

## Original Research Article

# Serum sodium level in dengue infected children: a retrospective study

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### ABSTRACT

**Background:** Dengue fever is one of the most common arbo virus mediated outbreaks, being reported from different parts of the world. Now as the outbreaks are hitting different geographic locations, different clinical manifestations are being reported recently. Aim of this study is to document the serum Sodium level in dengue infected children in a tertiary care centre.

**Methods:** A total 128 cases of NS1 antigen, IgM positive or ELISA positive dengue patients were included in this observational study and analyzed.

**Results:** The serum Sodium level in dengue varies according to the different groups. In group A (dengue with no warning signs) the serum Sodium level was normal, whereas in case of group B (dengue with warning signs), there was significant hyponatremia. In group C, severe dengue the serum Sodium was normal

**Conclusions:** Mild hyponatremia is a common electrolyte disturbance in patients with dengue with warning signs. Hence, the lower the serum Sodium levels the higher is the incidence of complications associated with dengue fever.

**Keywords:** Dengue, Dengue shock, Hyponatremia

### INTRODUCTION

Dengue is one of the most common infectious disease in tropical countries. Dengue is a mosquito-borne viral infection causing a simple flu-like illness to potentially lethal complication including death if not appropriately intervened. Severe dengue was earlier known as dengue hemorrhagic fever.<sup>1,2</sup>

The incidence of dengue has grown dramatically around the world in recent decades. According to WHO over 2.5 billion people live in areas where dengue virus can easily be transmitted and are at risk for severe dengue.<sup>1</sup>

Dengue should be suspected when a high fever (40°C/104°F) is accompanied by two of the following symptoms: severe headache, pain behind the eyes, muscle and joint pains, nausea, vomiting, swollen glands or rash.

The new WHO classification- Dengue without warning signs (Group A), Dengue with warning signs (Group B) and Severe dengue (Group C - dengue hemorrhagic fever, dengue shock syndrome). Dengue without warning signs generally advances to other groups after a second infection with a dissimilar serotype, which is notified as antibody-dependent enhancement (ADE) of infection. Capillary leakage in dengue fever makes it more severe than other viral infections.<sup>3</sup> There is no specific treatment for dengue fever. The 24-48 hours of the critical stage can be lethal; proper medical attention and intravenous fluids are required to avoid complications and risk of death.

Electrolyte disturbances takes place in dengue infection. Sodium is an essential nutrient in humans; regulate blood volume, blood pressure, osmotic equilibrium and pH. Hyponatremia is defined as a serum Sodium level <130

mEq/L. Hyponatremia is frequent in DHF, especially in shock patients.<sup>4</sup> 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, decreased renal excretion, transient inappropriate antidiuretic hormone or the influx of Sodium in the cells as a result of dysfunction of Sodium potassium pump.<sup>5</sup>

## METHODS

This was a cross sectional observational study. The study was done in a tertiary care centre hospital in South Karnataka.

The study was approved by the hospital ethics committee. Children between 0-15 years admitted with the clinical diagnosis of dengue infection on the basis of history of fever and constitutional symptoms and found positive to any one of Dengue NS I antigen and anti-dengue IgM antibodies (card test) or enzyme-linked immunosorbent assay (ELISA) were included in the present study. Dengue specific IgM antibody was detected using Dengue IgM capture ELISA. Children with dengue card test positive for IgG, Children with dengue and with other concurrent infections like leptospirosis etc, Incomplete records were excluded from the study. Severity of dengue was graded as per WHO criteria. Based on the WHO case definition, cases were classified as dengue fever without warning signs, dengue fever with warning signs and severe dengue.

Cases who presented with or developed abdominal pain or tenderness or had vomiting or any bleeding manifestations or edema were taken as with warning signs and those with shock, plasma leak or any organ involvement were classified as severe dengue. We included 128 patients diagnosed of dengue fever from June 2014 to May 2016 in the study. The demographic details and the clinical details at the time of admission were noted and the relevant investigation was taken from the medical records.

Serum Sodium level was noted from the medical records. Normal level of serum Sodium 135-145 mEq/L. Mild hyponatremia was taken as serum Sodium between 130-134.9 mEq/L. Moderate hyponatremia being 125-129.9 mEq/L and severe < 125 mEq/L. Hypernatremia was considered when the serum Sodium was >145 mEq/L. Hyponatremia is defined as a serum Sodium < 135 mEq/L. Results were analysed statistically using SPSS (Statistical package for social sciences) software version 24.0. p Value was calculated. A p -Value < 0.05 was considered statistically significant. Results were analysed statistically with chi square test done by using SPSS.

## RESULTS

In this study, total 128 cases of dengue diagnosed by any one of Dengue NS I antigen, anti-dengue IgM antibodies

(card test) or enzyme-linked immunosorbent assay (ELISA), were included and analysed.

**Table 1: Demographic characteristics.**

Characters	No. of patients	Percentage
<b>Age in years</b>		
0 -5 years	23	17.9
5.1 -10 years	49	38.4
10.1- 15 years	56	43.7
<b>Sex</b>		
Male	73	57
Female	55	43
<b>Epidemiological features</b>		
Urban	54	43
Rural	74	57
History of df in family	32	25
History of df in neighbourhood	2	1.5

**Table 2: Symptoms and number of patients.**

Symptoms	No. of patients (n)	Percentage
Fever	128	100
Headache	65	51.5
Arthralgia/Myalgia	35	26.92
Vomiting	51	39.23
Abdominal pain	32	24.61
Bleeding	4	3.0
Altered sensorium	3	2.30
Seizure	2	1.53
Rash	13	10

The demographic details are depicted in Table 1; different clinical features of these patients are shown in Table 2. 57% of the patients were male. Most patients were from rural area. Fever was present in all 128 patients (100%), next common symptom was headache (51.5%) followed by vomiting (39.23%) and myalgia (26.92%). Bleeding from different sites of the body was evident in four patients (3%). Among these, two patients had gum bleeding and other two had gastrointestinal bleeding in the form of hematemesis and both of them had expired. 13 patients (10%) had rash, which was erythematous maculopapular type and 15 patients (11.53%) had petechiae.

**Table 3: Type of dengue and number of patients.**

Type of dengue	No of patients (n)	Percentage
Group A	90	68.46
Group B	35	28.46
Group C	3	3.07

Most of the patients admitted were in group A (68.46%) followed by group B (28.46%) and only 4 patients (3.07%) were under group C as shown in Table 3.

**Table 4: Sodium levels.**

Sodium Level	Number	Percentage
Normal (135-145)	76	60.1
Mild hyponatremia (130-134.9)	5	3.9
Moderate hyponatremia (125-129.9)	0	0
Severe hyponatremia (<125)	0	0
Not done	46	35.9

**Table 5: Comparison of sodium level in different groups of dengue.**

Sodium level	Group A	Group B	Group C
Normal	46	27	3
Mild hyponatremia	3	2	0
Moderate hyponatremia	0	0	0
Severe hyponatremia	0	0	0
Not done	40	6	0

Fishers exact test p = 0.016; sig

Out of the total 128 patients, serum Sodium level was not done for 36.7% (n = 47) of the study population and 59.4% had normal levels of Sodium while 3.9% had hyponatremia. None of them had hypernatremia as shown in Table 4 and Table 5. Only 29.7% were treated with iv fluids as shown in Table 6.

**Table 6: Comparison of sodium level with dengue.**

Dengue	Received iv fluids (% of row total)	Not received iv fluids (% of row total)
Group A	1 (1.1%)	89 (98.9%)
Group B	34 (89.5%)	1 (1.1)
Group C	3 (100%)	0
Total	38 (29.7%)	90 (70.3%)

Fishers exact test p =.0001; HS

One child had dengue encephalitis which recovered without any neurological deficits, and one had co infection with malaria.

Two children had generalized seizure of which one was diagnosed to have encephalitis and other had febrile seizure. Two children died due to severe dengue (shock with multi organ dysfunction).

**Table 7: Comparison of sodium level with IV fluids.**

Sodium	Received IVF	Not received IVF
Normal	32	45
Hyponatremia	1	4
Hypernatremia	0	0

Out of the total 29.7% of the sample population who received IV fluids, only one patient received iv fluids in the group A as in Table 7.

**DISCUSSION**

We noted that serum Sodium level was not done for 36% of the dengue infected children as per the physician's decision. all of them had come under dengue fever with no warning signs. We have also noted some neurological manifestations like convulsions during the dengue - one diagnosed to have encephalitis and other had febrile seizure, and both of them had normal levels of serum Sodium. The child who had dengue encephalitis, MRI showed brainstem hyper intense lesion had recovered without any neurological deficits with disappearance of intensities on follow up scans. Neurological involvement in dengue may occur because of neurotropism of the virus, immunologic mechanism, cerebral anoxia, intracranial haemorrhage, hyponatremia, cerebral oedema, fulminant hepatic failure with portosystemic encephalopathy, renal failure or release of toxic products. In a study by Kamath SR et al, neurological manifestations were noticed in 20% of the patients.<sup>7</sup> We found them only in 0.76 % of our cases. Many studies revealed mild hyponatremia is common in dengue confirmed patients.<sup>4,5,8</sup> This study shows that Serum Sodium was normal in dengue in group A, whereas hyponatremia was common in dengue with warning signs which is similar to the study by Varavithya et al, where hyponatremia was common among dengue patients.<sup>3</sup> A study by Pancharoen et al, found that the hyponatremia in dengue patients can cause convulsions, especially in infants.<sup>9</sup> In the present study we noted that in severe dengue (Group C) Sodium levels were normal.

One of the limitations of the present study was, we had not taken the serum Sodium at different stages of dengue. only two patients were under severe dengue. In previous studies, the alteration in serum Sodium levels in dengue was not influenced by the sex of the child and also the incidence of dengue associated complications.

Future studies should include serum Sodium level in different stages of dengue - febrile, critical and recovery stages. Careful monitoring of electrolytes, acid-base status and renal function are necessary.

**CONCLUSION**

Serum Sodium levels are normal in dengue with no warning signs. Whereas there is mild hyponatremia in children classified as dengue with warning signs. Hence careful monitoring of serum Sodium helps to determine the severity of dengue infection.

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