



SERUM ELECTROLYTE AND ACID-BASE STATUS IN CHILDREN BELOW FIVE YEARS WITH ACUTE WATERY DIARRHEA AND DEHYDRATION

Pediatrics

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ABSTRACT

Aims: The study was planned to study the serum electrolyte levels and acid-base status in children of acute watery diarrhea with dehydration. **Methodology-** It was a hospital-based Observational Study included 200 Children below 5 years of age presenting with acute diarrhoea with dehydration requiring hospitalization. Study was conducted for a period of 1 year (July 2017-June 2018).

Results- Hyponatremic dehydration was seen in 51 (25.5%) children and hypernatremic dehydration in 41 (20.5%). Remaining had isonatremic dehydration. Severe hypokalemia was seen in 67 (33.5%) and severe metabolic acidosis in 27 (13.5%) children.

Conclusion- Electrolyte imbalance and acid-base abnormalities are frequently seen in under-five children with acute watery diarrhea with dehydration, so for optimal management of dehydration these should be considered while planning the treatment.

KEYWORDS

Diarrhea, dehydration, metabolic acidosis

INTRODUCTION:

Diarrhoea is best defined as excessive loss of fluid and electrolyte in the stool. Acute diarrhea is sudden onset of excessively loose stools of more than 10 ml/kg/day in infants and more than 200g/24hr in older children, which lasts less than 14 days. When the episode lasts longer than 14 days, it is called persistent diarrhea.^[1] Diarrheal disorders in childhood account for a large proportion (18%) of childhood deaths, with an estimated 1.5 million deaths per year.^[2] Diarrhea results in loss of sodium, chloride, bicarbonate and potassium in addition to water in stool.^[3] Because diarrhea is hypotonic, water losses exceed sodium losses, potentially leading to hypernatremia. Metabolic acidosis occurs due to the loss of alkali in the gut and various other factors and potassium depletion. Metabolic acidosis causes a shift of potassium out of cells, and renal insufficiency may lead to hyperkalemia. A combination of mechanisms may be present; thus, it may be difficult to predict the child's acid-base status or serum potassium level from the history alone.^[4]

In India, study by Dastidar RG et al from Kolkata reported prevalence of Hyponatremic dehydration 22.0%, 71.5% of isonatremic dehydration and 6.5% of Hypernatremic dehydration in children under 5 years of age.^[5] Clinical features and management of diarrhea and dehydration will depend upon severity of dehydration, type of dehydration (isonatremic, hyponatremic and hypernatremic), nutritional status, acid-base and electrolyte status.

Present study has been planned to study on serum electrolyte and acid base disturbances in acute watery diarrhea with dehydration.

MATERIALS AND METHODS

Study design, settings and participants:

It was a hospital-based Observational Study conducted over a period of one year in paediatric department of tertiary care teaching hospital of Southern Rajasthan. 200 Children below 5 years of age presenting with acute diarrhoea with dehydration requiring hospitalization were enrolled for study.

Data collection

The caregivers of the study subjects admitted in the pediatric department were interviewed after taking informed written consent. Clinical examination and related laboratory investigation like serum electrolyte, ABG analysis was done. Children with acute diarrhoea with gross blood in stool were excluded from the study.

Data Collection

After Enrolment of the patients as per inclusion and exclusion criteria following information were asked:

- Age, gender, socioeconomic status, nutritional status (as per WHO weight for height classification).
- Detailed examination was done, dehydration was classified and treated as per WHO protocol and severity of illness was classified as per Vesikari scoring system for diarrhoeal illness.
- Investigation like ABG analysis, serum electrolytes were done for all study subjects at the time of admission.

Socio economic status was assessed by Modified Kuppuswamy Socioeconomic status scale using updated current price index of 2017.

Statistical Analysis:

Data were analyzed and statistically evaluated using SPSS software, [10] version 17 (Chicago II, USA). Quantitative data was expressed in mean, standard deviation while qualitative data were expressed in percentage. Statistical differences between the proportions were tested by chi square test or Fisher's exact test. 'p' value less than 0.05 was considered statistically significant.

Ethical issues:

All participants were explained about the purpose of the study. Confidentiality was assured to them along with informed written consent from their parents or caregivers. The study was approved by the Institutional Ethical Committee

Observations

Out of 200 children enrolled in the study, 119 (59.50%) were male and 81 (40.50%) were female. Male:female ratio was 1.46. Maximum no of children, 97 (48.50%) were in the age group of <12 months followed by 47% and 4.5% in 12-36 and 36-60 months respectively. Maximum 118 (59%) belonged to Lower class of SE status followed by 79 (39.50%) of Middle class and 3 (1.5%) belonged to Upper class of SE status (Table 1). As per WHO classification 45 (22.50%) children had severe malnutrition, while 44 (22.0%) had moderate malnutrition.

142 (71%) had "SOME" and 58 (29%) had "SEVERE" dehydration as per WHO classification of dehydration. Out of total children below 5 years enrolled in the study, none had mild diarrhoeal illness as we have included hospitalized children, 27 (13.50%) had moderately severe illness, 137 (68.50%) had severe illness and 36 (18%) patients had very severe illness as per Vesikari scoring of diarrhoeal illness.

108 (54%) patients had isonatremic dehydration (Na^+ 135-145 mEq/L) followed by 51 (25.5%) patients who had hyponatremic dehydration (Na^+ <135 mEq/L) and 41 (20.5%) children had hypernatremic dehydration (Na^+ >145 mEq/L). Total 139 (69.50%) had hypokalemia (serum K^+ <3.5 mEq/L), 51 (25.50%) had normal serum potassium levels

(3.5-4.5 mEq/L) and only 10 (5%) had hyperkalemia (serum K⁺>4.5 mEq/L). (table 2)

106 (53.00%) had normal pH levels (7.35-7.45). Acidosis (pH <7.35) was present in 68 (34%) of patients and 26 (13.00%) cases had alkalosis (pH >7.45) in the study. Severe acidosis (pH <7.15) was present in 27 (13.5%) patients. (table 2) 5 (2.5%) subjects died during the period of hospitalization, hence the mortality rate was 2.5%.

DISCUSSION

The study entitled "Serum electrolyte and acid-base status in children below 5 years with acute watery diarrhea and dehydration" was conducted in pediatric department of tertiary care teaching hospital of Southern Rajasthan. It was a Hospital-based Observational Study conducted between January 2017 to December 2017. Two hundred children below 5 years admitted with acute watery diarrhea with dehydration were enrolled for the study.

In this study of 200 children, 119 (59.50%) were male and 81 (40.50%) were female. Male:female ratio was 1.46. Maximum no of children, 97 (48.50%) were in the age group of <12 months followed by 47% and 4.5% in 12-36 and 36-60 months respectively. Our findings were similar to study conducted by Dagar J et al, Maharashtra, 2015^[6] and Shah GS et al, Kathmandu, 2007^[7]. Maximum 118 (59%) belonged to lower class of SE status. This observation was in accordance with study by Phukan AC et al, Dibrugarh, 2003^[8]. In our study, 45 (22.50%) children had severe malnutrition (weight/height<-3SD) (Table 3). This observation was in accordance with study by Memon Y et al, Hyderabad, 2004^[9] in which they found that electrolyte changes were commonly seen in grade II and III malnourished patients particularly who presented with diarrhoeal episode of variable duration.

In our study, 142 (71%) had "SOME" and 58 (29%) had "SEVERE" dehydration as per WHO classification of dehydration. Similar observations were found in the study conducted by Okposio MM et al, Benin, 2015^[10] in which Electrolytes and acid base disturbances were observed in 165 (89.2%) of the children, most of them (114 or 61.6%) were moderately dehydrated, while mild and severe dehydration accounted for 41 (22.2%) and 30 (16.2%), respectively. Another study by Dastidar RG et al, 2017^[5] reported that out of 200 children 166 cases (83%) had moderate dehydration, whereas 34 cases (17%) had severe dehydration which was also near to our study.

108 (54%) children below five years had isonatremic dehydration (Na⁺ 135-145 mEq/L), while 139 (69.50%) had hypokalemia (serum K⁺<3.5 mEq/L). Metabolic acidosis was observed in 68 (34.0%) study subjects.

Okposio MM et al, Benin, 2015^[10] found that hyponatraemic dehydration was the most common type of dehydration (60.5%), while hypokalemia occurred in 82 (44.3%). Metabolic acidosis was reported in 59.5% children. Dastidar RG et al, Kolkata, 2017^[5] revealed that 71.5% had Isonatremia, 22% had Hyponatremia and 6.5% had Hypernatremia. Hypokalemia was present in 15% (30) cases and 85% (170) cases had Normokalemia.

Ahmad MS et al, Pakistan, 2012^[11] found that hyperchloremia was the commonest electrolyte disorder (53.8%), followed by hyperkalemia (26.9%) and hypernatremia (17.3%). Hyponatremia, hypokalemia and hypochloremia were present in 10.6%, 7.7%, and 10.6% cases, respectively. In this study hypernatremia was more common than hyponatremia. It may be due to the fact that the author selected participants from birth to 18 years of age, while in our study we have included subjects till 5 year of age. Other study By Purohit KR et al Andhra Pradesh, 1971^[12] and Dagar J et al, Maharashtra, 2015^[6] also reported higher incidence of hyponatremic dehydration and metabolic acidosis..

CONCLUSION & RECOMMENDATION

Out of total 200 children enrolled in the study, severe dehydration was seen in 58 (29%) children of acute watery diarrhea below five years. Hyponatremic dehydration was seen in 51 (25.5%) children, hypernatremic dehydration in 41 (20.5%) and severe Hypokalemia was seen in 67 (33.5%). Severe metabolic acidosis was seen in 27 (13.5%) and metabolic alkalosis in 26 (13%) children. While managing children with acute watery diarrhea with dehydration, all the above factors should be considered for optimizing the treatment.

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Table 1: Distribution of Study Subjects According to Socio-economic Status (Modified Kuppuswamy Scale, 2017)

Socio-economic Status	No.	%
Upper Class	3	1.50%
Upper Middle Class	14	7.00%
Lower Middle Class	65	32.50%
Upper Lower Class	117	58.50%
Lower Class	1	0.50%
Total	200	100.00%

Table 2. Serum electrolyte levels in Study Subjects

Serum electrolyte level	Male		Female		Total	
	No.	%	No.	%	No.	%
Serum Sodium Levels mEq/L						
<120 mEq/L	7	5.88%	3	3.70%	10	5.00%
120 - 134 mEq/L	23	19.33%	18	22.22%	41	20.50%
135- 145 mEq/L	66	55.46%	42	51.85%	108	54.00%
146- 160 mEq/L	23	19.33%	17	20.99%	40	20.00%
>160 mEq/L	0	0.0	1	1.23%	1	0.5%
Serum Potassium Levels mEq/L						
<2.5	41	34.45%	26	32.10%	67	33.50%
2.5-3.5	47	39.50%	25	30.86%	72	36.00%
3.5-4.5	27	22.69%	24	29.63%	51	25.50%
4.5-5.5	3	2.52%	4	4.94%	7	3.50%
>5.5	1	0.84%	2	2.47%	3	1.50%
pH Level						
<7.15	14	11.76%	13	16.05%	27	13.50%
7.15-7.25	9	7.56%	6	7.41%	15	7.50%
7.25-7.35	16	13.45%	10	12.35%	26	13.00%
7.35-7.45	63	52.94%	43	53.09%	106	53.00%
>7.45	17	14.29%	9	11.11%	26	13.00%

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