

To Determine the Frequency and Pattern of Common Electrolyte Abnormalities in Children Presenting with Acute Gastroenteritis

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ABSTRACT

Objective: To Determine the frequency and pattern of common electrolyte abnormalities in children presenting with acute gastroenteritis.

Study Design: Cross sectional study.

Place and Duration of Study: This study was conducted at the pediatric department Qazi Hussain Ahmad medical complex Nowshera from July 2019 to December 2019.

Materials and Methods: In this study 109 children were included. About 5 ml Blood was taken and sent to the laboratory for assessment of electrolyte abnormalities including hypo- & hyper-natremia, hypo- & hyper-kalemia.

Results: In our study, the mean age of children was 4 ± 5.57 years. There were 56% male and 44% female children. The frequency of pattern of common electrolyte abnormalities like hyponatremia was 28%, hypernatremia was 19%, hypokalemia was 12%, hyperkalemia was 7% among children presenting with acute gastroenteritis.

Conclusion: Our study concludes that frequency of pattern of common electrolyte abnormalities like hyponatremia was 28%, hypernatremia was 19%, hypokalemia was 12%, hyperkalemia was 7% among children presenting with acute gastroenteritis.

Key Words: Pattern of common electrolyte abnormalities, children, acute gastroenteritis.

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INTRODUCTION

Acute gastroenteritis in pediatrics is the global health concern. It happens to occurs in 1.5 billion diarrhea episodes and 3 million deaths every year.¹ A wide range of intestinal bacteria can cause acute pediatrics diarrhea.² The main pathogens and protozoan isolated from stool samples of children aged <5 years are diarrhea genic Escherichia coli, Salmonella spp., Shigella spp., Yersinia spp. & Campylobacter spp., and Giardia intestinalis, Entamoeba histolytic & Cryptosporidium spp., respectively. Additionally, the representatives of four viral families i.e. rotaviruses

(Reoviride), noroviruses & sap viruses (Caliciviride), human astroviruses (Astroviride) and adenoviruses subgenus F (Adenoviride), are mostly isolated in childhood acute gastroenteritis.³⁻⁶ Dehydration, electrolyte imbalances and renal failure are major complications of acute gastroenteritis. Since an oral rehydration therapy program has been initiated by WHO, the mortality rate has substantially declined. Apart from dehydration, electrolyte abnormalities are one of the major concerns in patients with acute gastroenteritis. Disorders in the electrolyte composition can have serious consequences and are associated with morbidity and mortality. Many pediatricians believe that laboratory studies, including Blood Chemical Analysis (BCA), are not usually necessary to assess children with acute diarrhea. However, it has been reported that serum electrolyte panels were useful in children receiving intravenous (IV) fluid therapy for their dehydration. On the other hand, other pediatricians express contradictory comments on the aforementioned finding.⁷⁻⁹

They believe that many electrolyte abnormalities would resolve if children with acute gastroenteritis are appropriately rehydrated. The common cause of hospitalization of pediatrics age group due to acute gastroenteritis is greater gradations of dehydration severity supplemented by social factors. The accurate assessment of dehydration degree among infants

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& children is essential for appropriate diagnosis and treatment. Under-estimation of dehydration raises morbidity & mortality, while over-estimation may cause unsuitable care and financial expenses. In one previous study on children with acute gastroenteritis 50% of children presented with moderate dehydration, 28.3% with mild and 22.6% with severe dehydration. Metabolic acidosis was recorded in 54.7%, hyponatremia in 17%, hypernatremia in 9.4%, hypokalemia in 22.6%, hyperkalemia in 3.8% and azotemia in 22.6%. In another study conducted by Ahmad MS the frequencies of the various patterns of electrolyte abnormalities were recorded as 26.9% hyperkalemia, 17.3% hypernatremia, 10.6% hyponatremia and 7.7% hypokalemia.¹⁰⁻¹³

This study was designed to estimate the frequency and pattern of electrolytes abnormalities in pediatrics presenting acute gastroenteritis. As mentioned above, blood analysis is generally avoided in children with acute gastroenteritis and chemical including electrolyte abnormalities if present can play a crucial role in the management plan and determine the overall morbidity and mortality of children who develop acute gastroenteritis. This study will provide us with local data and the findings will be shared with other pediatricians in local community and suggestions will be made regarding future research and implementation. Further recommendations will be made regarding screening of electrolytes level in pediatrics.

MATERIALS AND METHODS

This Cross sectional study was done at Qazi Hussain Ahmad medical complex Nowshera from July 2019 to December 2019. Duration of study was six months. Sample Size 109 cases was estimated keeping confidence level of 95%, and proportion of hypokalemia 7.7%⁷ in children with acute gastroenteritis, and adjusting 5% margin of error. Sampling technique used was Non-probability, consecutive sampling. All children presenting acute gastroenteritis were included. It was defined as Passage of three or more loose or watery stools in a 24 hours period for less than 14 days. A loose stool being one that would take the shape of the container as given by history both genders (male & females) and age between one month and five years were included in the study. Children with History of use of steroids in the last one month, History of treatment of acute gastroenteritis before presenting to opd and age group more than 5 years were excluded from the study.

This study was done after taking authorization from the hospitals' ethical & research committee. Children aged less than 5 years, both gender, with acute gastroenteritis fulfilling the selection criteria were recruited for the study. Main aim and benefits of research project were clarified to all the parents and the informed written consent taken from them. All children were evaluated

for complete history and clinical examination. A 5 ml venous blood sample was taken from all the children and sent to the laboratory of the hospital to detect electrolyte abnormalities including hyponatremia (sodium concentration < 135 meq/L), hypernatremia (sodium concentration > 150 meq/L), hypokalemia (potassium concentration < 3.5 mmol/L) and hyperkalemia (potassium concentration > 5.5 mmol/L). Data was stored and analyzed later on via SPSS version 20. The mean & SD were calculated for variables like age, serum analyses. Frequency (%) was calculated for variables like gender, electrolyte abnormalities (hyponatremia, hypernatremia, hypokalemia, hyperkalemia).

RESULTS

In this study, the mean age of patients was 4 ± 5.57 years. There were 12(11%) children of age between 1 month to 1 year, 48(44%) had age between 2 to 3 years and 49(45%) had age between 4 to 5 years. Out of 109 children, 61(56%) children were male while 48(44%) children were female. (Table no 1). Regarding serum analysis, the mean serum sodium concentration was 145 ± 12.12 meq/L while mean Serum potassium concentration was 4.7 ± 3.84 mmol/L. (Table no 2). Patterns of electrolyte abnormalities among 109 patients were analyzed as 31(28%) patients had hyponatremia, 21(19%) patients had hypernatremia, 13(12%) patients had hypokalemia, 8(7%) patients had hyperkalemia.

Table No 1. Age & gender Distribution (n=109)

Age (years)	Mean	4 ± 5.57
	1 month to 1 year	12 (11%)
	2-3 years	48 (44%)
	4-5 years	49 (45%)
Gender	Male	61 (56%)
	Female	48 (44%)

Table No. 2: Serum analyses (n=109)

Total	109
Serum sodium (meq/L)	145 ± 12.121
Hyponatremia <135 meq/L	31 (28%)
Normal sodium 135-150 meq/L	57 (52%)
Hypernatremia >150 meq/L	21 (19%)
Serum potassium (mmol/L)	4.7 ± 3.84
Hypokalemia <3.6 mmol/L	13 (12%)
Normal potassium 3.5-5.5 mmol/L	88 (81%)
Hyperkalemia >5.5 mmol/L	8 (7%)

DISCUSSION

Our study shows that the frequency of pattern of common electrolyte abnormalities like hyponatremia was 28%, hypernatremia was 19%, hypokalemia was 12%, hyperkalemia was 7% among children presenting with acute gastroenteritis. Similar results were observed

in another study done by Ukarapol et al., in which 50% of children presented with moderate dehydration, 28.3% with mild and 22.6% with severe dehydration. Metabolic acidosis was recorded in 54.7%, hyponatremia in 17%, hypernatremia in 9.4%, hypokalemia in 22.6%, hyperkalemia in 3.8% and Azotemia in 22.6%.

Similar results were also observed in another study done by Ahmad MSin which the frequencies of the various pattern of electrolyte abnormalities were recorded as hyperkalemia (26.9%), hypernatremia (17.3%). Hyponatremia (10.6%), hypokalemia (7.7%). Similar findings were observed in another study conducted by Okposio MMin which dehydration due to hyponatremia was the commonest cause of dehydration among children, accounting in about 60.5% children. Metabolic acidosis was diagnosed in about 59.5% children while hypokalemia was diagnosed in 44.3% children. But concentration of serum bicarbonates was disturbed considerably by the degree of dehydration ($p = 0.001$). In children age > 1 year and the presence of vomiting were significantly related to the hyponatremia ($p - \text{value} < 0.05$), while age of ≤ 1 year while the absence of vomiting was significantly related to the metabolic acidosis ($p - \text{value} < 0.05$).^{11, 14}

Such findings were also observed in a study by Shah et al., i.e. 56% children had electrolyte imbalance in Nepalese children. But, Ukarapol et al., found isonatremic dehydration as more common. The reason in this difference was due to the variation in the reference range that was used as cut-off value in several studies. While the serum sodium concentration < 136 mmol/L was considered as hyponatremia. In one study, conducted by Ukarapol et al., who defined hyponatremia as serum sodium concentration < 130 mmol/L, a significant relationship was observed in hyponatremia & children aged > 1 year, male children and also presence of vomiting. While Effiong et al., found frequency of hyponatremia was high with increasing age but insignificant for male gender. Dehydration because of hyponatremia occurs mostly in children less than five years old with gastrointestinal tract infections. Such cases are normally prescribed liquids containing less sodium concentration like water, juices, ginger ale, soda, or tea.¹⁵⁻¹⁹

Shah et al., also found similar results and reported 46% electrolyte imbalance and also high as 37.1% reported by Majeed et al. In our study, hypokalemia was observed was possibly because of greater loss of potassium through loose stool i.e. ≤ 100 meq/L potassium might be wasted in stools. Other risk factor for hypokalemia was malnutrition, but in our study, insignificant association was observed between hypokalemia and children weighed < 2 SD for age. The most description for this was that few children may have been misdiagnosed as having malnutrition; however, this may be because of acute diarrhea along

with the dehydration which may cause the acute weight loss. The altered weight that was reinstated after the rehydration might be marginally higher than before diarrhea and perhaps do not meet the criteria for malnutrition i.e. < 2 SD weight for age.^{15, 20-22}

The commonest clarifications of development of the metabolic acidosis among pediatric acute diarrhea are: reduced level of bicarbonate via stool, ketone production due to hunger, and production of lactic acid from reduced tissue perfusion in hypovolaemia. Reduced renal perfusion might also cause the reduced glomerular filtration rate that consecutively, leads to reduced excretion of hydrogen ions. However, few more studies found insignificant difference in level of serum bicarbonate in association with degree of dehydration.²³⁻²⁵

CONCLUSION

Our study concludes that frequency of pattern of common electrolyte abnormalities like hyponatremia was 28%, hypernatremia was 19%, hypokalemia was 12%, hyperkalemia was 7% among children presenting with acute gastroenteritis.

Author's Contribution:

Concept & Design of Study:	Irfan Ullah
Drafting:	Irfan Khan, Muhammad Shafiq
Data Analysis:	Farida Sherazi, Khalid Khan, Khalil Ahmad
Revisiting Critically:	Irfan Ullah, Irfan Khan
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