

Study of Electrolyte Disturbances in Dengue Infected Patients

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ABSTRACT

Introduction: Dengue is the most common arboviral disease worldwide and is usually endemic, but several epidemics have been recorded. Dengue fever is associated with electrolyte disturbances.

Material and methods: This study was a cross sectional, descriptive and non interventional study conducted on patients of Dengue fever, during the period of 18 months between October 2016 to March 2018 in a tertiary care centre. This study was conducted to find relation between electrolyte disturbances in patients with dengue fever.

Results: The majority of the patients 136 (67.32%) were males while 66 (32.67%) were female patients. The majority of patients 84.65% were with Dengue fever and 14.35% patients were with Dengue hemorrhagic fever and 0.99% patients were with Dengue shock syndrome. Hyponatremia and hypokalemia was the frequent electrolyte disturbances found in dengue patients. The mean value of serum sodium was 133.92mEq/L and of serum potassium was 3.62mEq/L. There exists a positive and significant correlation between difference in serum sodium ($r = 0.38$) and potassium levels ($r = 0.41$) with Dengue clinical syndrome (DF, DHF, and DSS) which implies that as the difference between the levels increases, greater are chances of the Dengue fever towards DHF or DSS.

Conclusions: Hyponatremia was the most frequent electrolyte disturbance and hyperkalemia was least common observed in patients with Dengue viral infection. 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).

Keywords: Dengue Fever, Electrolyte Disturbances, Hyponatremia, Hypokalemia.

INTRODUCTION

Dengue fever is a viral illness caused by one of the four serotypes of Dengue viruses belonging to the flaiviridae family. It has four serotypes DENV 1, DENV 2, DENV 3 and DENV 4. According to World Health Organization (WHO) more than 2.5 billion people are at risk of Dengue infection. Dengue has been identified as a disease of the future owing to trends toward increased urbanization, scarce water supplies and possibly environmental change.¹ Dengue is the most common arboviral disease worldwide and is usually endemic, but several epidemics have been recorded.² Dengue fever is associated with electrolyte disturbances. Hyponatremia and hypokalemia are the commonest electrolyte disturbances. The reason for hyponatremia in classic Dengue fever patients was uncertain. However, it might be the 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.^{3,4} Dengue infection also leads to mild hypokalemia due to poor intake and an increase in renal excretion due to activation of renninangiotensin and aldosterone system secondary to volume depletion.

The purpose of the present study was to assess the electrolyte disturbances in Dengue infected patients and to find relation of electrolyte disturbances to complication of Dengue fever.

MATERIAL AND METHODS

This study was a cross sectional, descriptive and non interventional study conducted on patients of Dengue fever admitted at Krishna Hospital Medical Research Centre, Karad, in the department of Medicine. This study was conducted over period of eighteen months between October 2016 to March 2018.

Inclusion Criteria

Patients of all gender aged > 18 years with diagnosis of Dengue fever

Exclusion Criteria

Patients aged < 18 years or with dual infection (like Dengue and malaria, Dengue and typhoid fever, Dengue and leptospirosis etc) and patients with pre-existing renal and hepatic dysfunction.

The suspected cases of Dengue virus infections were confirmed using Dengue day 1 test kit for detecting dengue antigen. It is a rapid solid phase immunochromatographic test for the qualitative detection of Dengue NS1 antigen and differential detection of IgM and IgG antibodies to Dengue virus. Serum samples were used for further estimation of sodium and potassium. Sodium and potassium were estimated by electrolyte kit method by ion selective electrode by full auto analyser.

Working Definitions^{5,6,7}

Hyponatremia- Serum sodium levels less than 135

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meq/L; Mild Hyponatremia- between 125-135 meq/L; Moderate Hyponatremia- between 120-125 meq/L; Severe Hyponatremia- less than 120 meq/L; Hypokalemia- Serum potassium levels less than 3.50 meq/L; 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 and Hyperkalemia: Serum potassium level more than 5.0 meq/L.

STATISTICAL ANALYSIS

The collected data was entered with the help of Microsoft Excel Sheet. Descriptive analysis (Frequency distribution) 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

In the present study majority of the patients 136 (67.32%) were males while 66 (32.67%) were female patients. In male patients, 58 patients (42.64%) were in the age groups of 18-25 years followed by 29 patients (21.32%) in 26-35 years. In females, 30 patients (45.45%) were in the age group of 18-25 years, followed by 11 patients (16.66%) in 36-45 years, 10 patients (15.15%) in 26-35 years. The mean age of male patients was 35.61 ± 12.93 years and of female patients was 33.25 ± 15.12 years. Fever was found to be the most common clinical presentation in 195 patients (96.53%) followed by

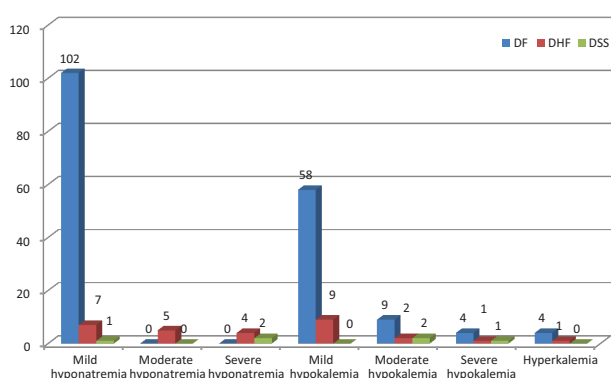


Figure-1: Distribution of cases according to classification of hyponatremia

myalgia in 159 patients (78.71%), headache in 127 patients (62.87%), skin rash in 87 patients (43.06%). The majority of patients 84.65% were with Dengue fever and 14.35% patients were with Dengue hemorrhagic fever and 0.99% patients were with Dengue shock syndrome.

In the present study, serum electrolyte levels (serum sodium and potassium) of Dengue patients were analysed on the day of admission. The mean value of serum sodium was 133.92mEq/L and of serum potassium was 3.62mEq/L. On the day of admission, majority of the patients 110 (54.45%) had reported mild hyponatremia, 81 (40.09%) patients were having serum sodium levels within normal limits, 5 (2.47%) patients reported moderate hyponatremia and 6 (2.97%) patients reported severe hyponatremia. Out of all the patients, majority of patients were having potassium level within normal range 112 (55.44%), 67 patients (33.16%) reported mild hypokalemia, 12 patients (5.94%) had moderate hypokalemia, 6 patients (2.9%) had severe hypokalemia and 5 patients reported hyperkalemia (2.47%). 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-1, figure-1).

The differences between serum sodium and potassium levels with Dengue clinical syndromes (dengue fever, dengue hemorrhagic fever and dengue shock syndrome) 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 ($r = 0.38$) and potassium levels ($r = 0.41$) with Dengue clinical syndrome (DF, DHF, and DSS) which implies that as the difference between the levels increases, greater are chances of the Dengue fever towards DHF or DSS.

DISCUSSION

In the present study demographic characteristics of the study participants was studied in which, majority of the patients 136 (67.32%) were males while 66 (32.67%) were female patients. Most common age group to be affected in male and female was 18-25 years with 58 patients (42.64%) in males

Serum sodium and potassium levels	Number of cases			Total
	DF	DHF	DSS	
Normal	70	11	0	81 (40.09%)
Mild hyponatremia	102	7	1	110 (54.45%)
Moderate hyponatremia	0	5	0	5 (2.47%)
Severe hyponatremia	0	4	2	6 (2.97%)
Mean and standard deviation of serum sodium levels	134.66± 3.57	130.55± 8.05	118.66± 10.39	133.92 ± 4.83
Normal	98	14	0	112 (55.44%)
Mild hypokalemia	58	9	0	67 (33.14%)
Moderate hypokalemia	9	2	2	12 (5.94%)
Severe hypokalemia	4	1	1	6 (2.97%)
Hyperkalemia	4	1	0	5 (2.47%)
Mean and standard deviation of serum potassium levels	3.64±0.47	3.25±0.56	2.53± 0.11	3.62 ± 0.45
Total	172	27	3	202 (100%)

Table-1: Comparison of serum sodium and potassium levels among patients of DF, DHF and DSS

and 30 patients (45.45%) in females respectively. The mean age of male patients was 35.61 ± 12.93 years and of female patients was 33.25 ± 15.12 years. Rahul Unnikrishnan et al cited that the mean age of the cases was 66.1 ± 4.7 years, of which 87% belonged to the age group of 60–70 years, 11% were in the age group 70–80 and 2% of the patients were 80+ years old.⁸ Muhammad AM et al cited that two-thirds (70.9%) were male. The mean age was 35.2 ± 14.7 years (range 15–85 years).⁹

In the present study patients were distributed according to their clinical presentation. Fever was the predominant clinical presentation in 195 patients (96.53%) followed by 159 patients (78.71%) presented with myalgia, 127 patients (62.87%) had headache and 87 (43.06%) patients had skin rash. Rahul Unnikrishnan et al stated that among Dengue fever cases, fever (ear temperature $>38^{\circ}\text{C}$) 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.⁸ Garg RK et al quoted that ten patients had myalgia and eight patients had a history of fever prior to development of weakness. Two patients had a family history of similar illness. One patient with idiopathic and two patients with secondary hypokalemic paralysis had respiratory involvement; none of them required ventilatory support.¹⁰ In this study 84.65% patients belonged to Dengue fever category whereas, 14.35% patients belonged to Dengue hemorrhagic fever category and 0.99% patients belonged to dengue shock syndrome category.

In the present study, serum electrolyte levels of Dengue patients were studied on the day of admission, 81 (40.09%) patients were having serum sodium levels within normal limits, whereas 110 (54.45%) patients had reported mild hyponatremia, 5 (2.47%) patients reported moderate hyponatremia and 6 (2.9%) patients reported severe hyponatremia. The mean value of serum sodium was 133.92mEq/L. Rahul Unnikrishnan et al quoted that the incidence of hyponatremia (serum sodium $<135\text{mEq/L}$) was higher (50.9%) (mean 129.8 with SD of 14.66) with seven patients (13.2%) of the patients developing significant hyponatremia ($<125\text{mEq/L}$). 58% of the hyponatremic patients were found to be symptomatic.⁸ Mekmullica J et al 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).¹¹ Bandaru A et al stated that the mean serum sodium level was 136.6 ± 5.4 in Dengue fever cases.¹⁵

Serum potassium levels were also analyzed on the day of admission, 55.44% patients (majority of the patients) were having 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 3.62mEq/L. Widodo et al stated that prevalence of hypokalemia in 23%

(n = 105) of the hospitalized patients with Dengue fever.¹² Kalita et al observed hypokalemia in association with infectious diseases, particularly in Dengue fever.¹³ Rathod N et al cited that the incidence of abnormal electrolytes as 13% in Dengue fever subjects.¹⁶

Serum sodium and potassium levels with Dengue clinical syndromes (dengue fever, dengue hemorrhagic fever and dengue shock syndrome) was compared using Spearman's correlation methods to find relationship between both the variables. It was found that there exists a positive and significant correlation between difference in sodium and potassium levels with dengue spectrums (DF, DHF, and DSS) which implies that as the difference between the levels increases, greater are chances of the Dengue spectrum towards DHF or DSS. Mild hyponatremia and hypokalemia were more common amongst patients of DF as compared to DHF and DSS. Rathod N et al stated that majority of the cases of severe Dengue with warning signs had abnormal serum electrolytes; the incidence of abnormal serum electrolytes was 13%.¹⁶ Arun Gogna et al quoted that the mean sodium levels were 135.5, and mean potassium levels were 4.1; The levels were significantly reduced among cases with severe dengue presented with warning signs.¹⁷ Bandaru A et al stated that the prevalence of hyponatremia was 35.5% among DF cases and 53.5% among DHF cases and hypokalemia as 16.1%. They also observed that the prevalence of deranged serum electrolytes was more common among severe cases of Dengue hemorrhagic fever (DHF).¹⁵

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

CONCLUSION

The present study was conducted to assess the occurrence of electrolyte disturbances in patients of Dengue viral infections with its association with severity of Dengue viral infections. Predominantly young age group was the commonest to get affected. Hyponatremia was the frequent electrolyte disturbance in patients of dengue fever and hyperkalemia was least common. 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).

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