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Original Research Article

Serum sodium as a prognostic marker in dengue fever cases admitted to PICU in Navodaya hospital, Raichur, India

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ABSTRACT

Background: Dengue fever is an arboviral infection which is mosquito transmitted, most common in tropical and subtropical countries. Worldwide around 2.5 billion population are at the risk of developing dengue infection.
Methods: The study was carried out in a 5 bedded (high dependency unit) PICU of Navodaya Medical College and Hospital, Raichur, Karnataka, India. The study was approved by the ethical committee of the hospital. The study was performed over a period of 12 months from August 2015 - August 2016. The study group included individuals from the age group of 1 month to 18 years, who were diagnosed with dengue fever.
Results: Out of the total 99 cases, 36 cases had no variation in serum sodium levels, 33 cases were mild hyponatremic, 12 cases were moderate hyponatremic and 18 cases were severely hyponatremic. Out of the 36 cases with normal serum sodium levels, only 1 case progressed to bleeding complications. Out of the 33 cases with mild serum sodium levels, 2 cases progressed to complications out of which 1 case having bleeding manifestations and 1 case having both bleeding and central nervous system (CNS) complications.
Conclusions: Hyponatremia is the most common electrolyte disturbance in dengue fever as well as dengue associated complications. The lower the serum sodium levels the higher is the incidence of complications associated with dengue fever. The incidence of CNS and bleeding complications is more as compared to the RS and hepatobiliary complications. The incidence of RS and hepatobiliary complications is high with moderate and severe hyponatremia. Thus serum sodium plays a most important role in the prognosis of dengue fever and associated complications..

Keywords: Dengue fever, Dengue associated complications, Hyponatremia

INTRODUCTION

Dengue fever is an arboviral infection which is mosquito transmitted, most common in tropical and subtropical countries. Worldwide around 2.5 billion population are at the risk of developing dengue infection1. It is an acute febrile illness caused by any of the 4 antigenically related positive sense single stranded viruses of genus Flavivirus, dengue viruses (DENV) charecterised by biphasic fever, myalgia or arthralgia, pain abdomen, rash, leukopenia and lymphadenopathy.[1-4]

There are previous reports suggestive of renal dysfunction and electrolyte dysfunction in dengue infected patients. Fall in serum sodium is a common problem in dengue infected patients.[4-6]

Dengue fever might progress to complications involving bleeding manifestations, CNS manifestations, Respiratory complications and hepatobiliary complications. This study deals with serum sodium levels as a prognostic marker in dengue positive patients who have progressed to the above mentioned complications.

METHODS

The study was carried out in a 5 bedded (high dependency unit) PICU of Navodaya Medical College and Hospital, Raichur, Karnataka, India. The study was approved by the ethical committee of the hospital. The study was performed over a period of 12 months from August 2015 to August 2016. The study group included individuals from the age group of 1 month to 18 years, who were diagnosed with dengue fever.

A written consent has been taken from the parents before drawing the blood sample for dengue serological testing, explaining them the need for investigations and the risk and complications of the disease if the serological testing turns out to be positive. The samples were collected in sterile containers and were then transported to microbiology lab carefully under all aseptic conditions. These samples were maintained at a room temperature of 250C under fluorescent lighting and appropriate humidity.[7]

A total of 99 serum samples were positive for IgM antibodies against dengue virus. IgM capture ELISA KIT (Version 2.4) was used to detect dengue specific IgM antibodies.[8] Serum samples which were positive for dengue were further used to determine the levels of sodium, potassium and chloride by electrolyte kit method by using a semi auto analyser.[9] Hyponatremia is defined as serum sodium <135meq/L.[10] These serum samples based upon the serum sodium levels were compiled and segregated into mild, moderate and severe hyponatremia based upon the reference values.[10]

Each of the mild, moderate and severe hyponatremia cases were classified again depending upon the systemic complications and their association with each other. Further they have been classified depending upon the system wise complications.

RESULTS

During our study period a total number of 99 cases were positive for dengue. IgM positive dengue cases were classified based upon the serum sodium levels in Table 1. The association between the serum sodium levels and the number of cases which had progressed to complications involving different systems is established in Table 2.

In Table 3, the systemic manifestations were further classified and compared with the varied degrees of hyponatremia. Out of the total 99 cases, 36 cases had no variation in serum sodium levels, 33 cases were mild hyponatremic, 12 cases were moderate hyponatremic and 18 cases were severely hyponatremic.

Out of the 36 cases with normal serum sodium levels, only 1 case progressed to bleeding complications. Out of the 33 cases with mild serum sodium levels, 2 cases progressed to complications out of which 1 case having bleeding manifestations and 1 case having both bleeding and Central nervous system (CNS) complications.

Table1: Classification of IGM positive dengue cases based upon the serum sodium levels.

Total cases	No hyponatremia (> 135 meq/L)	Mild hyponatremia (135-130 meq/L)	Moderate hyponatremia (130-120meq/L)	Severe hyponatremia (<120me/L)
99	36	33	12	18

Table 2: The association between the serum sodium levels and the number of cases which had progressed to complications involving different systems.

Parameter	Total no of complicated cases	Bleeding complications	CNS complication	Bleeding, CNS complications	Bleeding, RS complications	Bleeding, CNS and RS complications	Bleeding and hepatobiliary complications
No hyponatremia	1	1	0	0	0	0	0
Mild hyponatremia	2	1	0	1	0	0	0
Moderate hyponatremia	8	3	1	3	1	0	0
Severe hyponatremia	18	5	2	9	0	1	1

Out of the 12 moderately hyponatremic cases, 8 cases progressed to complications out of which 3 cases had only bleeding manifestations, 1 case had only CNS complications and 3 cases having both bleeding and CNS complications and 1 case showing bleeding and respiratory system (RS) complications. Out of the 18 severely hyponatremic cases all the 18 cases progressed to complications, 5 cases showing only bleeding

complications, 2 cases showing CNS complications, 9 cases presenting with both bleeding and CNS complications, 1 case presenting with bleeding, CNS and RS complications, 1 cases showing bleeding and hepatobiliary complications.

Table 3: Systemic manifestations were further classified and compared with the varied degrees of hyponatremia.

Total number of complicated cases	System involved	System wise complications	No hyponatremia	Mild hyponatremia	Moderate hyponatremia	Severe hyponatremia	Total
26	Hematopoetic system	Epistaxis	0	4	3	9	16
		Bleeding from IV site	1	4	3	10	18
		Malena	0	0	1	2	3
		Haematemesis	0	0	0	2	2
		petechial skin rash	1	3	3	5	12
		Gum bleeding	0	0	3	2	5
17	Central nervous system	Encephalopathy	0	2	4	7	13
		Hypokalemic paralysis	0	0	1	3	4
		Guillain barre syndrome	0	0	1	1	2
		Acute disseminating encephalo myelitis	0	0	0	1	1
2	Respiratory system	Pneumonia	0	0	1	0	1
		Acute respiratory distress syndrome	0	0	0	1	1
1	Hepato Biliary system	Acute acalculous cholecystitis	0	0	0	1	1

DISCUSSION

Hyponatremia is the most common electrolyte disturbance in dengue fever. The levels of serum sodium play a significant role in the prognosis of dengue fever and dengue associated complications.

Sodium plays a major role in neuronal function and osmoregulation between cells and extra cellular fluid. Na+/K+ ATPase mediates the distribution of sodium ions.[11] The cause for hyponatremia in dengue fever patients remain uncertain. However the contributing factors for hyponatremia may be: salt depletion; excess water from increased metabolism; decreased renal function; transient inappropriate ADH or influx of sodium in the cells as a result of dysfunction of sodium potassium pump.[12]

In previous studies, the alteration in serum sodium levels in dengue is not influenced by the sex of the child and also the incidence of dengue associated complications.[12]

In our present study it is evident that with the decreasing serum sodium levels, there is an increasing incidence of associated complications. It is also evident that the bleeding and the CNS complications are more common as compared to respiratory, hepatobiliary and other complications.

Respiratory and hepatobiliary complications are rare and have been seen only in cases with moderate and severe hyponatremia. Neurological complications of dengue are wide spread and may involve all parts of the nervous system through various pathogenic mechanisms.

Atypical respiratory complications are rare but life threatening. Most of the times respiratory complications are associated with bleeding manifestations.

Acute acalculous cholecystitis is also a very rare and life threatening complication which is most of the times associated with bleeding manifestations.

CONCLUSION

- Hyponatremia is the most common electrolyte disturbance in dengue fever as well as dengue associated complications.
- The lower the serum sodium levels the higher is the incidence of complications associated with dengue fever.
- The incidence of CNS and bleeding complications is more as compared to the RS and hepatobiliary complications.
- The incidence of RS and hepatobiliary complications is high with moderate and severe hyponatremia.
- Thus serum sodium plays a most important role in the prognosis of dengue fever and associated complications.

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