity of Dengue viral infections.

#### **CONCLUSION**

The electrolyte disturbances more commonly seen in our study were hyponatremia, hypokalemia and it had a positive correlation with severity of dengue fever. Also, Mild hyponatremia and mild hypokalemia were more common among patients of Dengue fever whereas moderate and severe hyponatremia and hypokalemia were more common among Dengue hemorrhagic fever (DHF) and Dengue shock syndrome (DSS). However, there is need for more research due to higher incidence of dengue in India also, studies with dedicated control groups will provide more statistically relevant results which was one of the limitations of our study.

Hence serum electrolytes testing early is very important in dengue patients during management so that if abnormalities are found, they can be appropriately managed as some of these abnormalities may lead to increased severity as well as mortality.

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