

STUDY OF ELECTROLYTE IMBALANCE IN DENGUE FEVER

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Article Info: Received 23 June 2019; Accepted 24 July, 2019

DOI: <https://doi.org/10.32553/ijmbs.v3i7.418>

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Conflict of interest: Nil

Abstract

Background: Dengue is one of the most common and potentially fatal infections in tropical and subtropical countries. Our study aims to compare serum electrolytes between dengue cases and non-dengue fever cases presenting to a tertiary care hospital.

Methods: This case control study was conducted in a tertiary health care hospital between October 2017 to December 2018. Cases were considered as serologically confirmed cases of dengue and controls were those with fever cases other than dengue. All the study participants were selected by convenient sampling. The study included 54 dengue cases and 50 non-dengue controls. Sodium, Potassium electrolytes were considered outcome variables.

Results and Discussion: The sodium level in dengue and non-dengue groups were in the level of 134.7-139 and 136-140, respectively. The potassium level in dengue and non-dengue groups were 3.6 - 4.3 and 3.6 - 4.65, respectively. In dengue group, 41(75.9%) patients had normal sodium level, and 13(24.1%) had a low level of sodium whereas, in the non-dengue group, 48(96%) had normal sodium level and 2(4%) had a low level of sodium. In dengue group, 47(87%) patients had normal potassium level, and 7(13%) had a low level of potassium whereas, in the non-dengue group, 43(86%) had normal potassium level and 7(14%) had a low level of potassium.

Conclusions: Dengue increases the risk of electrolyte imbalances, including hyponatremia and hypokalemia. They may be associated with poor treatment outcomes. Routine screening of dengue patients for electrolytes may help the clinicians in risk stratification of patients.

Keywords: Dengue infection, Hyponatremia, Hypokalemia, Routine screening

INTRODUCTION

Dengue is a mosquito-borne arboviral infection transmitted by infected *Aedes* mosquito.¹ It is one of the most common and potentially fatal infections in tropical and subtropical countries.² The incidence of Dengue fever has raised exponentially in the past 5 decades, and there are about 2.5 billion people living in dengue-endemic areas worldwide. South East Asia accounts for 75% of the global burden. International travel, which allows disease transmission from endemic areas to areas of less prevalence, is one of the main reasons for the exponential rise in dengue fever.³ Dengue had been endemic in 16 states in India and after 2010 has been present in all states.¹ No specific treatment is available, and the mainstay of treatment is careful fluid management, specific organ support and correction of metabolic and electrolyte derangement.²

Involvement of multiple organs, including kidneys, is found in complex cases. Kidney involvement can be indicated by asymptomatic electrolyte disturbances, abnormal urinalysis, and more severe manifestation such as acute kidney injury (AKI). A kidney involvement is not rare in Dengue fever, but is often misrecognized and can cause the physician to misread the real situation of the patient. The prevalence of Dengue infection-induced AKI ranges from 0.2%-10.0% in children and 2.2%-35.7% in adults. The presence of AKI dramatically increases the mortality rate among both childhood and adulthood Dengue infection from 12-44% to more than 60%.⁴ 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.⁴ There are very few studies documenting electrolyte imbalance in dengue patients in Indian

population. Therefore, the main aim of our study is to compare serum imbalance between dengue fever cases and non-dengue fever cases presenting to a tertiary care hospital.

MATERIALS AND METHODS

The study was a case control study conducted in a tertiary care hospital. The data collection was done between October 2017 to December 2018. The cases were considered as serologically confirmed cases of dengue, and the controls were those with fever other than dengue. All the study participants were selected by convenient sampling. The study included 54 dengue cases and 50 non-dengue controls. NS1Ag, Sodium and Potassium levels were determined for both groups and comparison was done between cases and controls.

Statistical methods:

Sodium and Potassium electrolytes were considered outcome variables. Dengue was considered as explanatory variables.

Descriptive analysis: Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency and proportion for categorical variables. Data was also represented using appropriate diagrams like a bar diagram, pie diagram and box plots.

Inferential statistics:

Quantitative outcome: The association between categorical explanatory variables and the quantitative outcome was assessed by comparing the mean values. The mean differences, along with their 95% CI, were presented. Independent sample t-test was used to assess statistical significance.

Categorical outcome: The association between explanatory variables and categorical outcomes was assessed by cross tabulation and comparison of percentages. Chi square test was used to test statistical significance.

A Shapiro-wilk's test ($p > 0.05$)^{5, 6} and a visual inspection of their histograms, normal Q-Q plots and box plots showed that the age, potassium, sodium parameters were non-normally distributed.⁷⁻⁹

RESULTS

A total of people in 104 were included in the analysis. The number of patients with dengue was 54(51.90%), and non-dengue were 50(48.10%). In this study, 43(41.30%) patients were NS1Ag positive, and 61(58.70%) patients were NS1Ag negative. 26(25%)

patients were IgM positive, and 78(75%) patients were IgM negative. (Table 1)

The median age in dengue and non-dengue groups were 30 and 47.5, respectively. This was statistically significant with the p value of 0.001. The number of males and females with dengue were 41(75.9%) and 13(24.1%) respectively. The number of males and females with no dengue were 20(40%) and 30(60%) respectively. This was statistically significant at p value is < 0.001 . In dengue patients, 6(11.1%) had bleeding manifestations, and 48(88.9%) had no bleeding manifestations, whereas, in non-dengue patients, 50(100%) had no bleeding manifestations. In Dengue group, 9(16.7%) patients had diabetes, and 45(83.3%) were non-diabetic, whereas, in the non-dengue group, 50(100%) patients were non-diabetic. (Table 2)

The median sodium in dengue and non-dengue groups were 136 and 137.5, respectively. This is statistically significant at the p value is 0.002 (Table 3).

In dengue group, 41(75.9%) patients had normal sodium level, and 13(24.1%) had a low level of sodium whereas, in the non-dengue group, 48(96%) had normal sodium level and 2(4%) had a low level of sodium. This is statistically significant at the p value is 0.004. (figure 1). In dengue group, 47(87%) patients had normal potassium level, and 7(13%) had a low level of potassium whereas, in the non-dengue group, 43(86%) had normal potassium level and 7(14%) had a low level of potassium. This is statistically insignificant as the p value is 0.877. (figure 2)

Table 1: Descriptive analysis of NS1Ag in study population (N=104)

Dengue serology	Frequency	Percentages
NS1Ag		
Positive	43	41.30%
Negative	61	58.70%
IgM		
Positive	26	25.00%
Negative	78	75.00%

Table 2: Comparison of dengue with gender in study population (N= 104)

Parameter	Dengue(N=54)	Non-Dengue(N=50)	P-value
Age (median, IQR)	30(24,45)	47.5(28.75, 65)	0.001
Gender			
Male (N, %)	41 (75.9%)	20 (40%)	<0.001
Female (N, %)	13 (24.1%)	30 (60%)	
Bleeding manifestations			
Present (N, %)	6 (11.1%)	0 (0%)	*
Absent (N, %)	48 (88.9%)	50 (100%)	
Diabetes Mellitus			
Present (N, %)	9(16.7%)	0 (0%)	*
Absent (N, %)	45(83.3%)	50 (100%)	

*No statistical test was applied- due to 0 subjects in the cells.

Table 3: Comparison of median sodium in dengue and non-dengue group in study population (N=104)

Parameter	Dengue		(Mann Whitney U test) P value
	Dengue (N=54)	Non-Dengue (N=50)	
Sodium Median (IQR)	136 (134.7,139)	137.5 (136,140)	0.002
Potassium Median (IQR)	3.8(3.6,4.3)	4.1(3.6,4.65)	0.069

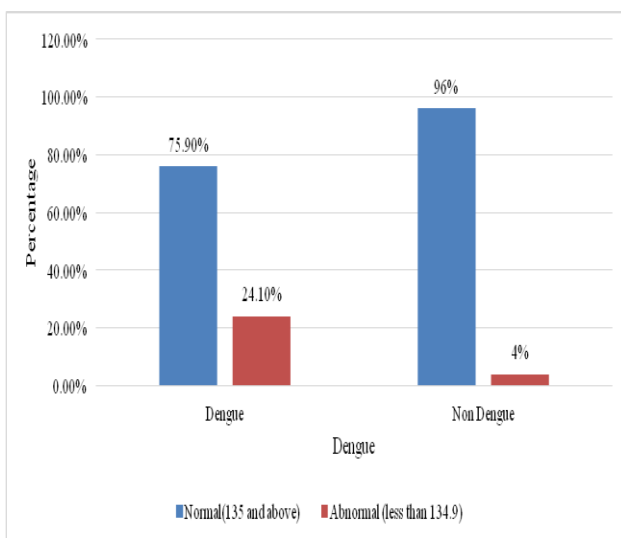


Figure1: Cluster bar graph for comparison of dengue with sodium level in study population (N=104)

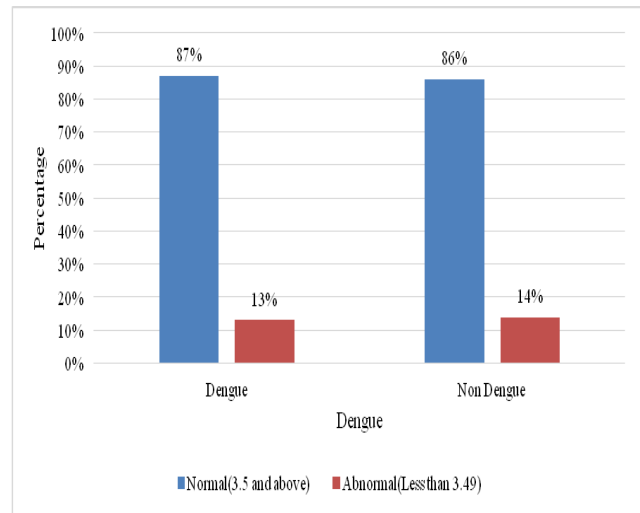


Figure 2: Cluster bar graph for comparison of dengue with potassium level in the study population (N=104)

DISCUSSION:

A case control study was done to compare the electrolyte imbalance among the 54-dengue fever and 50 non-dengue fever patients. The dengue patients were primarily in the age of 25-45 years and the non -dengue patients were in the age of 28-65 years. In the dengue group, males were highly infected than female, whereas, in the non-dengue group, females were more infected than males. In dengue group, 43(79.6%) were NS1Ag positive, 11(20.4%) were NS1Ag negative, 23(48.1%) were IgM positive ,28(51.9%) were IgM negative, 6(11.1%) had bleeding manifestations and 48(88.9%) had no bleeding manifestations, 9(16.7%) patients were diabetic and 45(83.3%) were non diabetic.

The sodium level in dengue and non-dengue groups were in the level of 134.7-139 and 136-140, respectively. The potassium level in dengue and non-dengue groups were 3.6 - 4.3 and 3.6 - 4.65, respectively. In dengue group, 41(75.9%) patients had normal sodium level, and 13(24.1%) had a low level of sodium whereas, in the non-dengue group, 48(96%) had normal sodium level and 2(4%) had a low level of sodium. In dengue group, 47(87%) patients had normal potassium level, and 7(13%) had a low level of potassium whereas, in the non-dengue group, 43(86%) had normal potassium level and 7(14%) had a low level of potassium.

The current study has shown low median sodium and potassium level similar to previous studies by Vachvanichsanong P et al.⁴ A study of the profile of dengue patients admitted to a tertiary care hospital

in Mumbai showed that dengue patients were associated with electrolyte abnormalities.¹⁰ Lumpaopong, A. et al.¹¹ in his study reported the prevalence of hyponatremia in patients with DF was 61%, and DHF was 72 %, the prevalence of hypokalemia in patients with DF was 14% and 17% in patients with DHF. Mekmullica, J. et al.¹² in his study reported that hyponatremia was 9.7 times more common in dengue patients.

This study contributed to the knowledge that Dengue leads to hyponatremia and hypokalemia. However, the study is not without any limitations. This was an observational study; thus, the observed association cannot be interpreted as causal inferences. The sample was a single centred, and convenience sampling technique was employed for the study, which is not a true representation of the general population. The age and gender matching were not done in this case control study. And finally, the sample size was not adequate. Because of these limitations, the external validity of the study is questionable. Hence the study cannot be generalised to the rest of the population. A large size, matched, the multicentric study is needed to determine the electrolyte imbalance in dengue fever.

CONCLUSION

Dengue increases the risk of electrolyte imbalance, including hyponatremia and hypokalemia. They may be associated with poor treatment outcomes. Routine screening of dengue patients for electrolytes may help the clinicians in risk stratification of patients. It is the need of the hour to conduct large scale prospective studies to assess the magnitude of electrolyte disturbances and their impact on treatment outcomes in Indian population to further enhance the quality of evidence.

ACKNOWLEDGEMENTS:

We acknowledge the technical support in data entry, analysis and manuscript editing by “Evidencian Research Associates”

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