Original Research Article

A prospective study on biochemical disturbances among cases of acute diarrhoea in children attending a tertiary care hospital of South India

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ABSTRACT

Background: Diarrhoea is one of the commonest clinical entities encountered regularly in clinical practice. In India, at least 1.5 million children die due to acute diarrhoea per year. Timely recognition, high index of suspicion and thorough understanding of various clinical signs in different types of dehydration is necessary in preventing the deaths. The present study focuses on the different types of biochemical alterations and electrolyte disturbances in cases of acute diarrhoea among children.

Methods: A prospective study with ethical committee consent was done at a tertiary care hospital for two years in department of Paediatrics. All cases of acute diarrhoea attending with signs and symptoms of moderate and severe dehydration were included. Clinical history and necessary biochemical investigations including serum electrolytes were performed. The results and data were entered in an excel sheet and analysed.

Results: 250 cases were enrolled in the study with males (57.6%) and females (42.4%). 1month to 5 years with 84 cases (33.6%) was the most common age group with mean age of 11.48± 2.4 years. History of passage of loose motions was with a frequency ranging from 6-12 /day with a mean frequency was 8.12/day. 80.8%cases had some kind of electrolyte abnormality with majority having isolated Hyponatremia and a combined Hyponatremia and Hypokalemia (33.6%) each.

Conclusions: Diarrhoeal disorders can be easily prevented with proper hand hygiene practices, health awareness programmes, increased breast-feeding practices and proper disinfection of water. Hyponatremia, hypokalemia, combined Hyponatremia and hypokalemia are major electrolyte abnormalities in cases of diarrhoea.

Keywords: Dehydration, Diarrhoea, Hypokalemia, Hyponatremia

INTRODUCTION

Diarrhoea is one of the commonest clinical entities encountered regularly in clinical practice. This condition is leading cause of death and illness among children in developing countries. In India, at least 1.5 million children die due to acute diarrhoea per year explaining the importance of the clinical condition. As per the estimates of WHO, 1 child dies due to diarrhoea per every six seconds.[1] Diarrhoea is defined as having loose or watery stools at least three times per day or more frequently than normal for an individual. 80% of the deaths occur in children below 2 years of life. According to the report of National institute of cholera and Enteric disease, Kolkata crude death rate due to diarrhoea in rural India is 9.3 per 1000 population and the diarrhoeal deaths account for 22% of rural deaths among 0 to 6 years age children.[2]

More incidences of diarrheal deaths in developing countries is attributed to the higher rates of malnutrition among children, lack of hygienic practices, poor

education, increased vulnerability to infections and early substitutes for breast milk. Reports of decreasing trend of breast feeding and faulty practice of early bottle feeding play a pivotal role in diarrhoeal deaths in developing countries.[3] More than 90% of cases of acute diarrhoea are due to infectious agents, which may be bacterial or viral. Most of the deaths in acute diarrhoea are due to excessive fluid loss and electrolyte loss that result in dehydration and acidosis, thus majority of deaths in diarrhoea are avoidable as long as fluid and electrolytes are replaced regularly and properly.

Oral rehydration therapy with glucose electrolyte solution has saved the lives of millions of children since it was introduced and remains the main stay of therapy for acute watery diarrhoea. Hence clinical recognition of signs and symptoms of dehydration and electrolyte disturbances becomes crucial in preventing the deaths due to diarrhoea.

Often in developing countries, the laboratory facilities in identifying the electrolyte disturbances are not available or may be available with a considerable time lag. Timely recognition, high index of suspicion and thorough understanding of various clinical signs in different types of dehydration is necessary to ensure their correction in preventing the deaths.[4]

No recent studies are available from the present place of study in identifying the different types of electrolyte disturbances. Hence the present study mainly focuses on the different types of biochemical alterations and electrolyte disturbances in cases of acute diarrhoea among children attending the tertiary care centre.

METHODS

The present prospective study was conducted at a tertiary care hospital of south India for a period of 2 years from January 2106 to December 2017. The study was approved by the institutional ethical committee and all the guidelines of the committee were followed. A total of 250 cases of children attending the emergency department of paediatrics and OPD of paediatrics with history of acute gastroenteritis during the study period were enrolled in the study.

Inclusion criteria

- Children between age group of 1month to 18 years were included in the study.

Detailed history of the patient was taken from the parents or associated persons regarding frequency of stools, consistency and history of urine output in last 24 hours were noted. Detailed clinical examination was performed by a senior paediatrician with special attention to severity of dehydration, altered sensorium, and grade of PEM was

noted. Severity of dehydration was assessed as per the WHO criteria.

Cases with moderate/ severe dehydration, passage of loose stools, large frequent stools, and vomiting, altered sensorium were taken into study. History of administration of oral rehydration salt was taken or not, if not its volume given after each loose motion. Patients with blood in stools or rehydrated by Intravenous administration or ORS were excluded from the study. Blood samples of the cases were obtained before rehydration and sent for clinical biochemistry laboratory. Details of the study were clearly explained to all the parents or cases or guardians and written informed consent was obtained from all the cases in the study. Basal Haematological investigations including Hb%, ESR, Total cell counts, and platelet counts were done. Basic biochemical investigations including basal blood sugar, urea and serum electrolytes including calcium, sodium, potassium and serum creatinine was estimated. The details of the cases enrolled were entered in a separate predesigned questionnaire sheet and analyzed.

All the cases were treated as per the WHO guidelines and discharged. Cases that were not followed till the discharge and discharged against advice, not consented for study were excluded from the study.

Definitions

- Hyponatremia: <135mmol/l,
- Hypernatremia: >145mmol/l.
- Hypokalemia: <3.5mmol/l;
- Hyperkalemia: >5.5mmol/l.
- Normal Creatinine levels: 1 month-1 year: 0.2-0.4; 1-2 years: 0.2-0.5; 3-18 years: 0.3-0.7

Statistical analysis

All the collected data was entered in a Microsoft excel spread sheet and analyzed. Data was tabulated and mean, and median values were calculated for variables.

RESULTS

In the present prospective study, 250 cases were enrolled with male predominance (144/250, 57.6%) and females (106/250, 42.4%). The male to female ratio in the study was 1.36:1. The most common age group in the study population was between 1 month to 5 years with 84 cases (33.6%) with males accounting for 48 and females 36 followed in order by >5 years -<10 years (78 cases, 31.2%), >10 years - <15 years (49 cases, 19.6%) and least >15 years -18 years (39 cases, 15.6%). The mean age of the study group was 11.48± 2.4 years with males being 12.11± 1.8 years and females 11.98± 1.6 years. Overall there was a male preponderance in all the age groups of present study (Table 1).

Table 1: Age distribution of cases in the study.

Age group	Male	%	Female	%	Total	%
1 month-5 years	48	33.33	36	33.96	84	33.6
>5 years-<10 years	41	28.47	37	34.91	78	31.2
>10 years-<15 years	29	20.14	20	18.87	49	19.6
>15 years-18 years	26	18.06	13	12.26	39	15.6
Total	144 (57.6%)		106 (42.4%)		250	

Clinical signs and symptoms

All the 250 cases presented with history of passage of loose motions with a frequency ranging from 6-12 /day (Mean Frequency was 8.12/day). Majority of the cases also presented with vomiting (71.2%) with an episode of 3-4 times /day.

Dry tongue (67.2%) and slow retraction of skin (61.6%) were the next major symptoms associated with cases of moderate and severe dehydration in present study.

Fever and Tachypnoea were observed in 48% of cases in the study. Increased thirst and sunken eyeball were seen in 34% of cases. Less commonly observed was altered sensorium, only in 9.6% of cases in the study (Table 2).

Table 2: Clinical symptoms associated with cases in the study.

Symptoms	No.	%
Increased frequency of stool	250	100
Vomiting	178	71.2
Fever	121	48.4
Increased thirst	85	34
Altered sensorium	24	9.6
Tachypnoea	120	48
Dry tongue	168	67.2
Slow retraction of skin	154	61.6
Sunken eyeball	86	34.4
Tachycardia	56	22.4

42% of the cases in the study were observed with some grade of malnutrition and 52% of the cases were normal.

Table 3: Grading of malnutrition of cases in the study.

Grade of PEM	Number	%
Normal	145	58
Grade-I (mild)	45	18
Grade-II (moderate)	29	11.6
Grade-III (severe)	26	10.4
Grade-IV (very severe)	5	2

Grading of PEM was done as per IAP classification and majority were observed with Grade-1 (MILD) (18%) followed in order by grade-II (MODERATE) (11.6%),

Grade-III (10.4%) and severe Grade-IV only in 2% of the cases in the study (Table 3).

Biochemical abnormalities

Two hundred and two children (80.8%) had some kind of electrolyte abnormality while 48 (19.2%) cases presented with normal electrolyte levels in present study.

Majority of the cases in the study were identified with Isolated Hyponatremia and a combined Hyponatremia and Hypokalemia (33.6%) each.

Increased frequency of diarrhoea, increased thirst, more episodes of vomiting, altered sensorium were associated with Hyponatremia in present study.

Isolated Hypokalemia was observed in 27.2% of cases in the study, isolated Hypernatremia in 9.6% of cases, Hyponatremia with hyperkalemia in 8%, hypernatremia with hypokalemia in 7.2% of cases in present study. No cases of isolated hyperkalemia were observed in present study (Table 4).

Table 4: Biochemical alterations among the cases in study.

Type of Biochemical disturbance	Number	%
Isolated Hyponatremia	84	33.6
Isolated Hypokalemia	68	27.2
Isolated Hypernatremia	24	9.6
Isolated Hyperkalemia	0	0
Hyponatremia+ Hypokalemia	84	33.6
Hyponatremia+ Hyperkalemia	20	8
Hypernatremia+ Hypokalemia	18	7.2
Hypernatremia+ Hyperkalemia	0	0
Normal electrolytes	48	19.2

The mean serum sodium was 134.8± 10.5 mEq/l and mean serum potassium was 3.5±1.2mEq/l. High levels of creatinine were observed in 24 cases and mean serum creatinine level was 1.2±0.8mg/dl.

DISCUSSION

Acute diarrhoeal disease is a major public health problem and a leading cause of paediatric morbidity and mortality with 1.5 billion episodes and 1.5-2.5 million deaths per

year among children aged less than 5 years. For children under 5 years in developing countries, there is a median of 3.2episodes of diarrhoea /child / year with a mortality of 4.9 / 1000 episodes /year constituting to 21 % of all deaths in children under 5 years of age.[5] In the present study, a total of 250 cases were enrolled with male dominance 57.6%, and the common age group in present study was 1 month to 5 years with 84 cases (33.6%) which is on par with the findings of many studies universally indicating male preponderance. In the study of Behera et al. The incidence was 48% which is higher than present study, the incidence of acute gastroenteritis varies from place to place and region to region in different parts of india based upon the hygienic conditions and public awareness.[6]

All the cases presented with loose motions with variable frequency and the average frequency was 8.12/day, similar finding was observed in the reports of Subbarao SD et al vomiting was observed in 71% of cases with 3-4 episodes/day.[7] Malnutrition was observed in 42% of cases in present study which is similar to the finding of Deivanayagam et al who reported the incidence as 52% in his study.[8] In the present study, electrolyte abnormality was observed in 80.8% of cases while similar result was observed in Shah GS et al with 84% of cases in his study.[9] Isolated Hyponatremia and combined Hyponatremia and Hypokalemia (33.6%) was the most common electrolyte abnormality in present study group, however study of Purohit KR et al reported 39% of cases of isolated Hyponatremia in his study.[10]

Increased frequency of diarrhoea, increased thirst, more episodes of vomiting, altered sensorium were associated with Hyponatremia in present study, where similar clinical findings were reported in majority of cases universally. The incidence of hypokalemia was 27.2% in present study which was similar to the reports of Ahmed I et al in his study.[11] The incidence of hypernatremia in the study was 9.6% which was similar to the findings of Samadi AR et al who observed the incidence of hypernatremia in their study as 12%.[12] However, few of the studies reported a higher incidence in the range of 18-22% of hypernatremia in their reports. Absence of cases of isolated hyperkalemia was an additional finding in present study, however most of the studies reported hyperkalemia in the range of 4-8% in their studies.

CONCLUSION

To conclude, diarrhoeal disorders can be easily prevented with proper hand hygiene practices, health awareness programmes, increased breast-feeding practices and proper disinfection of water.

Proper maintenance of nutrition is one of the key factors in reducing the mortality and morbidity associated with diarrhoea. Hyponatremia, hypokalemia, combined Hyponatremia and hypokalemia are major electrolyte abnormalities in cases of diarrhoea. Hence it is always necessary to keep a watch on developing signs in cases of severe or moderate dehydration. In order to reduce the mortality and morbidity proper use of ORS according to WHO recommendations should be used.

REFERENCES

1. Lakshminarayanan S, Jayalakshmy R. Diarrheal diseases among children in India: Current scenario and future perspectives. J Nat Sci Biol Med. 2015;6(1):24-8.
2. Million Death Study Collaborators. Bassani DG, Kumar R, Awasthi S, Morris SK, Paul VK, et al. Causes of neonatal and child mortality in India: A nationally representative mortality survey. Lancet. 2010;376(9755):1853–60.
3. Estimation of the Burden of Diarrheal diseases in India, NICED Kolkata Available at http://www.whoindia.org/linkfiles/commision on macroeconomic and health Bg P2 Estimation of the burden of diarrhoeal diseases in India.Pdf.
4. Kumar SG, Subitha L. Diarrhoeal diseases in developing countries: A situational analysis. Kathmandu Univ Med J (KUMJ) 2012;38(2):83-8.
5. Bulletin of the World Health Organ: The global burden of diarrhoeal disease: Vol.81: No.3: Geneva 2015.
6. Behera SK, Mohapatra SS, Kar S, Das D, Panda C Incidence and mortality of hospitalized diarrhoea cases. Part III. Indian Pediatr 1980.17(7):607-12.
7. Subba Rao SD, Thomas B. Electrolyte abnormalities in children admitted to paediatric intensive care unit. Indian Pediatr. 2000;37(12):1348-53.
8. Devignam N Mala, N Shafi Ahmad, Jagdish Shankar. Measles associated diarrhoea and Pneumonia in south India. Indian Pediatric. 1994;3:35.
9. Shah GS, Das BK, Kumar S, Singh MK, Bhandari GP. Acid base and electrolyte disturbance in diarrhoea. Kathmandu Univ Med J (KUMJ). 2007; 5(1):60-2.
10. Purohit KR, Jyotsna PSR. Electrolyte disturbances in Acute Diarrhea. Indian J Pediatr. 2014.38:393-5.
11. Ahmed I, Webb JK Childhood Diarrhoea in S. India with particular reference to fluid and electrolyte disturbance. Indian J Child Health 2013.12(2):85-91.
12. Samadi AR, Wahed MA, Islam MR, Ahmed SM consequences of hyponatremia and hypernatremia in children with acute diarrhoea in Bangladesh. Br Med J. 2014;286(6366): 671-3.