LABORATORY ABNORMALITIES IN ACUTE DIARRHOEA IN CHILDREN

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ABSTRACT

BACKGROUND

Diarrhoeal diseases are major cause of hospitalisation and child deaths globally. Together, they account for approximately one in six deaths among children younger than five years. In Indian health institutions, up to a third of paediatric admissions are due to diarrhoeal diseases and up to 17% of all deaths in indoor paediatric patients are due to diarrhoea.

The objectives of this study are-

- To determine the incidence and clinical importance of Hypokalaemia, Hypernatraemia, Hyponatraemia in children with acute diarrhoeal illness.
- To assess renal function in acute gastroenteritis.

MATERIALS AND METHODS

It is proposed to conduct a descriptive study with 100 children in the age group of 1 month to 5 years admitted to Paediatric ward with history of diarrhoea, significant dehydration and weight loss at Katuri Medical College and Hospital from November 2014 to November 2015 over a period of 1 year. Analysis will be done using appropriate statistical tools.

RESULTS

Mean age in the male children suffering from diarrhoea are 52%, which is more than females. 39% have some signs of dehydration vs 69% of no signs of dehydration, 39% suffered from paralytic ileus. 40% of the children have higher creatinine levels, i.e. into AKI. 46% are Hyponatraemic, 15% of Hypernatraemic and 17% are hypokalaemic. In this study, most of the patients are Hyponatraemic, Hypernatraemic and Hypokalaemic.

CONCLUSION

There is huge impact of diarrhoea on Biochemical abnormalities, especially Hyponatraemia and Hypokalaemia. Early treatment with ORS has been associated with improvement in the children to prevent morbidity and mortality.

KEYWORDS

Acute Diarrhoea, Hyponatraemia, Hypernatraemia, Hypokalaemia, AKI, Paralytic Ileus.

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BACKGROUND

Diarrhoeal diseases are major cause of hospitalisation and child deaths globally. Together, they account for approximately one in six deaths among children younger than five years. Of India's more than 2.3 million annual deaths among children, about 334,000 are attributable to diarrhoeal diseases. Global deaths from diarrhoea of children aged less than 5 years were estimated at 1.87 million (95% confidence interval, CI: 1.56 - 2.19). Total diarrhoeal deaths in India among children aged 0 - 6 years was estimated to be 158,209 and proportionate mortality due to diarrhoea in this age group was 9.1%. Average estimated incidence of diarrhoea in children aged 0 - 6 years was 1.71 and 1.09 episodes/ person/ year in rural and urban areas. Diarrhoea is defined as passage of 3 or more loose or watery stools in a 24-hour period, a loose stool being one that would take the shape of container. Acute watery diarrhoea is defined as sudden onset of exclusively loose stools of > 10 mL/ kg/ day in infants and > 200 g/ 24 hrs. in older children, which lasts < 14 days. Young age, low socioeconomic status, poor maternal literacy, presence of under-five sibling in the family, birth weight, inadequate breastfeeding, malnutrition, poor sanitation and hygiene practices of the mother are associated with a higher incidence of diarrhoeal diseases in young children.[1]

Infectious Diarrhoea occurs as a Result of 2 Major Disturbances in the Normal Intestinal Physiology-

1. Increased intestinal secretions mediated by variety of secretagogues including prostaglandins, 5-HT, substance P and VIP.
2. Decreased absorption due to-
   a. Impaired epithelial transport process.
   b. Osmotic diarrhoea due to appearance of incompletely absorbed nutrients.
   c. Impaired water and sodium reabsorption by the colon due to direct involvement of colonic absorptive process.[2]

A safe antisecretory agent can offer relief to diarrhoeal symptoms and reduce the use of inappropriate antimicrobial agents and the consequent risk of developing antimicrobial resistance. However, in high volume watery diarrhoea such as cholera replacing the loss orally still present a major challenge for health care professionals.[3]

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ORS cannot be the ultimate management of dysentery and cholera. World Health Organisation has recommended the drug treatment in dysentery and cholera as long as the drug used has proven safety and efficacy in paediatric population.[4]

Aims and Objectives

1. To determine the incidence and clinical importance of Hypokalaemia, Hypernatraemia, Hyponatraemia and Hypoglycaemia in children with acute diarrhoeal illness.
2. To assess renal function in Acute Gastroenteritis.

MATERIALS AND METHODS

Source of Data

It is proposed to conduct a study with 100 children in the age group of 1 month to 5 years admitted to paediatric ward with history of diarrhoea, significant dehydration and weight loss at Katuri Medical College and Hospital from November 2014 to November 2015 over a period of 1 year. Data analysed by using frequencies, percentages, mean and chi-square test using SPSS-21 version.

Study Design

Study over a period of 1 year from 1/11/2014 to 30/11/2015.

Study Centre

Patients attending to Paediatrics OPD and IPD at Katuri Medical College and Hospital.

Sample Size

100 children were studied with acute gastroenteritis.

Inclusion Criteria

1. 1 month to 5 years of age (with acute gastroenteritis).
2. Some/ severe dehydration.
3. Excessive vomiting.
4. Large frequent stools.

Exclusion Criteria

1. Altered sensorium.
2. Pneumonia.
3. Gastroenteritis more than 7 days.

Method of Collection

A detailed history from the patients with acute gastroenteritis of age 1 month to 5 years was taken. The procedure of the study explained and required consent for the study was taken. Examination of the patient was done and all relevant data has been obtained.

Clinical History

1. Patient's name, age, sex.
2. History of loose stools.
3. History of excessive vomiting.
4. History of large frequent stools.
5. History of abdominal distension.
6. Signs of dehydration according to WHO classification.
7. Feeding pattern.

Clinical Examination

Detailed clinical examination has been done to look for thirsty, irritability, pinched look, sunken eyes, dry inner side of cheeks, abdominal distension, deep and rapid breathing, weak and thready pulse, falling blood pressure, reduced quantity of urine according to WHO dehydration assessment scale.

Laboratory Investigations

1. Basic Haematological and Biochemical investigations were done in all patients including haemoglobin, total and differential white cell counts, platelets and peripheral smear examination.
2. Basal blood urea nitrogen and random blood sugar was done in all patients.
3. Serum electrolytes were determined at '0' hour (admission) and once between 24 to 48 hours (post hydration).
4. Stool microscopy for faecal leucocytes per high power field and parasites was done in all patients.
5. Liver function tests with serum calcium levels were done in most patients.
    1. Maintenance therapy.
    2. Correction of ongoing losses.
    3. Oral rehydration therapy (ORS).
    4. Oral antibiotic.
    5. IV fluids
    6. Dietetic treatment.

RESULTS

The present one year study was conducted in the Department of Paediatrics, Katuri Medical College and Hospital on patients presented with acute diarrhoea. A total of 113 children with acute diarrhoea aged more than 1 month to 5 years were selected for the study.

The data obtained was coded and entered into Microsoft Excel Worksheet. The data was analysed and the final results were tabulated as below-

Age in Yrs.	Frequency	Percent
< 1	59	52.2
1-2	11	9.7
3-5	43	38.1
Total	**113**	**100.0**

Table 1. Incidence of Age in Patients Studied

Sex	Frequency	Percent
F	53	46.9
M	60	53.1
Total	**113**	**100.0**

Table 2. Sex Distribution in Patients Studied

Dehydration	Frequency	Percent
No	69	61.1
Some	44	38.9
Total	**113**	**100.0**

Table 3. Distribution of Dehydration in Patients Studied

Abdominal Distension	Frequency	Percent
Absent	80	70.8
Present	33	29.2
Total	**113**	**100.0**

Table 4. Abdominal Distension in Patients Studied

Stool	Frequency	Percent
NAD	106	93.8
V. cholera	7	6.2
Total	**113**	**100.0**

Table 5. Incidence of V. cholera in Patients Studied

Urea (mg/dL)	Frequency	Percent
<20	5	4.4
20-35	76	67.3
>35	32	28.3
Total	**113**	**100.0**

Table 6. Urea Levels in Patients Studied

B. Glucose (mg/dL)	Frequency	Percent
<65	22	19.5
65-99	74	65.5
>=100	17	15.0
Total	**113**	**100.0**

Table 7. Glucose Levels in Patients Studied

LFT - T. Bil (mg/dL)	Frequency	Percent
<1.3	107	94.7
>1.3	6	5.3
Total	**113**	**100.0**

Table 8. Total Bilirubin Levels in Patients Studied

Weight in Kgs	Frequency	Percent
<5	19	16.8
5-10	49	43.4
10-15	32	28.3
>15	13	11.5
Total	**113**	**100.0**

Table 9. Incidence of Loose Motion according to Weight

Creatinine (mg/dL)	Frequency	Percent
<0.4	68	60.2
Total	**113**	**100.0**

Table 10. Creatinine Levels in Patients Studied

LM (Frequency)	No. of Patients	Percent
3	10	8.8
4	19	16.8
5	15	13.3
6	16	14.2
7	5	4.4
8	12	10.6
10	22	19.5
12	2	1.8
15	11	9.7
20	1	.9
Total	**113**	**100.0**

Table 11. Frequency of Loose Motion in Patients Studied

VOM (Frequency)	No. of Patients	Percent
0	35	31.0
1	8	7.1
2	14	12.4
3	16	14.2
4	21	18.6
5	5	4.4
6	4	3.5
7	3	2.7
8	2	1.8
10	3	2.7
12	1	0.9
14	1	0.9
Total	**113**	**100.0**

Table 12. Frequency of Vomiting in Patients Studied

	B. Glucose (mg/dL)	LFT - T. Bil (mg/dL)	Urea (mg/dL)	Creat. (mg/dL)	Na+ (mmol/L)	K+ (mmol/L)	LM (Days)	LM (Frequency)	VOM (Days)	VOM (Frequency)
Mean	78.25	1.0885	32.16	.425	136.89	4.032	2.37	7.41	1.22	2.74

Table 13. Mean Values

LM (Frequency)	Urea (mg/dL)			Total
	<20	20-35	>35	
3	1	8	1	10
4	2	16	1	19
5	0	12	3	15
6	1	11	4	16
7	0	2	3	5
8	1	9	2	12
10	0	10	12	22
12	0	1	1	2
15	0	6	5	11
20	0	1	0	1
	5	76	32	113

Table 14. Urea Levels in Patients having Loose Motion

Chi-square for R by C table, Chi-square: 24.09, dF: 18, P-value: 0.1522

LM (Frequency)	Creat (mg/dL)		Total
	<0.4	>0.7	
3	8	2	10
4	12	7	19
5	11	4	15
6	10	6	16
7	2	3	5
8	8	4	12
10	9	13	22
12	1	1	2
15	6	5	11
20	1	0	1
	68	45	113

Table 15. Creatinine Levels in Patients having Loose Motion

Chi-square: 8.192, dF: 9, P-value: 0.5149

LM		Weight (Kgs)			Total
	<5	5-10	10-15	>15	
3	0	4	4	2	10
4	4	3	9	3	19
5	3	6	4	2	15
6	0	11	5	0	16
7	1	3	0	1	5
8	0	8	4	0	12
10	8	8	3	3	22
12	1	0	0	1	2
15	1	6	3	1	11
20	1	0	0	0	1
	19	49	32	13	113

Table 16. Incidence of Loose Motion in Different Weights

Chi-square: 41.37, dF: 27, P-value: 0.03

LM		Na (mmol/L)		Total
	<135	135-145	>145	
3	5	5	0	10
4	8	10	1	19
5	4	8	3	15
6	5	9	2	16
7	2	2	1	5
8	5	6	1	12
10	12	10	0	22
12	1	1	0	2
15	3	7	1	11
20	1	0	0	1
Total	**46**	**58**	**9**	**113**

Table 17. Sodium Levels in Loose Motion

Chi-square: 11.98, dF: 18, P-value: 0.8

LM (Frequency)	K (mmol/L)			Total
	<3.5	3.5-5.5	>5.5	
3	2	8	0	10
4	6	13	0	19
5	2	13	0	15
6	0	14	2	16
7	2	3	0	5
8	1	11	0	12
10	2	19	1	22
12	2	0	0	2
15	0	11	0	11
20	0	1	0	1
Total	**17**	**93**	**3**	**113**

Table 18. Potassium Levels in Loose Motion

Chi-square: 31.64, dF: 18, P-value: 0.02422

DISCUSSION

Acute diarrhoeal disease is a major public health problem and a leading cause of paediatric morbidity and mortality. For children under 5 years in developing countries, there is a median of 3.2 episodes 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] Of India's more than 2.3 million annual deaths among children about 334,000 are attributable to diarrhoeal diseases.[6]

In Indian health institutions, up to a third of paediatric admissions are due to diarrhoeal diseases and up to 17% of all deaths in indoor paediatric patients are due to diarrhoea.

Electrolyte abnormalities are common in children with diarrhoea. It may remain unrecognised and result in mortality and morbidity. Timely recognition, a high index of suspicion and thorough understanding of common electrolyte abnormalities is necessary to ensure their correction. The present work was undertaken to study the common electrolyte abnormalities in diarrhoea and its impact on the mortality.

The present one year study was conducted in the Department of Paediatrics, Katuri Medical College and Hospital on children presenting with acute diarrhoea. Biochemical abnormalities of 113 children belonging to age between 1 month and 5 years were selected for the study.

Age

The most common age group in the present study was age less than 1 year (52.2%) followed by 3 - 5 years (38.1%).

Prospective UK study[7] included 1148 children younger than 16 years admitted to a subregional infectious disease hospital with a diagnosis of gastroenteritis over a 1 year period. Of the admitted children 55% (635/1148) were younger than 1 year, while 5% were over 5 years of age.

Shah GS et al[8] study showed majority (70%) of patients were below-

2 Years of Age/ Sex
In this study, male patients (53.1%) outnumbered female patients (46.9%). Rebecca Oketcho et al showed that nearly all children (99.5%) resided in Morogoro and there were more male children (57.9%) than female.[9] There were 37 (65%) males and 20 (35%) females according to Shah GS et al.[8]

Loose Motion
In our study, all patients had loose motion, highest being 10 times per day (19.5%) followed by 4 times (16.8%).

Vomiting
In this study, most of the patients had no vomiting (31%) followed by vomiting 4 times/ day in 18.6% patients.

Dehydration
In this study 61% patients had no dehydration and 39% had some dehydration. Study by JA Begum et al found 57 patients with dehydration.[10] 55 with some and 16 with severe dehydration were found by Wathen et al.[11]

Abdominal Distension
In this study, 70.8% were not having and 29.2% were having abdominal distension.

Weight of the Patients
Most of the patients had weight of 5 - 10 kgs (43.4%) followed by 10 - 15 kgs (28.3%).

V. cholera
In our study, 6.2% were detected to be affected by V. cholera and rest were not affected.

Urea Levels
In this study, most of the patients (67.3%) had normal urea levels followed by increased levels in 28.3% patients. A clinical and biochemical study by KR Purohit et al of 100 cases of acute diarrhoea in infancy was done. Blood urea was raised in 53 cases.[12]

Creatinine Levels
Majority of the patients (60.2%) had normal levels followed by increased levels in 39.8% patients. A clinical and biochemical study by KR Purohit et al of 100 cases of acute diarrhoea in infancy was done. S. creatinine levels increased in 53 cases.[12]

Glucose Levels
In our study, most of the patients (65.5%) had normal glucose levels. Subba Gangaraj et al[13] showed 3.9% of cases had hypoglycaemia.

Bilirubin Levels
In this study, 94.7% had normal levels and only 5.3% had increased levels.

Serum Sodium Levels
In this study, 46 (40.7%) patients had low sodium levels and 58 (51.32%) patients had normal levels. The incidence of hypernatraemia was 15.7% in a study by Subba Gangaraj et al.[13] Shah GS et al[8] study showed that major electrolyte disturbances noted were Hyponatraemia (56%), which was either isolated (26%) or associated with Hypokalaemia (26%) and about 10% patients had Hypernatraemia. A clinical and biochemical study by KR Purohit et al of 100 cases of acute diarrhoea in infancy was done. 75 cases each showed low serum values of sodium electrolyte disturbances in acute diarrhoea.[12]

Serum Potassium Levels
In our study, most of the patients (93) had normal levels followed by low levels in 17 patients. Subba Gangaraj et al[13] showed 51% had Hypokalaemia, who were severely malnourished. Shah GS et al[8] study showed the second common abnormality was Hypokalaemia (46%), which was again either isolated (14%) or associated with Hyponatraemia (26%) and about 3% had Hyperkalaemia.

CONCLUSION

The Present Study of 113 Cases of Acute Diarrhoea showed the following Conclusions

- Maximum age incidence was found in age group of less than 1 yr.
- The incidence of acute diarrhoea was greater in males (53.1%) compared to females (46.9%).
- Vomiting was absent in 31% cases.
- Dehydration was absent in 61.1% cases and some dehydration was present in 38.9% cases.
- Abdominal distension was present in 29.2% cases and in rest (70.8%) it was absent.
- Most of the patients (43.4%) had body weight between 5 - 10 kgs followed by 28.3% having 10 - 15 kgs.
- V. cholera isolated in 6.2% cases.
- B. urea levels were elevated (> 35 mg/dL) in 28.3% cases and normal in 67.3% cases with mean being 32.16 mg/dL.
- S. creatinine levels were elevated (> 0.7 mg/dL) in 39.8% cases and rest having normal levels with mean being 0.425 mg/dL.
- Hypoglycaemia (65 mg/dL) was present in 19.5% cases and normal glucose levels in 65.5% cases with mean being 78.25 mg/dL.
- Total bilirubin levels were elevated (> 1.3 mg/dL) in 5.3% cases, whereas in rest levels were normal with mean being 1.08 mg/dL.
- Hyponatraemia was present in 40.70% cases, normal levels in 51.32% and hypernatraemia in 7.96% cases. Mean sodium levels being 136.89 mmol/L.
- Hypokalaemia was present in 15.04%, normal levels in 82.30% and increased in 2.65% cases. Mean potassium levels being 4.032 mmol/L.

Summary

- Acute diarrhoea in children is associated with high morbidity and mortality. The present study aimed at noting the biochemical changes in patients having acute diarrhoea.
- Hyponatraemia and Hypokalaemia were common in our patients. Among this, Hyponatraemia was more prominent.
- Males outnumbered females.
- Most of the patients with transient Hyponatraemia and transient Hypokalaemia were treated with ORS. These patients did not show classical signs and symptoms of Hyponatraemia and Hypokalaemia.

- Like any other electrolyte abnormalities which occur in conditions other than Diarrhoea are basically asymptomatic and does not require aggressive correction of electrolytes. They do very well with ORS and fluid correction as recommended by WHO.

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