ISSN:0975-3583,0976-2833 VOL13, ISSUE05,2022

ORIGINAL RESEARCH ARTICLE

ASSESSMENT OF ELECTROLYTE DISTURBANCES IN CHILDREN WITH DENGUE FEVER AT TERTIARY CARE CENTRE

[1]Dr. Girish Rajaram Shakuntal, [2]Dr.Vaibhav Kashinath Gode, [3]Dr. Swati Vinay Jain, [4]Dr. Ashwini Baban Kundalwal, [5]Manas Vaibhav Pustake

[1,2,3,4]MD Pediatrics, Associate Professor, SMBT Institute of Medical Sciences and Research Centre, Dhamangaon, Nashik, Maharashtra, India

[5]MMBS Student, Grant Govt. Medical College and JJ Group of Hospitals, Mumbai, Maharashtra, India

Corresponding Author:

Dr. Ashwini Baban Kundalwal (drkundalwal.aswini@gmail.com)

Abstract

Background: Dengue is severe flu-like illness and, sometimes causing a potentially lethal complication called severe dengue. The incidence of dengue has increased 30-fold over the last 50 years. Hypokalaemia and Hyponatremia are frequent electrolyte disturbances in Dengue fever.

Aim: To study the spectrum of electrolytes disturbances in dengue patients.

Material and Methods: Descriptive cross-sectional hospital-based study conducted at paediatrics department in tertiary care hospital on 200 children up to age of 14 years having serologically proven dengue infection.

Results: Female to male ratio was 0.88:1 with mean age of 8.97 years. Highest number of cases were from age group between 5 to 9 years (44.5%). 59% cases had dengue fever, 29% had Dengue Haemorrhagic Fever and 12% had Dengue Shock Syndrome. Fever (94%) and myalgia (71%) were commonest presentations. Mean serum sodium levels in DF, DHF and DSS were 137.29, 117.67 and 111.09 while mean s. sodium in all patients was 122.01 mEq/L. Mean levels of s. potassium in DF, DHF and DSS were 3.97, 2.97 and 2.07 respectively. Difference between these three mean levels was statistically significant ($p<0.0001$).

Conclusion: DF cases had mild hypokalaemia and mild hyponatremia while moderate to severe hyponatremia and hypokalaemia were found in DHF and DSS cases. Due to crucial role of fluids and lesser role of antibiotics in management of Dengue cases, keeping eye on serum electrolytes levels may help for assessment of severity as well as can reduce occurrence of complications and mortality.

Keywords: Vector borne diseases, break bone fever, hyponatremia, hypokalaemia, fever with rash

ISSN:0975-3583,0976-2833 VOL13, ISSUE05,2022

Introduction

Dengue is fast emerging pandemic-prone viral disease in many parts of the world. It causes a severe flu-like illness and, sometimes causing a potentially lethal complication called severe dengue. The incidence of dengue has increased 30-fold over the last 50 years[1]. During 2017 in India, about 157,996 cases were reported with 253 deaths. The case fatality rate was 0.16 per cent[2,3]. Dengue is classified into 2 major categories i.e. dengue (with/without warning signs) and severe dengue. Dengue without warning sign (Dengue fever-DF) has high grade fever (40^{o}C) while Dengue with warning sign (Dengue Haemorrhagic fever-DHF) has characteristics like severe headache, pain behind eyes, myalgia, rash and swollen glands. Severe Dengue (Dengue shock syndrome-DSS) has characteristics like severe abdominal pain, bleeding gums, hematemesis and falling blood pressure. Severe dengue is a potentially fatal complication, due to plasma leaking, fluid accumulation, respiratory distress, severe bleeding, or organ impairment[4,5].

Hypokalaemia and Hyponatremia are frequent electrolyte disturbances in Dengue fever. Hypokalaemia may be due to an increased in renal excretion due to activation of renin-angiotensin and aldosterone system secondary to volume depletion and poor intake. Hyponatremia may due to excess water from increased. Metabolism, salt depletion, influx of sodium in the cells as a result of dysfunction of sodium potassium pump or transient inappropriate antidiuretic hormone[6,7,8].

Considering high incidence of dengue infection in India and occurrence of electrolyte imbalance responsible for increased severity in dengue cases, this study was aimed to know the spectrum of electrolytes disturbances in dengue cases.

Material and Methods

An observational descriptive longitudinal hospital-based study was conducted in the department of Paediatrics in a tertiary care hospital, for a period of 1 year from January 2017 to December 2017. Institutional Ethics Committee (IEC) permission was taken before commencement of study. Children up to the age of 14 years with positive dengue tests, either IgM, IgG antibody rapid serological test or ELISA or NS1 antigen, were included. Patients with pre-existing kidney and liver dysfunction, suffering from any other febrile illness or with co-infection (like Dengue and malaria or typhoid fever) were not included. Two hundred children up to age of 14 years were enrolled for this study.

Written informed consent and assent was taken from children and their parents before data collection. Information about demographic profile; onset, duration and progress of disease was collected in details. Thorough general and systemic clinical examination was done to find out signs of dengue infection. Blood investigations like haemoglobin, total leucocytes count, platelets count, haematocrit value, liver enzymes, BUN, serum creatinine, sodium, potassium and chloride levels were done at the time of admission.

Standard operating protocols and definitions were set before hand and followed till end. Hypokalaemia (Serum potassium levels <3.50 mEq/L; Mild Hypokalaemia (3 to 3.5 mEq/L); Moderate Hypokalaemia (2.5 to 3 mEq/L; Severe Hypokalaemia (<2.50 mEq/l) and Hyperkalaemia (Serum potassium >5.0 mEq/L. Hyponatremia (serum

ISSN:0975-3583,0976-2833 VOL13, ISSUE05,2022

sodium levels < 135 mEq/L); hyponatremia (Mild-125-135 mEq/L, Moderate-120-125 mEq/L, Severe-hyponatremia-<120 mEq/L and hypernatremia (>145 mEq/L). Normal range of S. Chloride level was 96-105 mEq/L[9,10,11].

Data was entered in Microsoft Excel 2007 and analysed using SPSS v.16. Data was summarized and presented using tables and graphs. Descriptive statistics like frequency, proportion, mean and standard deviations were used. One-way ANOVA was used as inferential statistics.

Results

Table no. 1 depicts, age and gender wise distribution of study participants. Mean age of study participants was 8.97 years with female to male ratio of 0.88:1. Maximum children were from 5 to 9 years of age group (44.5%) in both gender. Least number of cases were below the age of 1 year. Out of 200 children, 53% were male and 47% were female. Mean age of male and female children were 8.9 years and 9.4 years, respectively.

As shown in fig. No.1, total dengue cases were classified into dengue fever, dengue haemorrhagic fever and dengue shock syndrome. Most cases were of dengue fever (59%), followed by Dengue haemorrhagic fever (DHF) (29%) and dengue shock syndrome (DSS) (12%). These classes were based on severity of dengue fever based on symptoms and signs characteristics to DF/DHF/DSS. The most common symptom was fever present in 94% cases followed by myalgia in 130 (71%) cases, headache in 110 cases (55%) and skin petechial rash in 52 cases (25.1%).

As shown in table no. 2 which depicts serum electrolytes levels in study participants, mean serum sodium levels in DF, DHF and DSS were 137.29, 117.67 and 111.09 while mean s. sodium in all patients was 122.01 mEq/L. Out of 200 cases, 57% had normal serum sodium levels while 40% had mild to moderate hyponatremia, 1.5% had sever hyponatremia and 1% had hypernatremia. Difference between mean levels of serum sodium among DF, DHF and DSS were statistically significant after applying one way ANOVA test. ($p<0.0001$). In 200 cases, mean potassium level was 3.03 mEq/L. Mean levels of s. potassium in DF, DHF and DSS were 3.97, 2.97 and 2.07 respectively. With one way ANOVA, the difference between these three mean levels was statistically significant ($p<0.0001$). Out of total cases, 54.5% had normal potassium levels while, 38% had mild to moderate hypokalaemia, 4.5% had severe hypokalaemia and 3% had hyperkalaemia. Mean S. Chloride level was 103+/-1.35 mEq/L in all cases. Normal S. Chloride level was found in 94.5% cases.

Table no. 3 highlights haematological and liver enzyme levels in study participants. Out of total 200 cases, 55% had normal TLC levels, 18% had leucocytosis and 27% had leukopenia. Among 119 cases with DF, 60% had normal TLC, 14% had raised TLC and 26.6% had decreased TLC levels. Among 58 cases with DHF, 50% normal TLC count, 22% had raised count and 28% had decreased count. Among 23 DSS cases, 43% had normal TLC count, 26% had raised TLC count while 30% had decreased count. Among 200 cases, 33% and 52% had raised SGPT and SGOT levels, respectively. Raised SGPT levels were found in 39.13%, 39.66% and 28.81% cases of DSS, DHF and DF respectively. Raised SGOT levels were found in 69.57%, 60.34% and 44% cases of DSS, DHF and DF respectively. SGPT levels raised above 1000 U found in 8.7%, 3.45% & 1% cases of DSS, DHF & DF respectively. SGOT levels raised above

ISSN:0975-3583,0976-2833 VOL13, ISSUE05,2022

1000 U found in 13.04%, 12.07% & 3.39% cases of DSS, DHF & DF respectively.

Table 1: Age and gender wise distribution of study subjects (n=200)

Age group (years)	Male		Female		Total	
	Frequency	%	Frequency	%	Frequency	%
Up to 1 year	4	3.77	5	5.32	9	4.5
1 to 5	31	29.25	26	27.66	57	28.5
5 to 9	47	44.34	42	44.68	89	44.5
9 to 14	24	22.64	21	22.34	45	22.5
Total	106	100.00	94	100.00	200	100

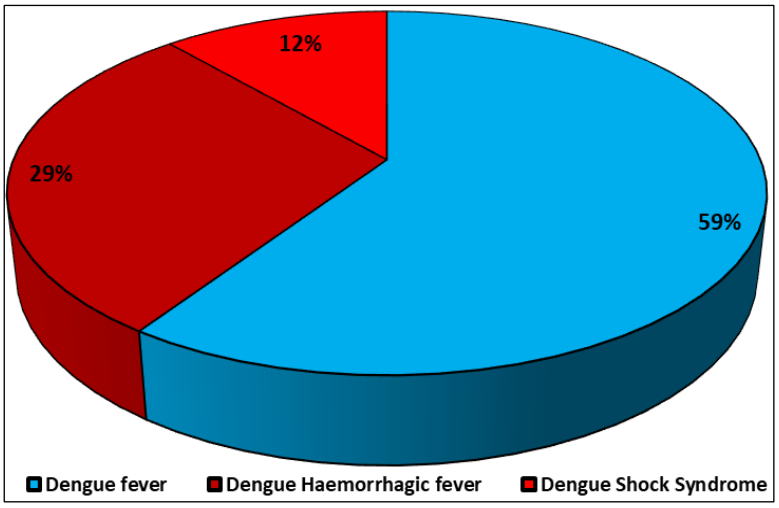

Fig 1: Distribution of cases according to severity (n=200)

Table 2: Serum electrolytes levels in study participants (n=200)

Serum electrolyte levels (mEq /L)		Dengue Fever	Dengue Haemorrhagic Fever	Dengue Shock Syndrome	Total	%
Serum sodium levels	Normal	69	32	13	114	57
	Mild hyponatremia	43	13	6	62	31
	Moderate hyponatremia	7	11	1	19	9.5
	Severe hyponatremia	0	1	2	3	1.5
	Hypernatremia	0	1	1	2	1
	Mean ± SD sodium levels	137.29±1.33	117.67±7.14	111.09±12.73	122.01±15.89*	
Serum potassium levels	Normal	73	27	9	109	54.5
	Mild hypokalaemia	34	17	3	54	27
	Moderate hypokalaemia	8	9	5	22	11
	Severe hypokalaemia	3	2	4	9	4.5
	Hyperkalaemia	1	3	2	6	3
	Mean ± SD potassium	3.97±0.67	2.97±0.48	2.07±0.81	3.03±0.75*	

ISSN:0975-3583,0976-2833 VOL13, ISSUE05,2022

	levels					
Serum chloride levels	Normal	117	53	19	189	94.5
	Mean ± SD chloride levels	-	-	-	103±1.35	
	Total	119	58	23	200	100
*p value <0.0001 (Statistically significant)						

Table3: Haematological & liver enzyme parameters in dengue cases

Severity of dengue cases		**Dengue Fever (n=119)**		**DengueHaemorrhagic Fever (n=58)**		**Dengue Shock Syndrome (n=23)**		**Total (n=200)**	
Haematologicalparameters		**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
TLC	Leukopenia (<4000 cells/mm3)	31	26.27	16	27.59	7	30.43	54	27.00
	Leucocytosis (>11000 cells/mm3)	17	14.41	13	22.41	6	26.09	36	18.00
	Normal TLC (4000-11000/mm3)	71	60.17	29	50.00	10	43.48	110	55.00
Liver enzymes									
Rise in SGPT (IU/L)	Rise in	34	28.81	23	39.66	9	39.13	66	33.00
	50-200 U	28	23.73	16	27.59	4	17.39	48	24.00
	200-1000 U	5	4.24	5	8.62	3	13.04	13	6.50
	>1000 U	1	0.85	2	3.45	2	8.70	5	2.50
Rise in SGOT (IU/L)	Rise in	52	44.07	35	60.34	16	69.57	103	51.50
	50-200 U	38	32.20	22	37.93	8	34.78	68	34.00
	200-1000 U	10	8.47	6	10.34	5	21.74	21	10.50
	>1000 U	4	3.39	7	12.07	3	13.04	14	7.00

Discussion

Present study conducted on 200 children up to 14 years of age having dengue infection. In present study, female to male ratio was 0.88:1 with mean age of 8.97 years. Mean age of male children (8.9 years) was lower than that of female children (9.4 years). Only 4.5% were infants. Highest number of cases were from age group between 5 to 9 years (44.5%). Study done by Shankar *et al*.[12] reported, 47% cases from age group of 5 to 12 years and 5.5% cases from infancy. These study findings were similar to present study. Study done by Mishra *et al*. [13] reported 49% cases from 4 to 11 years of age group and 15.4% cases below the age of three years. They also reported 0.29:1, female to male ratio. These findings were concurrent with present study findings. More number of male than female cases may be due to more attention to male children than female. Another reason may due to female used to wear full body covering dresses than male.

In current study, out of 200 cases 59% cases had dengue fever (DF), 29% had Dengue Haemorrhagic Fever (DHF) and 12% had Dengue Shock Syndrome (DSS). Also fever

ISSN:0975-3583,0976-2833 VOL13, ISSUE05,2022

(94%) and myalgia (71%) were commonest presentations in current study. Study done by Mishra *et al.* [13] reported, 13% cases of DSS and 54.6% cases of DF and DHF. They also reported fever in 100% cases, myalgia in 77% cases and abdominal pain in 54% cases. These findings were parallel in line with current study findings.Study done by Shankar *et al.* [12] reported, fever and myalgia in 98% and 71% cases while Khandelwal *et al.* [14] reported fever (97%) and myalgia (79%) as commonest symptoms. Unnikrishnan *et al.* [15] noted fever (ear temperature >38°C) in 98.1% patients. Shankar *et al.* [12] reported 68% DF, 22% DHF and 10% DSS cases while Khandelwal *et al.* [13] reported, 85% DF cases, 14% DHF and 1% DSS cases.

Studies done by Mekmullica *et al.* [16] and Lumpaopong *et al.* [17] reported mean sodium levels in dengue cases in Thailand were 132 mEq/L and 133 mEq/L. Shankar *et al.* [12] also reported mean sodium level of 133.69 mEq/L in their study. This was in line with current study finding which reported slightly lower mean level i.e. 122 mEq/L. in present study, 57% had normal serum sodium levels while 40% had mild to moderate hyponatremia, 1.5% had sever hyponatremia and 1% had hypernatremia. Shankar *et al.* [12] reported 49 % with mild hyponatremia, 37% with serum sodium levels within normal limits, 8% with moderate hyponatremia and 1% patients had severe hyponatremia. In current study mean sodium levels decrease from DF cases to DHF cases to DSS cases. Difference between mean levels of serum sodium among DF, DHF and DSS were statistically significant. This highlight utility of S. Sodium level for prediction of progression of DF cases to DSS cases. Mekmullica J *et al.* [16]reported, hyponatremia was almost 10 times more common in Dengue patients, average S. Sodium level was statistically significantly lower in DSS cases as compared to DF/DHF cases (p-value = 0.003).

In present study, 54.5% had normal potassium levels while, 38% had mild to moderate hypokalaemia, 4.5% had severe hypokalaemia and 3% had hyperkalaemia while mean levels of s. potassium in DF, DHF and DSS were 3.97, 2.97 and 2.07 respectively. DSS cases had less S. Potassium as compared to DHF and DF cases. The difference was statistically significant. So Both S. Sodium and S. Potassium levels can be used to predict DSS. Shankar *et al.* [12] reported, 60% with normal level, 27 % with mild hypokalaemia, 10% with moderate hypokalaemia, 2% with severe hypokalaemia and only 1% with hyperkalaemia. Kalita *et al.* [18] noted hypokalaemia in Dengue fever cases. Widodo *et al.* [19] reported hypokalaemia in 23% cases of dengue fever. Similar findings were reported by Khandelwal *et al.* [14], where 55% cases with normal serum potassium levels, 33% with mild hypokalaemia, 6% with moderate hypokalaemia and 3% with severe hypokalaemia. They have also reported 2.5% cases with hyperkalaemia. Mishra *et al.* [13] reported, 31% and 47% cases with raised SGPT and SGOT levels, respectively. They have also reported, 39% and 77% cases of DSS with raised SGPT and SGOT levels. These findings were similar to present study findings. So SGOT levels are more raised in DSS cases as compared to SGPT levels.

Conclusion

In present study, statistically significant differences found between mean levels of S. Sodium and S. Potassium among Dengue fever, Dengue Haemorrhagic fever and Dengue Shock Syndrome cases. DF cases had mild hypokalaemia and mild hyponatremia while moderate to severe hyponatremia and hypokalaemia were found in

ISSN:0975-3583,0976-2833 VOL13, ISSUE05,2022

DHF and DSS cases. Due to urbanization, the incidence of dengue cases is rising and mortality rates increase from DF to DHF to DSS. Due to crucial role of fluids and lesser role of antibiotics in management of Dengue cases, keeping eye on serum electrolytes levels may help for assessment of severity as well as can reduce occurrence of complications and mortality.

References

1. Dengue Control. World Health Organization. Accessed on 26 Dec. 19. Available at: https://www.who.int/denguecontrol/disease/en/
2. Dengue situation in India. NVBDCP. Accessed on 26 Dec. 19. Available at: https://nvbdcp.gov.in/index4.php?lang=1&level=0&linkid=431&lid=3715
3. K. Park. Dengue. Park's Textbook of Preventive and Social Medicine. Bhanot Publishers, Jabalpur. 25th Ed. 2019; pp: 269-79.
4. Dengue and severe-dengue. World Health Organization. Accessed on 26 Dec. 19. Available at: https://www.who.int/news-room/fact-sheets/detail/dengue-and-severe-dengue
5. Dengue fever. National Health Portal. Accessed on 26 Dec. 19. Available at: https://www.nhp.gov.in/disease/musculo-skeletal-bone-joints-/dengue-fever
6. Vikram K, Nagpal B, Pande V, Srivastava A, Saxena R, Anvikar A, *et al*. An epidemiological study of dengue in Delhi, India. Acta Trop. 2016;153:21-7.
7. Caroline RoseJ, Palanisamy AVH. Electrolyte disturbance in Dengue infected patients in Salem, Tamilnadu. Int J Adv PHARMACY, BiolChem., 2014, 3(4).
8. DasB,DasM,DwibediB,KarSK,HazraRK. Molecular investigations of dengue virus during outbreaks in Orissa state, Eastern India from2010 to 2011,Infection, Genetics and Evolution.2013;16:401-410.
9. Chirag Vaidya, Warren HO BJF. Management of hyponatremia: Providing treatment and avoiding harm. Cleve Clin J Med [Internet]. [cited 2018 Nov 6], 2010, 10.
10. National Health Services. Guideline for the Management of Hypokalaemia in Adults. Med Information, CGH, 2008-2010July, 2009-10.
11. Kayal AK, Goswami M, Das M, Jain R. Clinical and biochemical spectrum of hypokalemic paralysis in North: East India. Ann Indian AcadNeurol. 2013;16:211-7.
12. Shankar P, Nithya E, Kavya C. Study on electrolyte disturbances in dengue fever in a tertiary care centre. Int J Contemp Pediatr. 2019;6:2504-8.
13. Mishra S, Ramanathan R, Agarwal S. Clinical Profile of Dengue Fever in Children: A Study from Southern Odisha, India. Hindawi Publishing Corporation Scientifica, 2016, 6. Article ID 6391594. http://dx.doi.org/10.1155/2016/6391594
14. Khandelwal VG, Patil VC, Botre A. Study of Electrolyte Disturbances in Dengue Infected Patients. International Journal of Contemporary Medical Research. 2019;6(2):B5-B8.
15. Unnikrishnan R, Faizal BP, Vijayakumar P, Paul G, Sharma RN. Clinical and laboratory profile of dengue in the elderly. J Fam Med Prim care. 2015;4:369-72.
16. Mekmullica J, Suwanphatra A, Thienpaitoon H, Chansongsakul T, Cherdkiatkul T, Pancharoen C, *et al*. Serum and urine sodium levels in dengue patients. Southeast Asian J Trop Med Public Health. 2005 Jan;36(1):197-9.

ISSN:0975-3583,0976-2833 VOL13, ISSUE05,2022

17. Lumpaopong A, Kaewplang P, Watanaveeradej V, Thirakhupt P, Chamnanvanakij S, Srisuwan K, *et al*. Electrolyte disturbances and abnormal urine analysis in children with dengue infection. Southeast Asian Journal of Tropical Med and Public Health. 2010 Jan;41(1):72.
18. Kalita J, Misra UK, Mahadevan A, Shankar SK. Acute pure motor quadriplegia: is it dengue myositis? Electromyogr Clin Neurophysiol. 2018;45:357-61.
19. Widodo D, Setiawan B, Chen K, Nainggolan L, Santoso WD. The prevalence of hypokalaemia in hospitalized patients with infectious diseases problem at Cipto Mangunkusumo Hospital, Jakarta. Acta Med Indones. 2018;38:202-5.