



Electrolyte Disturbances in Children Presenting with Acute Diarrhea: A Prospective Cohort Study

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Abstract

Introduction: Acute diarrhea is one of the common causes of hospital admissions in pediatric age group. In developing world diarrheal diseases are cause of a considerable morbidity as well as mortality. Incidence of diarrhea worldwide has remained unchanged and diarrhea related illness and its complications results in millions of visits to pediatricians the mortality has been reduced to considerable levels. One of the common causes of complications in children with diarrhea is electrolyte imbalance which needs to be identified and treated. Hyponatremia and hypokalemia are the common electrolyte imbalances seen in children presenting with acute diarrhea. Though uncommon hypernatremia as well as hyperkalemia can also be seen in these children and needs to be treated so as to prevent complications. This study was undertaken to know the incidence of electrolyte abnormalities in children under the age of 5 years who were admitted with acute diarrhea.

Materials and Methods: This was a prospective cohort study in which 120 children below the age of 5 years and with acute diarrhea were included based on a predefined inclusion and exclusion criteria. Detailed history was taken and clinical examination was done. Stool examination and serum electrolytes were also done in all the cases. Presenting signs and symptoms were analysed. Patients were treated according to institutional protocol. Presence of electrolyte abnormalities were recorded. SSPS 21.0 was used for statistical analysis.

Results: Out of 120 children up to the age of 5 years there were 78 boys (65%) and 42 girls (35%) with a M:F ratio of 1:0.53. The mean age of the affected cases was found to be 2.24 +/- 1.78 years. After loose motion the most common complaint was found to be Abdominal pain which was present in 78 (65%) cases. 78 (65%) children had serum sodium level less than s/o hyponatremia whereas in 41 patients (34.16%) serum sodium was found to be within normal range (135-145 meq/lit). Only 1 patient (0.83%) was found to be having hypernatremia. 21 (17.5%) children had serum potassium level less than 3.5 meq/lit s/o hypokalemia whereas in 99 patients (82.5%) serum potassium was found to be within normal range (3.5-5.5 meq/lit). There was no patient with hyperkalemia in our study.

Conclusion: Electrolyte imbalance is a common occurrence in children presenting with acute diarrhoea and needs to be diagnosed early so as to prevent complications of severe dyselectrolytemia.

Keywords: Acute Diarrhea, Dyselectrolytemia, Hyponatremia, Hypokalemia.

Introduction

Acute gastroenteritis is one of the common causes for which pediatric patients are admitted. It is one of the important causes of morbidity and mortality amongst children particularly in developing world¹. Irrespective of the etiology of the diarrhea

it is the fluid loss which is responsible for complications that may need intensive care or even may prove fatal if appropriate intervention is not done in time. Various offending organisms including bacteria and viruses may be responsible for diarrhea and consequent dehydration². The two

important mechanisms by which diarrhea occurs are damage to villous brush border and release of toxin that may induce increase intestinal fluid secretion that is well beyond the capacity of gastrointestinal tract that results in diarrhea.

Incidence of diarrhea worldwide has remained unchanged and diarrhea related illness and its complications results in millions of visits to pediatricians the mortality has been reduced to considerable levels³. Use of oral rehydration solution is one of the most important factors responsible for reduction in mortality due to diarrheal diseases. This effectiveness of oral rehydration solution in management of diarrheal diseases in children is due to the fact that sodium-coupled solute co-transport mechanism remains intact even in severe diarrhea⁴.

The presentation of uncomplicated diarrhea in children is usually by increased frequency and altered consistency of stools. In many cases this is also accompanied by vomiting and abdominal pain. If appropriate treatment is not instituted these children may develop complications secondary to dehydration such as hypovolemic shock and renal failure. In some children electrolyte imbalance may occur leading to neurological manifestations such as lethargy or irritability and convulsions⁵.

The consequences of untreated diarrhea include varying degree of biochemical changes, electrolyte imbalance and dehydration consequences of which may have catastrophic consequences particularly in children younger than 5 years of age⁶. The common electrolyte imbalances seen in children with diarrhea include hypokalemia, hyponatremia and altered urea and creatinine. Hyperkalemia and hypernatremia are uncommon in these children. Management of electrolyte imbalance seen in patients with diarrhea include sodium or potassium replacement in cases of hyponatremia and hypokalemia respectively. Hypernatremia dehydration is usually seen in patients who receive exclusive intravenous fluids during hospital stay⁷. It is also common in newborn and infants and usually

present with irritability, shrill cry and lethargy in infants. In relatively older children it may present with altered sensorium, diuresis and fever. Hypernatremic dehydration requires replacement of body water deficit. This body water deficit needs to be replaced with appropriate amount of fluid which is usually determined by taking into consideration total body water deficit and sodium concentration in replacement fluid⁸.

The management of diarrhea and accompanying electrolyte imbalance require judicious use of oral rehydration solution, intravenous fluids and correction of electrolyte imbalance. In cases where children are brought to hospital with severe dehydration admission in pediatric intensive care unit with appropriate intensive care and management of shock may be needed. In addition to rehydration and correction of electrolyte imbalance appropriate antibiotics may be required in cases where bacterial etiology is confirmed⁹.

We undertook this prospective study of 60 pediatric patients less than 5 years of age who were admitted in our hospital with diarrhea.

Materials and Methods

This was a prospective cohort study conducted in a tertiary care pediatric hospital. Pediatric patients below the age of 5 years and presenting with acute gastroenteritis with dehydration were included in this study on the basis of a predefined inclusion and exclusion criteria. A written informed consent was obtained from the parents or guardians of the children. Demographic details of all the patients such as age, gender, height and weight were noted. Socioeconomic status of the parents or guardians was also noted. Presence of any co-morbid illness was also noted down. A detailed history with particular reference to number of stools per day, presence of additional features such as vomiting, abdominal pain, excessive crying, lethargy or refusal to feed in case of infants was asked and noted. Caregivers were asked about the history of giving ORS to the child before coming to hospital and if it was given then the procedure of making ORS was specifically

asked for so as to ascertain appropriateness of preparing ORS. The ORS given was divided into appropriate preparation, concentrated ORS or diluted ORS based on history given by parents or caregiver. A through clinical examination was done and signs and severity of dehydration was noted. Stool examination was done. In all patients 2 ml venous blood was collected and serum sodium and serum potassium levels were determined. Appropriate management was done. Fluid therapy and if needed antibiotics were given. Electrolyte imbalance was managed by appropriate institutional protocol.

The data analysis was done using statistical software SSPS 21.0 and p value less than 0.05 was taken as statistically significant.

Inclusion Criteria

- All pediatric patients less than 5 years of age and presenting with acute diarrhea.
- Parents/Guardian Gave informed written consent.

Exclusion Criteria

- Children below the age of 1 month (Neonates).
- Serious patients.
- Children having serious co-morbid condition likely to affect the outcome.
- Presence of diarrhea since more than 2 weeks i.e. persistent diarrhea.

- Diarrhea without dehydration where the children were treated on outpatient basis.
- Parents/ Guardian refused consent.

Results

We studied 120 cases admitted in our hospital with dehydration. Out of 120 children up to the age of 5 years there were 78 boys (65%) and 42 girls (35%) with a M:F ratio of 1:0.53.

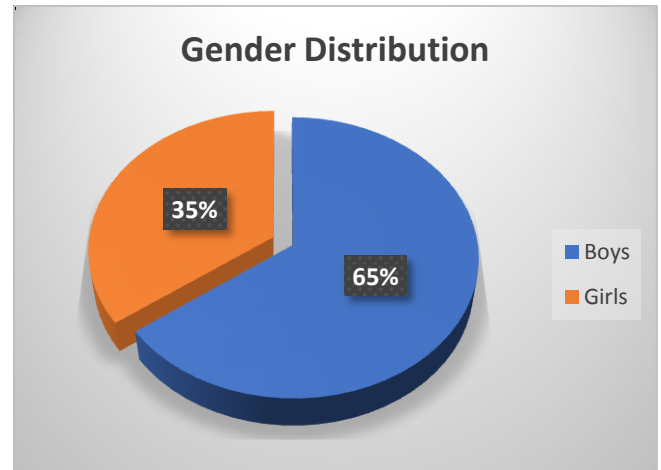


Figure 1: Gender Distribution of the studied cases.

The analysis of the age group of the studied cases showed that the most common affected age group was between 1-3 years of age (51.67 %) followed by 1month- 1year of age (31.67%) and 3-5 years (16.67%). The mean age of the affected cases was found to be 2.24 +/- 1.78 years.

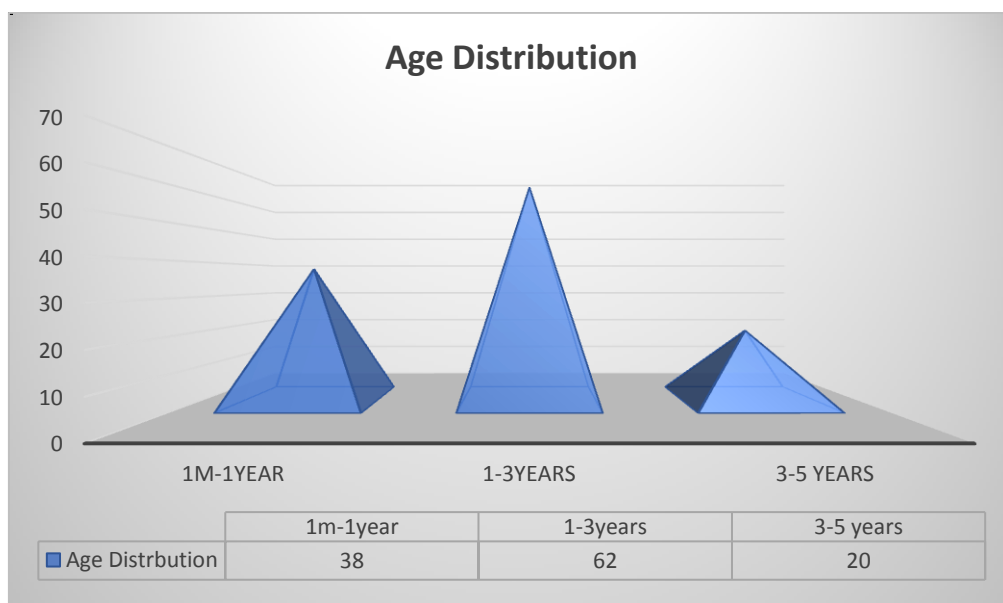


Figure 2: Age Distribution of the affected cases

Out of 120 studied cases all patients had loose motions. After loose motion the most common complaint was found to be Abdominal pain which was present in 78 (65%) cases. The other common

complaints included Vomiting (40%), lethargy (36.66%) and refusal to take feeds (26.66%). Convulsions were seen in 5 patients (4.16%).

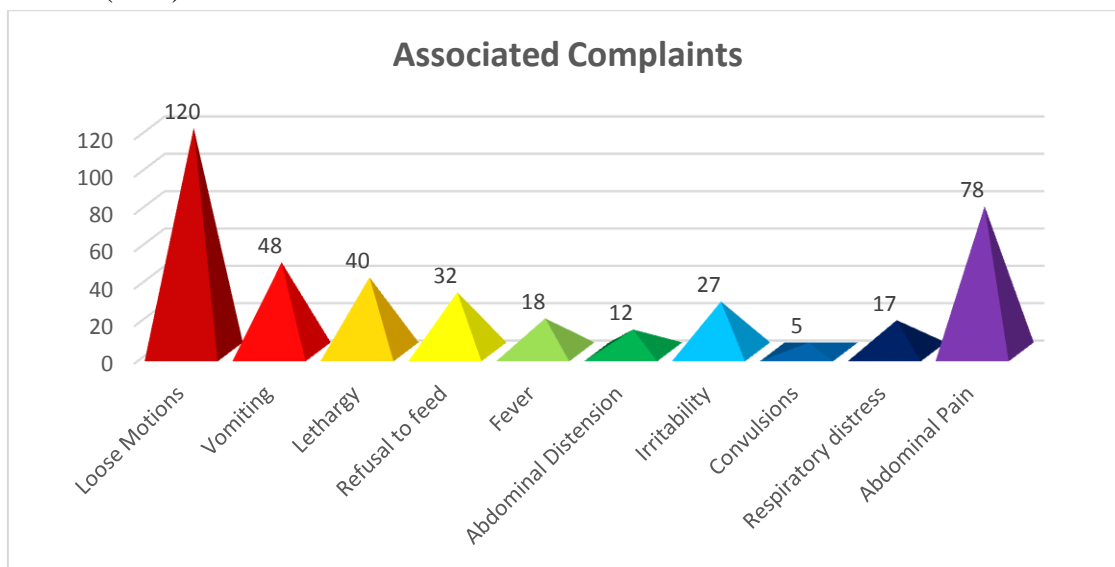


Figure 3: Associated signs and symptoms.

Out of 120 patients 88 (73.33%) patients were diagnosed to be having some dehydration whereas 32 (26.67%) patients were found to have severe

dehydration. Patients having acute gastroenteritis with no dehydration were not included in this study.

Table 1: Type of dehydration in studies cases

Severity of Dehydration	No of Patients	Percentage
Some Dehydration	88	73.33%
Severe Dehydration	32	26.67 %
Total	120	100%

The analysis of serum sodium level in studied cases showed that out of 120 cases 78 (65%) children had serum sodium level less than s/o hyponatremia whereas in 41 patients (34.16%)

serum sodium was found to be within normal range (135-145 meq/lit). Only 1 patient (0.83%) was found to be having hypernatremia.

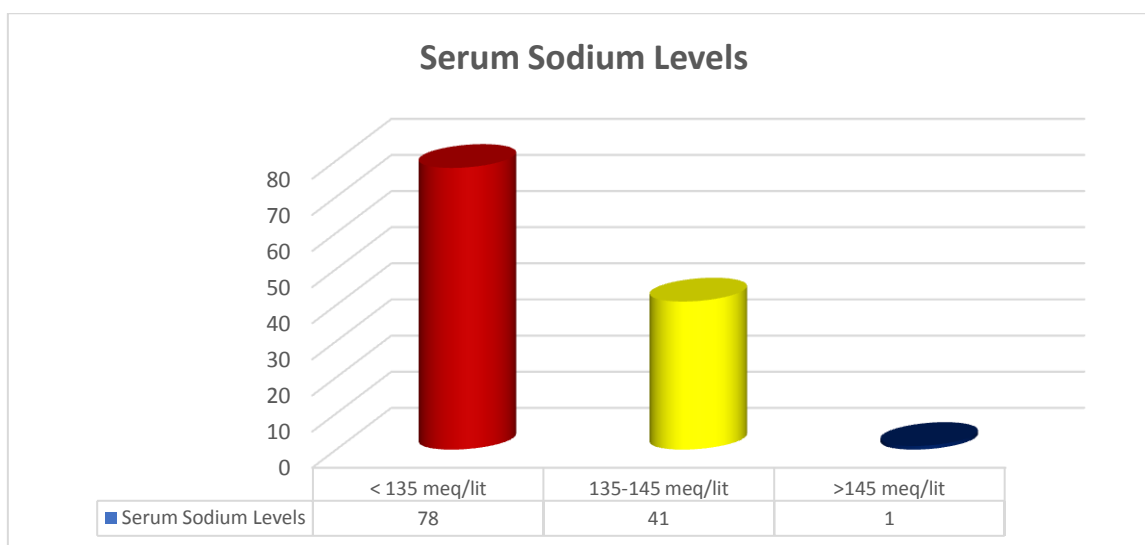


Figure 4: Sodium Levels in studied cases.

The analysis of serum Potassium level in studied cases showed that out of 120 cases 21 (17.5%) children had serum potassium level less than 3.5 meq/lit s/o hypokalemia whereas in 99 patients

(82.5%) serum potassium was found to be within normal range (3.5-5.5 meq/lit). There was no patient with hyperkalemia in our study.

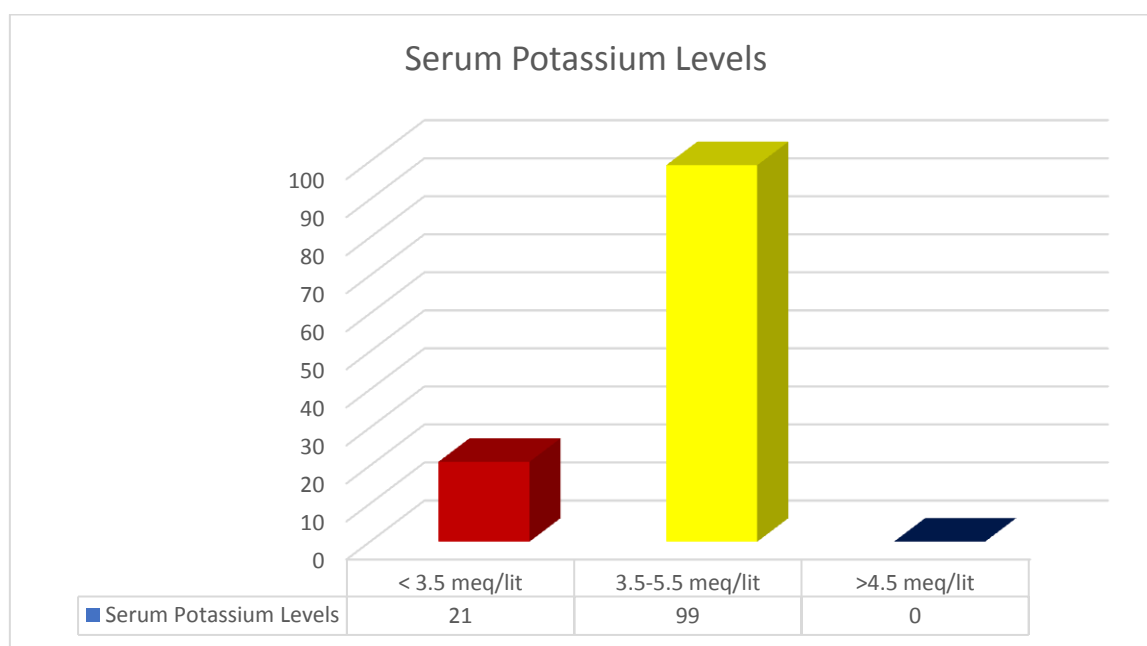


Figure 5: Potassium Levels in Studied cases.

Discussion

In this prospective study of 120 children who were hospitalized with dehydration there was a male predominance with a M:F ratio of 1:0.53. Most common affected age group was between 1-3 years of age (51.67 %) followed by 1month-1year of age (31.67%) and 3-5 years (16.67%). The mean age of the affected cases was found to be 2.24 +/- 1.78 years.

The diarrheal diseases are responsible for considerable morbidity and mortality in developing world. The infants are more prone for developing repeated episodes of gastroenteritis if they are not breast fed. The other risk factors for development of gastroenteritis include immunodeficiency states, unhygienic feeding practices and malnutrition. Young children are not only susceptible for gastroenteritis but also the complications of it since they have a large body surface area responsible for relatively more insensible water loss. These children are more prone for development of electrolyte imbalance because of presence of greater water content¹⁰.

The most common electrolyte abnormality in our study was found to be hyponatremia which was seen in 78 (65%) children. Only 1 (0.83%) patients was found to be having hypernatremia whereas serum sodium levels were found to be normal in 41 patients (34.16%). Hyponatremia was found to be common electrolyte abnormality in studies conducted by Various authors. Pratima P et al conducted a descriptive, hospital based cross-sectional study of children with diarrhea. In this study author studied 80 children below five years age group admitted with dehydration due to acute gastroenteritis. Out of 80 children studied, 44 (55%) children were aged below 12 months, 20 (25%) children were between 13 to 36 months, and 16 (20%) children were between 3 to 5 years. The frequencies of various types of dehydration were hyponatremic in 49 (62.5%) children, isonatremic in 31 (38.75%) children and no case of hypernatremia. Hypokalemia was observed in 21 (26.5%) children¹¹. Hyponatremia was found to be the most common electrolyte abnormality in children with diarrhea in studies conducted by the

authors such as Dastidar RG et al¹² and Hanna M et al¹³.

out of 120 cases 21 (17.5%) children had serum potassium level less than 3.5 meq/lit s/o hypokalemia whereas in 99 patients (82.5%) serum potassium was found to be within normal range (3.5-5.5 meq/lit). There was no patient with hyperkalemia in our study. Similar incidence of hypokalemia has been reported by many studies. In a prospective study undertaken by Ankireddy et al all cases of acute diarrhea attending with signs and symptoms of moderate and severe dehydration were investigated by the authors for presence of electrolyte imbalance. 250 cases were enrolled in the study with males (57.6%) and females (42.4%). 1 month 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%) each¹⁴. Similar incidence of hypokalemia was reported by Dhyani A et al¹⁵.

Conclusion

Dyselectrolytemia particularly hyponatremia and hypokalemia are commonly seen in children admitted with acute diarrhea. Untreated severe electrolyte imbalance and fraught with danger of neurological complications such as convulsions. Therefore, these electrolyte imbalance needs to be diagnosed and treated early before severe dyselectrolytemia sets in.

Conflict of Interest: None

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