Original Research Paper

Paediatrics

ELECTROLYTE CHANGES IN ACUTE DIARRHOEA WITH DEHYDRATION AMONG UNDER-5 CHILDREN - AN OBSERVATIONAL STUDY IN A RURAL TERTIARY CARE CENTER.

Madhunandan Krishnegowda*	Assistant Professor, Department of Paediatrics, Adichunchanagiri Institute of Medical Sciences, Mandya, Karnataka, India. *Corresponding Author
Sunil Kumar P	Professor, Department of Paediatrics, Adichunchanagiri Institute of Medical Sciences, Mandya, Karnataka, India.
Keerthana T Babu	Junior Resident, Department of Paediatrics, Adichunchanagiri Institute of Medical Sciences, Mandya, Karnataka, India.

ABSTRACT **Introduction:** Diarrhoea is a leading cause of malnutrition among children under five years of age. Diarrhoea accounts for 20% of all deaths in under 5 children. In India, 1 in 82 children are dying from diarrhea before the age of 5 years. **Methodology:** This study was conducted in Adichunchanagiri Institute of Medical Sciences, B.G.Nagara, Mandya, Karnataka from September 2020 to November 2021, with the objective to study the electrolyte changes in acute diarrhoea with dehydration among under 5 children. **Results:** Out of 50 children 29 (58%) were females and 21 (42%) were males. A total of 39 (78%) babies had some dehydration; remaining 11 (22%) babies had severe dehydration. Most common electrolyte abnormality was hyponatremia which was followed by hypokalemia. **Conclusion:** Electrolyte abnormality needs to be identified early managed meticulously and appropriately.

KEYWORDS : Diarrhoea, Electrolytes, Hyponatremia, Hypokalemia.

INTRODUCTION

Diarrhoea is defined as change in consistency and frequency of stools, i.e. liquid or watery stools, that occur >3 times a day.[1] It is called as acute diarrhoea if it lasts for < 2 weeks. Most of the times these acute episodes last less than 7 days.[1] Diarrhoea is a leading cause of malnutrition among children under five years of age.[2] Diarrhoea accounts for 20% of all deaths in under 5 children.[1] In India, 1 in 82 children are dying from diarrhea before the age of 5 years.[3] The two most important consequences of diarrhoea are malnutrition and dehydration. Malnutrition and dehydration forms a vicious cycle since malnutrition increases the risk and severity of diarrhoea.

A child may lose as much water as an adult during an acute episode of diarrhoea, which translates into higher proportion of total body water loss in the child.[1] Serum electrolyte disturbance is one of the most common complication of acute diarrhea in children.[4,5] Depending on amount of fluid loss degree of dehydration is classified as no dehydration (< 5% of fluid loss), some dehydration (5- 10% of fluid loss) and severe dehydration (>10% of fluid loss).[1] If not treated these electrolyte disturbances are associated with increased mortality.[4,5] Introduction of rotavirus vaccine into national immunization program of India may help to further reduce under-5 mortality and morbidity.[6]

METHODS

This study was conducted in Adichunchanagiri Institute of Medical Sciences, B.G.Nagara, Mandya, Karnataka from September 2020 to November 2021.

Objectives

To study the electrolyte changes in acute diarrhoea with dehydration among under 5 children.

INCLUSION CRITERIA

1. Children aged less than 5 years.
2. History diarrhoea with some or severe dehydration.

EXCLUSION CRITERIA

1. Diarrhoea lasting for more than 14 days.
2. Children with diarrhoea with no dehydration.

Method of data collection

Babies who met the inclusion criteria were enrolled in the study. Babies were examined clinically and graded based on the severity of dehydration as no dehydration some dehydration and severe dehydration. Children with no dehydration were excluded from the study.

Before starting any rehydration measures, 3 ml of blood was drawn to estimate the levels of serum electrolytes, particularly sodium and potassium. Based on values obtained from laboratory, hyponatremia is considered when serum sodium is <135 mEq/L, hypernatremia when sodium >145 mEq/L. Hypokalemia when potassium is <3.5 mEq/L and hyperkalemia when potassium >5.5mEq/L.

Statistical Analysis

Data thus obtained was compiled and entered in MS Excel spread sheet; descriptive statistics was applied, cross tables were constructed, data was expressed in terms of frequency and percentage.

RESULTS

A total of 50 babies who met the inclusion criteria were enrolled in the study. Among them 29 (58%) were females and 21 (42%) were males. 11 (22%) babies belonged to the age group of less than 1 years, 21 babies (42%) babies belonged to the age group of 1- 3 years of age, 18 (36%) babies belonged to the age group of 3- 5 years. Most of our cases 19 babies (38%) belonged to class 2 modified B.G. Prasad classification which was followed by 16 babies (32%) who belonged to class 3. (Table 1)

Table 1: Socio-demographic profile of the study population.

PARAMETER	Number (50)
Age	
< 1 years	11 (22%)
1- 3 years	21 (42%)
3- 5 years	18 (36%)
Gender	
Male	21 (42%)
Female	29 (58%)
Socioeconomic status	
Class 1	10 (20%)
Class 2	19 (38%)
Class 3	16 (32%)
Class 4	5 (10%)
Class 5	-

A total of 39 (78%) babies had some dehydration; remaining 11 (22%) babies had severe dehydration. Among babies who had some dehydration 16 (76.2%) babies belonged to age group of 1- 3 years which was followed by 15 (83.3%) babies who belonged to 3- 5 years. Among babies who had severe dehydration, 5 (23.8%) babies belonged to age group of 1- 3 years, there were 3 (27.3%) babies in < 1 year group and 3 babies (16.7%) babies in 3- 5 years group. (Table 2)

Table 2: Distribution of babies based on age and dehydration status.

PARAMETER	< 1 years (n=11)	1- 3 years (n=21)	3- 5 years (n=18)	Total (n=50)
Some dehydration	8 (72.8%)	16 (76.2%)	15 (83.3%)	39 (78%)
Severe dehydration	3 (27.3%)	5 (23.8%)	3 (16.7%)	11 (22%)

About 38 babies (76%) had normal serum sodium and 40 babies (80%) had normal serum potassium. Among babies with some dehydration 34 babies (87.2%) had normal serum sodium and 35 (89.8%) babies had normal serum potassium. Among the babies with severe dehydration 4 (36.4%) had normal serum sodium while 5 (45.5%) babies had normal serum potassium; In our study most common electrolyte abnormalities were hyponatremia which was seen in 10 (20%) babies and hypokalemia which was seen in 7 (14%)babies. (Table 3)

Table 3: Distribution of babies based on dehydration status and electrolyte changes.

PARAMETER	SOME DEHYDRATION (n=39)	SEVERE DEHYDRATION (n=11)	Total (n=50)
Hyponatremia	4 (10.2%)	6 (54.6%)	10 (20%)
Isonatremia	34 (87.2%)	4 (36.4%)	38 (76%)
Hypernatremia	1 (2.6%)	1 (9%)	2 (4%)
Hypokalemia	2 (5.1%)	5 (45.5%)	7 (14%)
Isokalemia	35 (89.8%)	5 (45.5%)	40 (80%)
Hyperkalemia	2 (5.1%)	1 (9%)	3 (6%)

DISCUSSION

In our present study, hyponatremia was seen in 20% of the cases while other similar studies by Shah GS et al[4] had 26%, AN Onyiriuka et al[7] had 55.6%, Gubbari KTN et al[8] had 2.72 %. Our values were similar with Shah GS et al[4]. Hypernatremia was seen in 4% of babies in our study while Shah GS et al[4] had 10%, AN Onyiriuka et al[7] had 4.8%, Gubbari KTN et al[8] had 14.09%. Our values were similar with AN Onyiriuka et al[7].

In our study, we found hypokalemia as second most common electrolyte disturbance was seen in 14% of the cases while other studies done by Shah GS et al[4] had 14%, AN Onyiriuka et al[7] had 14.3%, Gubbari KTN et al[8] had 9.09 %. Our values were similar with Shah GS et al[4] and AN Onyiriuka et al[7]. Hyperkalemia was seen in 6% of babies in our study while Shah GS et al[4] had 3%, AN Onyiriuka et al[7] had 0%, Gubbari KTN et al[8] had 4.54%.

In our present study, most common electrolyte disturbance is hyponatremia. Study done by Shah GS et al[4] and AN Onyiriuka et al[7] also found that hyponatremia as most common electrolyte disturbance. Hyponatremia in diarrhoea is due to a combination of sodium and water loss and water retention to compensate for volume depletion.[9] In addition, it is possible that initially the dehydration may be normonatremic, resulting in the thirst and demand for water by the child. The mother responds by giving water to the child. The hypovolemia will stimulate the release of antidiuretic hormone and water excretion by the kidney will be minimized. In the process, water retention leads to hyponatremia, thus, resulting in higher frequency of hyponatremia as found in the present study. Although hyponatremia is often asymptomatic, it has the potential of causing severe neurological damage and death.[10]

Second most common electrolyte abnormality in our study was hypokalemia. Study done by Shah GS et al[4] and AN Onyiriuka et al[7] also found that hypokalemia as second most common electrolyte disturbance. Gastric secretions contain up to 20 mmol/L of potassium and diarrheal fluid contains 10–80 mmol/L.[11] Persistent vomiting and the dehydration resulting from vomiting and/ or diarrhea stimulate aldosterone release. Aldosterone excess further potentiates hypokalemia, thereby compounding the potassium loss.[12]

CONCLUSION

Most common electrolyte abnormality noted was hyponatremia which was followed by hypokalemia. These electrolyte abnormality needs to be identified early managed meticulously and appropriately.

REFERENCES

1. Srivastava A, Jagadisan B, Yachha SK. Diseases of gastrointestinal system and liver. Ghai essentials pediatrics. 9th ed. New Delhi: CBS publishers and distributors; 2109: p 273-328.
2. Bassani DG, Kumar R, Awasthi S, Morris SK. Causes of neonatal and child mortality in India. A Nationally representative mortality survey. Lancet. 2010;376:1853-60.
3. Morris SK, Awasthi S, Khera A, Bassani DG, Kang G, Parashar UD, et al. Rotavirus mortality in India: estimates based on a nationally representative survey of diarrhoeal deaths. Bulletin of the World Health Organization. 2012;90:720-7.
4. Shah GS, Das BK, Kumar S, Singh MK, Bhandari GP. Acid base and electrolyte disturbance in diarrhoea. Kathmandu Univ Med J (KUMJ). 2007;5(1):60-2.
5. JA Begam, MM Hoque, M Hussain, MNA Hasan, MH Molla, Impact of electrolyte disturbance in outcome of acute diarrhea in children, DS(child) H J. 2010;26(1):36-40.
6. Lodha R, Shah D. Prevention of rotavirus diarrhoea:is vaccination the only strategy. Indian Pediatr.2012;49(6):441-3.
7. Onyiriuka AN, Iheagwara EC. Serum electrolyte profiles of under-five Nigerian children admitted for severe dehydration due to acute diarrhea. Niger J Health Sci. 2015 Jan 1;15(1):14.
8. Gubbari KTN. Electrolyte disturbance in rotaviral diarrhea and other acute diarrheal diseases in children under 5 years. Int J Contemp Pediatr 2019;6:2077-80.
9. Greenbaum L. Fluid and electrolyte treatment of specific disorders. In: Kliegman RM, Behrman RE, Jenson HB, Stanton BF, editors. Nelson Textbook of Pediatrics. 18th ed. Philadelphia: Saunders Elsevier; 2007. p. 316-9.
10. World Health Organisation. The Treatment of Diarrhoea: A Manual for Physicians and Other Senior Health Workers. Geveva, Switzerland: World Health Organisation; 1995.
11. Akinbami FO. Diarrhoeal diseases in childhood. In: Azubuike JC, Nkangieneme KE, editors. Paediatrics and Child Health in a Tropical Region. 2nd ed. Owerri: African Educational Services; 2007. p. 283-8.
12. Balachandra S, Kalia A. Electrolyte and acid-base disorders. In: Srivastava RN, Bagga A, editors. Pediatric Nephrology. 5th ed. New Delhi: Jaypee Brothers Medical Publishers Ltd.; 2011. p. 96-129.