



CORRELATION OF SERUM ELECTROLYTES WITH SEVERITY IN PATIENTS WITH DENGUE

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Abstract

Introduction

Dengue is a mosquito borne acute febrile illness caused by viruses belonging to group flaviviridae. Primarily this disease is transmitted by Aedes mosquito. Dyselectroemia is very common among dengue patients. Hyponatremia and hypokalemia are the most common electrolyte abnormalities.

Methodology

The present study is a cross sectional study, 50 patients were assessed that were admitted from January 2024 to May 2024 in the Department of General Medicine, Dr Balasabheb Vikhe Patil Rural Medical College, Loni.

Objectives of study

- 1) To estimate serum electrolytes in patients with Dengue.
- 2) To correlate Dengue infection severity with serum electrolyte levels.

Results

Out of 50 subjects, 15 had mild hyponatremia, 4 had moderate hyponatremia and 31 had normal Sodium levels. Chi-square test revealed significant association between sodium levels and Dengue severity. Among 50 subjects, 17 had mild hypokalemia, 1 had moderate hypokalemia and 32 had normal potassium scores. Chi-square test showed no significant association between potassium levels and Dengue severity.

Conclusion

Hyponatremia was the most frequent electrolyte disturbance. Mild hyponatremia and mild hypokalemia were commonly observed among patients of dengue without warning signs, whereas moderate hyponatremia was common among severe forms like dengue with warning signs and dengue shock syndrome.

Index terms- Dengue fever without warning signs, Dengue with warning signs, Dengue shock syndrome, hyponatremia, hypokalemia.

INTRODUCTION

Dengue is a mosquito borne arboviral infection transmitted by infected Aedes mosquito. It is one of the most common and potentially fatal infections in tropical and subtropical countries. Dengue virus illness belongs to the family flaviviridae and has four serotypes DENV 1, DENV 2, DENV 3 and DENV 4. It is also known as breakbone fever due to severe muscle spasms and joint pain, dandy fever or seven day fever due to unusual duration of symptoms dengue has been identified as a disease of future owing to trends towards increased urbanisation, scarce water supplies and environmental changes (Kuhn and Crozier, 2022 and WHO, 2009). It is most common in tropical and sub-tropical regions of the world and is usually endemic but epidemics have been reported. The infection may have wide spectrum of presentation ranging from asymptomatic to a clinical illness, varying from undifferentiated fever to a severe life-threatening dengue hemorrhagic syndrome or dengue shock syndrome with multiple organ failure and fatal disease. The condition is also associated with electrolyte disturbances. Hyponatremia and hypokalemia are

the most common electrolyte abnormalities (Khandelwal *et al.*, 2019). The purpose of the present study is to assess the electrolyte disturbances in dengue infected patients and to find the relation of electrolyte disturbances to complications in dengue fever.

TARGET

To study serum electrolytes and to correlate with severity in patients with dengue.

Objectives

1. To estimate serum electrolytes in patients with dengue.
2. To correlate dengue infection severity with serum electrolyte levels

MATERIALS AND METHODS

Study design

Cross sectional study

Study population

50 cases of Dengue virus infections who are confirmed by using Dengue day-1 test kit for detecting dengue antigen

Study period

5 months from January 2024 to May 2024

Sample size

50 in-patients who were positive for dengue IgG, IgM and Dengue Ns1Ag

Inclusion criteria

Adult patients of any gender (greater than 18 years of age) with confirmed dengue infection

Exclusion criteria

Patients less than 18 years age, not willing to give consent and with preexisting renal and hepatic dysfunction.

METHODOLOGY

The present study is a crosssectional study, 50 patients were assessed that are admitted during period January 2024 to May 2024 in Department of General Medicine, Dr Balasaheb Vikhe Patil Rural Medical College, Loni. 50 cases of dengue virus infections were confirmed by using Dengue day-1 test kit for detecting dengue antigen. It is a rapid solid phase immuno-chromatographic test for the qualitative detection of Dengue NS1 antigen and differential detection of IgM and IgG antibodies to dengue virus. Serum sodium and potassium were estimated at the time of admission. Data was analyzed by descriptive statistics.

RESULTS

In the present study majority of the patients 36 (72%) were males while 14 (28%) were female patients. Fever was found to be the most common clinical presentation in 48 patients (96%) followed by myalgia in 34 (68%) patients, headache in 30 (60%) patients, skin rash in 13 (26%) patients.. The majority of patients (34/50; 68%) were with affected dengue fever without warning signs and 14 patients (28%) had dengue fever with warning signs and 2 patients (4%) were affected with dengue shock syndrome (Table 1). The median age was 45 for subjects with dengue shock syndrome; 28 for subjects having dengue fever with warning signs and 26 for subjects having dengue fever without warning signs (Table 2).

In the present study, serum electrolyte levels (serum sodium and potassium) of dengue patients were analysed on the day of admission. The median sodium levels (mEq/L) were high in group having dengue infection with no warning signs (137) followed by dengue with warning signs (131) and dengue shock syndrome (124), Kruskal-Wallis test was applied to compare the sodium levels among the groups which demonstrated statistical significant difference among the groups ($p=0.00$) (Table 3). Out of 50 subjects, 15 had mild hyponatremia, 4 had moderate hyponatremia and 31 had normal Sodium scores (Table 4).

Median Potassium levels (mEq/L) were high in group having dengue without warning signs (3.90) followed by dengue with warning signs (3.75) and dengue shock syndrome (3.70). Kruskal-Wallis test showed no statistical significant difference among the groups ($p=0.398$) (Table 3). Out of 50 subjects, 17 had mild hypokalemia, 1 had moderate hypokalemia and 32 had normal potassium scores (Table 4).

This study revealed a positive and significant correlation between difference in sodium levels with dengue spectrums (Chi-square 34.82; $p=0.00^*$) whereas no significant association between potassium and dengue severity (Chi-square 2.7; $p=0.60$).

DISCUSSION

In the present study demographic characteristics of the study participants were studied in which, majority of the patients (72%) were males while 14 (28%) were female patients. Earlier studies also recorded higher incidence of dengue infection in males (Maheshwari and Bansal, 2017 and Khandelwal *et*

al., 2019) and this could be explained by the more outdoor activity of the males as compared to the females, which might have caused more frequent mosquito bites (Vijayakumar *et al.*, 2005).

Fever was the predominant clinical presentation in 48 patients (96%) followed by 34 patients (68%) presented with myalgia, 30 patients (60%) had headache and 13 (26%) patients had skin rash. These findings were in accordance with the previous observational and cross sectional studies (Khandelwal *et al.*, 2019 and Ali *et al.*, 2022). However, few differences in the clinical presentation could be attributed to the stage of severity of the condition.

Distribution of patients according to their clinical presentation revealed 68% patients belonged to dengue fever category whereas, 28% patients belonged to dengue hemorrhagic fever category and 4% patients belonged to dengue shock syndrome category. The median age was higher (45 years) for subjects with dengue shock syndrome when compared to 28 years for subjects having dengue fever with warning signs and 26 years for subjects having dengue fever without warning signs. The immune dysregulation and co-morbidities might have resulted in severe infection in elderly patients (Rowe *et al.*, 2014).

In the present study, hyponatremia was documented in 38% (19/50) of the patients. Median sodium levels were higher in group having dengue fever with no warning signs (137mEq/L) followed by dengue fever with warning signs (131mEq/L) and dengue shock syndrome (124mEq/L). The levels were significantly reduced among cases with severe dengue presented with warning signs. The renal manifestations might have led to changes in the concentration of electrolytes in dengue fever patients.

Among 50 patients 62% (31/50) had normal serum concentration while mild and moderate hyponatremia was recorded in 15 (30%) and 4 (8%), respectively. Moderate hyponatremia was found in one patient with dengue shock syndrome and in three patients with dengue fever with warning signs. Majority of the dengue fever cases had mild hyponatremia (26/31). Hyponatremia was documented in 38% of patients, which was higher when compared to Mekmullica *et al.* (2005) and less than Khandelwal *et al.* (2019) who recorded hyponatremia in 18.00% and 59.91% of the dengue patients, respectively. There was 9.7% increased risk of developing hyponatremia in Dengue fever (Mekmullica *et al.*, 2005). Causes for hyponatremia in dengue fever patients were uncertain. Sodium regulated the pH, osmotic equilibrium and blood pressure. 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 (Khandelwal *et al.*, 2019).

The prevalence of hyponatremia was higher among dengue shock syndrome patients (100.0%; 2/2), and 64.29% and 23.53%, respectively in dengue patients with and without warning signs. Significant association of serum sodium (mEq/L) levels with severity of dengue as observed in the present study was similar to the previous reports (Khandelwal *et al.*, 2019 and Ali *et al.*, 2022). Reddy *et al.* (2017) documented a direct correlation of hyponatremia with complications of dengue fever and it could be used as a prognostic marker in such patients¹⁰. On contrary Rehman *et al.* (2020) did not find any association of electrolyte disturbances, and metabolic acidosis at the time of admission with either the length of stay or case fatalities in dengue viral infection.

In the present study out of all the patients, majority of patients were having potassium level within normal range 32 (64%), 17 patients (34%) reported mild hypokalemia and 1 patient (2%) had moderate hypokalemia. On the whole 36% (18/50) of dengue patients exhibited hypokalemia while 64% were normokalemic. Khandelwal *et al.* (2019) and Widodo *et al.* (2006) reported hypokalemia in 42% and 24% of patients, respectively. Hypokalemia has been reported in dengue fever probably because of decreased dietary consumption and renal excretion due to activation of RAAS pathway secondary to volume depletion. Kalita *et al.* (2005) reported that many infectious diseases especially dengue fever resulted in hypokalemia.

The prevalence of hypokalemia was 50.00% among dengue shock syndrome, and 21.43% and 41.17% in dengue patients with and without warning signs, respectively. Chi-square test showed no significant association between potassium and dengue severity.

Although median serum potassium (mEq/L) were higher among patients with dengue fever without warning signs as compared to dengue fever with warning signs and dengue shock syndrome, the association was insignificant. This finding was consistent with the documentation of Kaitwatcharachai and Namasae (2022) who reported that hypokalemia was common among adult patients with dengue virus but not associated with severity of illness or clinical manifestations.

The correlation of hyponatremia with the severity of illness showed significance rather than hypokalemia in the present study. Contrary to the present finding Rajalekshmy and Vadivelan (2019) documented that though hyponatraemia and hypokalaemia were found to be commonly present in patients with dengue fever, only hypokalaemia showed a significant correlation with the severity of illness among

patients.

SUMMARY

Besides hematological abnormalities, dengue was also associated with dyselectrolytemia. In the present study most frequently encountered electrolyte imbalance was hyponatremia and hypokalemia and these electrolyte abnormalities especially hyponatremia was directly associated with the severity of dengue. Electrolyte abnormalities could be detected and managed at an early stage to prevent the progression of morbidity as well as mortality as dengue is becoming endemic in our country and is more prevalent in the young adults. Further studies should be performed with specified controlled larger groups to provide results that are more relevant statistically.

CONCLUSION

Hyponatremia was the most frequent electrolyte disturbance in this study. Mild hyponatremia and mild hypokalemia were more commonly found among patients of dengue without warning signs, where as moderate hyponatremia was common among severe forms like dengue with warning signs and dengue shock syndrome. Significant association was observed between serum sodium concentrations and the severity of the disease.

Drawback

Study sample size was conducted with a small group of patients with dengue. Larger patient population is needed to determine the utility of serum electrolytes as prognostic markers.

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Table 1: Clinical category for the subjects studied

S. No	Clinical category	Number (n)	Percentage (%)
1	Dengue fever without warning signs	34	68.0
2	Dengue fever with warning signs	14	28.0
3	Dengue shock syndrome	2	4.0
	TOTAL	50	100.00

Table 2: Distribution of the subjects based on age

Clinical category	Number (n)	Min	Max	Median	IQR
Dengue fever without warning signs	34	18	56	26	12
Dengue fever with warning signs	14	18	60	28	14
Dengue shock syndrome	2	40	50	45	-

Table 3: Comparison based on sodium and potassium levels using Kruskal-Wallis

Clinical category	Number (n)	Min	Max	Median	IQR	P value
Serum Sodium (mEq/L)						
Dengue fever without warning signs	34	130	150	137	4	0.00*
Dengue fever with warning signs	14	122	141	131	9	
Dengue shock syndrome	2	122	126	124	-	
Serum Potassium (mEq/L)						

Dengue fever without warning signs	34	2.7	4.9	3.90	0.5	0.398
Dengue fever with warning signs	14	3.1	5.2	3.75	0.5	
Dengue shock syndrome	2	2.9	4.5	3.70	-	

Table 4: Severity of dengue infection and serum sodium and potassium levels

Clinical category	Number (n)	Serum Sodium (mEq/L)				Chi Square value 34.82 P value 0.00*
		Normal	Hyponatremia			
			Mild	Moderate	Severe	
Dengue fever without warning signs	34	26 (76.47)	8 (23.53)	0	0	
Dengue fever with warning signs	14	5 (35.71)	6 (42.86)	3 (21.43)	0	
Dengue shock syndrome	2	0	1 (50.00)	1 (50.00)	0	
TOTAL	50	31 (62.00)	15 (30.00)	4 (8.00)	0	
Clinical category	Number (n)	Serum Potassium (mEq/L)				Chi Square value 2.70 P value 0.60
		Normal	Hypokalemia			
			Mild	Moderate	Severe	
Dengue fever without warning signs	34	20 (58.82)	13 (38.23)	1 (2.94)	0	
Dengue fever with warning signs	14	11 (78.57)	3 (21.43)	0	0	
Dengue shock syndrome	2	1 (50.00)	1 (50.00)	0	0	
TOTAL	50	32 (64.00)	17 (34.00)	1 (2.00)	0	

Figures in parenthesis are percentages