International Journal of Contemporary Pediatrics
Ul Zehra V et al. Int J Contemp Pediatr. 2022 Dec;9(12):1168-1172
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: https://dx.doi.org/10.18203/2349-3291.ijcp20223063

Original Research Article

The electrolyte abnormalities and duration of hospitalisation in children with gastroenteritis

Vaseefat Ul Zehra[1], Naseer Yousuf Mir[2]*, Elmira Haji Esmail Memar[1], Aakifa Fayaz[1]

[1]Department of Paediatrics, Tehran University of Medical Sciences, Iran
[2]Department of Paediatrics, Government Medical College Srinagar, Jammu and Kashmir, India

Received: 29 September 2022
Revised: 07 November 2022
Accepted: 10 November 2022

***Correspondence:**
Dr. Naseer Yousuf Mir,
E-mail: mirnasirgmc@gmail.com

ABSTRACT

Background: Diarrhoea remains one of the major causes of death among infants significantly in Asia, Africa and Latin America. The major contributing factors for higher incidence and mortality rates are improper sanitation, unsafe drinking water, physiological conditions like malnutrition, weak immune system. Rotavirus is the major causative agent of diarrhoea in young children in developed and undeveloped countries. Electrolyte abnormalities is the leading causes of morbidity and mortality in younger children with acute gastroenteritis and increased mortality is seen in malnourished children. The common abnormalities associated with acute gastroenteritis are hyponatremia and hypokalaemia. The average duration of hospital stay is 2.5 days.
Methods: This is a descriptive cross-sectional study which studied 173 patients of acute gastroenteritis which have been admitted to the CMC, Tehran in 1 year. (June 2021-May2022).
Results: In this study 173 patients were studied. 101 patients (58.4%) were infants, 55 patients (31.8%) were preschool children and 17 patients (9.8%) were older children. 70 patients (40.5%) were females and 103 patients (59.5%) were males. The most common electrolyte abnormality that was encountered in this study is hyponatremia (51.4%) >hypokalaemia (11.6%) >hypernatremia (6.9%) >hyperkalaemia (1.2%).
Conclusions: The order of electrolyte abnormalities seen: Hyponatremia (51.4%), hypokalaemia (11.6%), hypernatremia (6.9%), hyperkalaemia (1.2%). Duration of hospitalisation is 1 day for majority of the patients and is high for patients with hyponatremia.

Keywords: Acute gastroenteritis, Electrolyte, Hyponatremia, Hypokalaemia, Duration of hospitalisation

INTRODUCTION

Acute gastroenteritis is still one of the leading causes of morbidity and mortality. Diarrhoea is the second leading cause of preventable illness in children under age five.[1,2] The risk factors however appear to be distributed differently between developed and developing countries.[3] Developing countries often experience similar sanitation and poverty related risk factors, which predisposes their population to diarrheal illnesses.[4] Rotavirus is the major causative agent of diarrhoea in young children in developed and undeveloped countries. However, the incidence of illness in developed countries tend to be more related to seasonality, travel and food borne transmission.[5] According to CDC, Norovirus is the most common cause of acute gastroenteritis causing 685 million cases per year. Every year almost 50,000 children die, mostly in developing countries. Acute gastroenteritis is a problem in both high- and low-income countries. It is estimated to cost $60 billion globally due to health care costs and lost productivity. Norovirus illness and outbreaks are more common in winter. Electrolyte abnormalities is the leading causes of morbidity and mortality in younger children with acute gastroenteritis and increased mortality is seen in malnourished children.[6] The common abnormalities associated with acute

gastroenteritis are hyponatremia and hypokalaemia.[7-9] The average duration of hospital stay is 2.5 days.[10]

METHODS

It is a descriptive, cross sectional, retrospective study conducted in children medical centre, a tertiary care hospital in Tehran, Iran from June 2021 to May 2022. with a sample size of 173 patients calculated by non-probable sampling (convenience sampling).

Inclusion criteria

All gastroenteritis patients referred to the hospital in 1 year were included in the study.

Exclusion criteria

Patients with other underlying disease with gastroenteritis starting during hospital stay were excluded from study.

The aim of the study is to determine the incidence of electrolyte abnormalities and duration of hospitalisation of the gastroenteritis patients admitted over one year. (June 2021-May 2022). The ethical approval was provided by the ethical committee of the hospital. The protection of the privacy of the participants was ensured and no details were shared.

Statistical analysis

The collected data is entered into SPSS statistical software. The frequency command is used to determine the frequency of data. To describe qualitative variables, the number and percentage and quantitative variables, mean and standard deviation are used if the distribution of variables is normal. If the data is not normal, the median and inter quarter range (IQR) will be used.

To compare the means of quantitative variables in qualitative subgroups, independent t test and chi square test are used and in non-parametric conditions, U-Man Whitney is used. Also, ANOVA command is used to compare the means of quantitative variables in several independent groups. The study sample is 173 patients with the diagnosis of acute gastroenteritis admitted to CMC over 1 year period. The bivariate and Pearson correlation coefficients will be used to compare the means of the quantitative variables.

RESULTS

Out of total 173 patients, 103 patients (59.5%) are males and 70 patients (40.5%) are females. The sample size is divided in three different age groups of infants (<1 year), pre-schoolers (1-7 years) and older children (>7 years) (Table 1). CBC-differentials, Stool exam and stool culture were performed.

Table 1: Number and percentage of children in different age groups.

Age (Years)		Frequency	Percentage (%)
Valid	1.00	101	58.4
	2.00	55	31.8
	3.00	17	9.8
	Total	173	100.0

1=infants (<1 year), 2=preschool children (1-7 years), 3=older children (>7 years).

The most common sodium abnormality encountered in this study is hyponatremia seen in 89 patients (51.4%). In infants (101 patients), the most common sodium abnormality found was hyponatremia, which is seen in 53 patients (52.5%), followed by normo-natremia in 39 patients (38.6%) and the hypernatremia in 9 patients (8.9%) (Table 2). The similar trend was seen in preschool children (55 patients) with 28 patients (50.9%) hyponatremia, 24 patients (43.6%) with normo-natremia and 3 patients (5.5%) with hypernatremia. In older children (17 patients), mostly patients presented with normal sodium values as seen in 9 patients (52.9%) followed by hyponatremia in 8 patients (47.1%). Therefore, on the basis of age, hyponatremia was found as a dominant finding in infants and pre-schoolers followed by normonatremia and then hypernatremia. Older children mostly presented with normal sodium values followed by hyponatremia and then hypernatremia (Figure 1). This variability of sodium abnormalities was analysed using chi square test and the p=0.591. this implies that there is no significant relation between variability of sodium values and age of the patients.

Table 2: Percentages of patients with hyponatremia, hypernatremia and normal sodium levels of patients at the time of hospital admission.

Sodium level		Frequency	Percentage (%)
Valid	Low	89	51.4
	Normal	72	41.6
	High	12	6.9
	Total	173	100.0

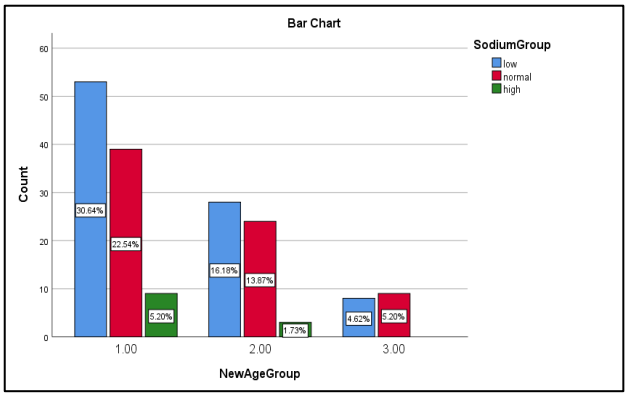

Figure 1: Sodium values with which children of different age groups presented to the hospital.

Sodium values were evaluated on the basis of different degrees of dehydration and the most common sodium abnormality found in all the three groups of mild, moderate and severe dehydration was hyponatremia. Among the mildly dehydrated patients (28 patients), 15 patients (53.6%) presented with hyponatremia followed by normal sodium values in 13 patients (46.4%). The same trend was seen in moderately dehydrated and severely dehydrated patients. In moderately dehydrated patients (38 patients), 23 patients (60.5%) presented with hyponatremia followed by normonatremia in 13 patients (34.2%) and then hypernatremia in 2 patients (5.3%). Among the severely dehydrated patients (107 patients), 51 patients (47.7%) presented with hyponatremia followed by normonatremia in 46 patients (43%) and hypernatremia in 10 patients (9.3%). It seen that hypernatremia was most common among severely dehydrated patients (9.3%) followed by moderately dehydrated patients (5.3%) (Table 3). This relation was analysed using chi square test and it showed a p=0.328. This implies that relation between the different degrees of dehydration and sodium abnormalities is not significant.

Table 3: Degree of dehydration and corresponding sodium levels.

Degree of dehydration		Low	Normal	High
Mild	Count	15	13	0
	% within degree of dehydration	53.6	46.4	0.0
Moderate	Count	23	13	2
	% within degree of dehydration	60.5	34.2	5.3
Severe	Count	51	46	10
	% within degree of dehydration	47.7	43.0	9.3
Total	Count	89	72	12
	% within degree of dehydration	51.4	41.6	6.9

1=infants, 2=pre-schoolers, 3=older.

Again, hyponatremia was seen as a dominant finding in both males and females. Out of 70 females (100%), 37 patients (52.9%) presented with hyponatremia and out of 103 males (100%), 52 patients (50.5%) presented with hyponatremia. Hypernatremia was found to be present only in 3 females (4.3%) and in 9 males (8.7%). This implies that in both males and females, hyponatremia was seen as the major sodium abnormality. This relationship between variability of sodium values and gender was tested by chi square tests. The p=0.527 and this shows that there is no significant relationship between sodium levels and the gender of the patients.

For patients who presented with hyponatremia, mean duration of hospitalisation was 3.809 days. This was followed by mean duration of hospitalisation of 2.417 days for hypernatremia patients. This relation of variability of sodium levels and duration of hospitalisation was analysed using ANOVA and the p=0.124. This implies there is no effect of variability of sodium levels on the duration of hospitalisation.

In this study, mostly patients presented with normal potassium values as seen in 151 patients (87.3%). When analysed on the basis of age, following normokalaemia, as the most common finding, hypokalaemia was the major potassium abnormality found in all of the age groups. In infants (101 patients), 96 patients (95%) presented with normokalaemia followed by hypokalaemia seen in 4 patients (4%) and hyperkalaemia in 1 patient (1%). The same trend was seen in preschool children and older children. In preschool children (55 patients), 43 patients (78.2%) presented with normokalaemia, 12 patients (21.8%) presented with hypokalaemia and there was no patient that presented with hyperkalaemia from preschool age group. Among older children (17 patients), 12 patients (70.6%) presented with normokalaemia, 4 patients (23.5%) presented with hypokalaemia and 1 patient (5.9%) presented with hyperkalaemia (Figure 2). To test the significance of this variation, Chi Test is performed and the p=0.0001 Which shows that this predominance of Normokalaemia in different age groups is significant.

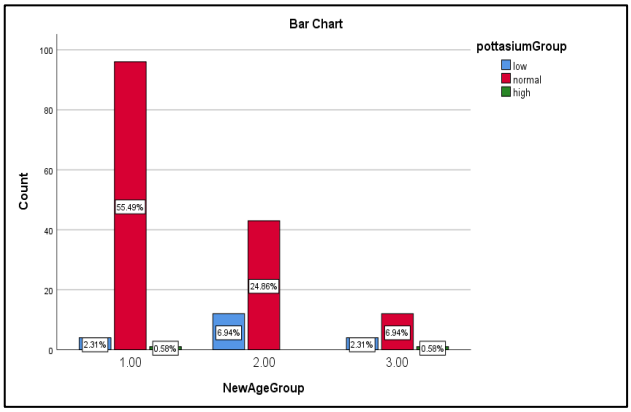

Figure 2: Potassium levels at admission in three different age groups.

Potassium values were evaluated on the basis of degree of dehydration and the most common finding in all the groups was normokalaemia. In mildly dehydrated patients (28 patients), 24 patients (85.7%) presented with normokalaemia followed by hypokalaemia in 4 patients (14.3%). Among the moderately dehydrated patients (38 patients), 32 patients presented with normokalaemia followed by hypokalaemia in 5 patients (13.2%) and the hyperkalaemia in 1 patient (2.6%). In severely dehydrated patients (107 patients), 95 patients (88.8%) presented with normokalaemia followed by hypokalaemia in 11 patients (10.3%) and then hyperkalaemia in 1 patient (0.9%). Therefore, the most common potassium abnormality in all the three groups of

degree of dehydration was seen as hypokalaemia (Table 4). This relation was tested using chi square test. The p=0.813. this implies there is no significant relation between different degrees of dehydration and the variability of potassium abnormalities.

Table 4: Degree of dehydration and corresponding potassium levels.

Degree of dehydration		Low	Normal	High
Mild	Count	4	24	0
	% within degree of dehydration	14.3	85.7	0
Moderate	Count	5	32	1
	% within degree of dehydration	13.2	84.2	2.6
Severe	Count	11	95	1
	% within degree of dehydration	10.3	88.8	0.9
Total	Count	20	151	2
	% within degree of dehydration	11.6	87.3	1.2

Also, hypokalaemia was seen as common potassium abnormality in both males and females. Out of 70 females (100%), 7 patients (10%) presented with hypokalaemia and out of 103 males (100%), 13 patients (12.6%) presented with hypokalaemia. There was no case of hyperkalaemia in females and 2 males (1.9%) presented with hyperkalaemia. The relation between the variability of potassium values and gender of patients was analysed by chi square test. The p=0.426. this implies there is no significant relationship between variability of potassium values and gender of the patients.

For patients who presented with hypokalaemia, highest mean duration of hospitalisation was noted and that is 4 days. For hyperkalaemia patients, mean duration of hospitalisation was 1.5 days. The relation between potassium values and duration of hospitalisation was tested by ANOVA. The p=0.631. This shows that the effect of different potassium levels on the variability of duration of hospitalisation is not significant.

Thus, the frequency of electrolyte abnormalities was seen the following order: Hyponatremia (51.4%)>hypokalaemia (11.6%)>hypernatremia (6.9%)>hyperkalaemia (1.2%).

Out of 173 patients, 77 patients (44.5%) stayed for 1 day in the hospital and 22 patients (12.7%) stayed for <1 day. This shows that mostly acute gastroenteritis patients stayed for 1 day in the hospital.

There were no fatalities reported among these 173 patients.

DISCUSSIONS

A similar study was done in 2018 in INDIA by Pratima and et al with the goal of determining the electrolyte abnormalities in children aged <5 years suffering from acute gastroenteritis. In this study 80 children were studied. Among these 80 children, 55% were <12 months, 25% were between 13-36 months, 20% were between 3-5 years. 62.5% were hyponatraemic, 38.75% were isonatremic and no cases of hypernatremia. 26.5% were hypokalaemic. The fatality rate was 7.5%. The children who died were all <36 months and all of them were acidotic. Mostly deaths were due to associated infection and peripheral circulatory failure. Hyponatremia and hypokalaemia were the common electrolyte abnormalities.[7]

Mostly acute gastroenteritis patients presented with normal BUN and Cr values at the time of hospital admission. 145 patients (83.8%) had normal BUN and only 18 patients (10.4%) had BUN values >20. 153 patients (91.3%) presented with normal creatinine values and 15 patients (8.7%).

In terms of other laboratory variables, almost 50% patients presented with normal ESR and CRP values and 50% had high ESR and CRP. 100 patients (57.8%) had normal WBC values at the time of hospital admission and 67 patients (38.7%) had leukocytosis. The 113 patients (65.3%) presented with normal Hb levels and 57 patients (32.9%) presented with low HB levels. Platelet values were normal for most of the acute gastroenteritis patients that is 115 patients (66.5%) and 50 patients (28.9%) presented with high platelet values. The 84 patients (48.1%) presented with neutropenia and 59 patients (34.1%) presented with normal neutrophil levels. Lymphocytosis was seen in 79 patients (45.7%) patients at the time of hospital admission.

Limitations

limited time duration for which the study is being conducted. Long term follow up and outcome records were not available.

CONCLUSION

In this study, the following order of electrolyte abnormalities was seen: Hyponatremia (51.4%)>hypokalaemia (11.6%)>hypernatremia (6.9%)>hyperkalaemia (1.2%). The same trend was seen in all age groups and both the genders. When variability of electrolyte abnormalities was analysed on the basis of age and gender, there is no significant relation found between electrolyte abnormalities and gender of the patients, also no significant relation between sodium abnormalities and the age of the patients was found.

Mostly patients presented with severe dehydration (61.8%) and order of electrolyte abnormalities in all

dehydrated patients goes as follows: hyponatremia>hypokalaemia>hypernatremia>hyperkalaemia.

Duration of hospitalisation is 1 day for majority of the patients (44.5%) and when analysed on the basis of electrolyte abnormalities the following order for mean duration of hospitalisation was seen: hypokalaemia (4 days) >hyponatremia (3.809 days) >hypernatremia (2.417 days), >hyperkalaemia (1.50 days). Duration of hospitalisation has no significant relation with sodium values and potassium values at the time of hospital admission.

The commonly associated laboratory abnormalities in acute gastroenteritis patients are high ESR (56.1%), high CRP (48%), lymphocytosis (45.7%) and neutropenia (48.1%). The common symptom with which these patients presented is vomiting (72.8%). Mostly acute gastroenteritis patients presented with normal stool WBCs, RBCs and negative stool culture.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Sturmberg JP, Watt P. Acute gastroenteritis in children. In: Aust Fam Physician. 1999;28(4):329-32.
2. Giordano MO, Ferreyra LJ, Isa MB, Martinez LC, Yudowsky SL, Nates SV. The epidemiology of acute viral gastroenteritis in hospitalized children in Cordoba city, Argentina: an insight of disease burden. SciELO Brazil. 2001;8.
3. Cardine AM, Gourlain K, Mouterde O, Castignolles N, Hellot MF, Mallet E et al. Epidemiology of Acute Viral Gastroenteritis in Children Hospitalized in Rouen, France. Clin Infect Dis. 2002;34(9):1170-78.
4. Kim KH, Yang JM, Joo SI, Cho YG, Glass RI, Cho YJ. Importance of rotavirus and adenovirus types 40 and 41 in acute gastroenteritis in Korean children. J Clin Microbiol. 1990;28(10):2279-84.
5. Fletcher SM, McLaws ML, Ellis JT. Prevalence of gastrointestinal pathogens in developed and developing countries: systematic review and meta-analysis. J Publ Heal Res. 2013;2(1):45-53.
6. Tajiri H, Takeuchi Y, Takano T, Ohura T, Inui A, Yamamoto K, Higashidate Y, Kawashima H, Toyoda S.The burden of rotavirus gastroenteritis and hospital-acquired rotavirus gastroenteritis among children aged less than 6 years in Japan: a restrospective, multicenter epidemiological survey. BMC Pediatr. 2013;22.
7. Pratima P, Geethanjali MP. Study of electrolyte imbalance in children suffering from acute gastroenteritis of under 5 age group. ResearchGate. 2018;3210-13.
8. Shah GS, Das BK, Kumar S, Singh MK, Bhandari GP. Acid base and electrolyte disturbance in diarrhea. In: Kathmandu Univ Med J (KUMJ). 2007;5(1):60-2.
9. Assar S, Samir MA, Manesh HJ. The frequency of plasma sodium and potassium imbalance in children hospitalized with gastroenteritis in Ahvaz's Golestan hospital, 2011-2012. Jundishapur Scientific Med J. 2017;453-60.
10. Homsi M, Singh B, Azawi M, Panchal A, Hauter N, Salafia C et al. Antibiotic therapy in acute gastroenteritis: a single-center retrospective cohort study. Ann Gastroenterol. 2019;32(6):565-9.

Cite this article as: Ul Zehra V, Mir NY, Memar EHE, Fayaz A. The electrolyte abnormalities and duration of hospitalisation in children with gastroenteritis. Int J Contemp Pediatr 2022;9:1168-72.