Original Article

Dehydration in Children with Acute Diarrhea

Association of Serum Electrolyte Derangements with Severity of Dehydration in Children with Acute Diarrhea

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ABSTRACT

Objectives: To see the association of serum electrolyte derangement with severity of dehydration.
Study Design: Observational / descriptive study.
Place and Duration of Study: This study was conducted at the Department of Peadiatric Medicine, Nishtar Medical College and Hospital, Multan from March 2016 to August 2016.
Materials and Methods: Consecutive 107 children with acute diarrhea having dehydration were included in this cross-sectional study. Serum sodium and potassium levels were analyzed to see their association with severity of dehydration by applying ANOVA test using SPSS – 20.
Results; Out of these 107 children having acute diarrhea, 59 (55.1%) were boys and 48 (44.9%) were girls and their mean age was noted to be 19.12 ± 8.89 months (range; 7 months to 36 months). Mean age of the boys was 15.29 ± 7.25 months while that of girls was 23.83 ± 8.49 months (p=0.000) and 58 (54.2%) were aged more than 1 year. Sixty five (60.7%) were from urban areas, 82 (76.6%) had poor background, 65 (60.7%) had history of stools less than 6 during last 24 hours. Mean duration of diarrhea was 5.13 ± 2.23 days and 74 (69.2%) presented with duration of less than one week of onset of the diarrhea. Fever was present in 65 (60.7%) and associated vomiting was present in 91 (85%) our study cases. Mean serum sodium level in our study was 133.65 ± 3.18 nmol/L while mean serum potassium level was 3.82 ± 0.625 nmol/L
Conclusions: High frequencies of serum electrolyte derangement was noted in our study and this serum electrolyte derangement (hyponatremia and hypokalemia) was significantly associated with severity of the dehydration. Severity of dehydration is a predictor of hyponatremia and hypokalemia which ultimately lead to disease morbidity and mortality, hence these patients need to be monitored appropriately for better clinical outcomes.
Key Words: dehydration, hyponatremia, hypokalemia.

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INTRODUCTION

Worldwide diarrheal illnesses are responsible for 1 out of 9 deaths among children and is categorized as 2nd most common causes of death in pediatric population. It is estimated to cause approximately 800, 000 death every year in children under 5 years of age [1,2]. Diarrhea itself accounts for approximately 4.1% of total global burden of all illnesses. Etiological agents may include many different kinds of viruses, different bacterial pathogens and some parasites as well [3]. Some of these culprits may include "rotavirus A, norovirus GI and GII, adenovirus, sapovirus, astrovirus, Salmonella, Campylobacter jejuni, Shigella spp. and enterotoxigenic Escherichia coli (ETEC)" [4, 5].

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Global statistics from different parts of the world indicate that burden of these etiological agents vary with regards to demographic distribution, personal hygienic behaviors and social stratification among community. From available data from different countries like South Asian countries, Europe, Africa, Middle & far eastern nations, South Americal countries and USA have documented different variety of enteropathogens being reported in varying frequencies and patterns [6 - 13].

In children having diarrhea, co – infection with many different kinds of pathogens is also common which leads to severe illness and adverse outcomes when compared with disease caused by a single pathogen [14, 15].

Deaths due to diarrheal diseases may be due to immediate or long term complications of the illness [16]. The immediate complications may include electrolyte and/or fluid derangements which leads to imbalance in acid base equilibrium in body as extracellular fluid osmolality and volumes are controlled by sodium levels in body which has a key role in water and electrolyte balance in the bodies [17]. Hence such biochemical disturbances may lead to hyponatremia, isonatremia and even hypernatremia particularly among children

with dehydration while other biochemical derangements may also be noted such as hypokalemia and metabolic acidosis [18-20]. Dehydration remains most common and more dangerous complication of acute diarrhea in children which is associated with significant morbidity and mortality in children having acute diarrhea so evaluation of these electrolyte parameters at presentation have significant impact on the treatment protocol as well as disease prognosis [21].

This prospective study was done to determine the association of various grades of dehydration with serum electrolyte derangement and to relate them with severity of disease as there was no local data found on this topic.

MATERIALS AND METHODS

One hundred and seven children having acute diarrhea with different grades of dehydration were taken in this cross-sectional study. The parents of these children were asked for consent after briefing them objectives of this study. Diarrhea was defined as "Passage of more than three watery stools within 24 hours, for duration of less than 2 weeks". Dehydration was graded as mild, moderate and severe as per WHO criteria. It was defined as mild "if general condition is restless, eyes look normal, drinks normally and skin pinch goes back quickly", it was defined as moderate "if general conditions is restless and irritable, with sunken eyes, drinks eagerly and is thirsty and skin pinch goes back slowly" and it was graded as severe "If the child is lethargic or unconscious, having sunken eyes, drinks poorly or not able to drink and skin pinch goes back very slowly". The children with persistent or bloody diarrhea, having associated systematic illnesses and those who got relevant electrolyte therapy were excluded from this study. A questionnaire was used to record these findings. Data regarding child's age, gender, duration of illness, no. of stools passed in a day, fever, vomiting, severity of dehydration and serum electrolyte derangements was taken and was analyzed by SPSS – 20. ANOVA test was applied to see the association of serum electrolyte derangement with regards to the severity of the dehydration.

RESULTS

Out of these 107 children having acute diarrhea, 59 (55.1%) were boys and 48 (44.9%) were girls and their mean age was noted to be 19.12 ± 8.89 months (range; 7 months to 36 months). Mean age of the boys was 15.29 ± 7.25 months while that of girls was 23.83 ± 8.49 months (p=0.000) and 58 (54.2%) were aged more than 1 year. Sixty five (60.7%) were from urban areas, 82 (76.6%) had poor background, 65 (60.7%) had history of stools less than 6 during last 24 hours. Mean duration of diarrhea was 5.13 ± 2.23 days and 74 (69.2%) presented with duration of less than one week of onset of the diarrhea. Fever was present in 65 (60.7%) and associated vomiting was present in 91 (85%) our study cases. Mean serum sodium level in our study was 133.65 ± 3.18 nmol/L while mean serum potassium level was 3.82 ± 0.625 nmol/L.

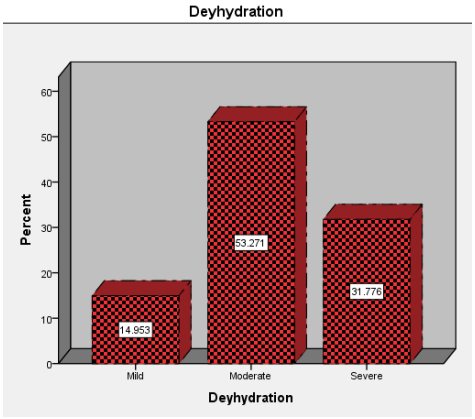

Figure No. 1: Various grades of dehydration.

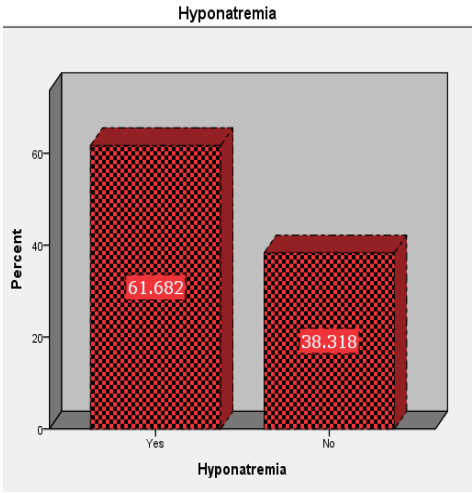

Figure No. 2: Hyponatremia in study cases.

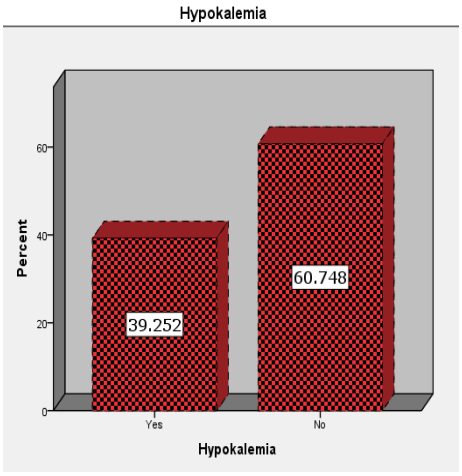

Figure No. 3: Hypokalemia in study cases.

Distribution of different study parameters with regards to severity of dehydration is given in table – 1.

Table No. 1: Distribution of various parameters with severity of dehydration.

Parameter		Mild	Moderate	Severe	P – value
Gender	Male	00	49	10	0.001
	Female	16	08	24	
Disease duration	1 week	16	32	26	0.002
	>1week	00	25	08	
Fever	Yes	16	24	25	0.001
	No	00	33	09	
Vomiting	Yes	08	49	34	0.001
	No	08	08	00	
Hypona-tremia	Yes	00	32	34	0.001
	No	16	25	00	
Hypoka-lemia	Yes	00	08	34	0.001
	No	16	49	00	

Table No. 2: Analysis of variance (ANOVA) of serum electrolyte levels in different grads of dehydration.

Serum Electrolytes	Mild	Moderate	Severe	P – value
Serum Sodium level (In nmol/L)	137.5± 0.51	134.59± 2.26	130.26± 1.79	0.001
Serum Potassium level (In nmol/L)	4.40±0.206	4.08±0.50	3.12±0.08	0.001

DISCUSSION

Out of these 107 children having acute diarrhea, 59 (55.1%) were boys and 48 (44.9%) were girls and their mean age was noted to be 19.12 ± 8.89 months (range; 7 months to 36 months). A study conducted by Bilal et al [22] from Rawalpindi also reported similar results with 61 % children with acute diarrhea were boys which is similar to our results. Okposio et al [23] from Nigeria has also reported similar results with more boys than girls as there were 57 % boys, similar to our findings. Rocha et al[24] from Brazil also reported male gender predominance with 53 % boys which is close to our findings. Mean age of the boys was 15.29 ± 7.25 months while that of girls was 23.83 ± 8.49 months (p=0.000) and 58 (54.2%) were aged more than 1 year. Bilal et al [22] from Rawalpindi 1.9 ± 1.4 years mean age of the children with acute diarrhea which is close to our results. Okposio et al[23] from Nigeria has also reported 14.6 ± 10.5 months mean age in children with acute diarrhea which is close to our results. Rocha et al [24] from Brazil also reported 16.5 ± 17.8 months mean age which is close to our findings.

Sixty five (60.7%) were from urban areas, 82 (76.6%) had poor background, 65 (60.7%) had history of stools less than 6 during last 24 hours. Okposio et al[23] from Nigeria has also reported 70.3 % children with acute diarrhea had history of stools less than 6 during last 24 hours which is same as our study results. Rocha et al[24] from Brazil also reported 32.3% children with diarrhea presented with history of more than 5 stools within 24 hours which is similar to our study results.

Mean duration of diarrhea was 5.13 ± 2.23 days and 74 (69.2%) presented with duration of less than one week of onset of the diarrhea. Bilal et al [22] from Rawalpindi has also reported 3.2 ± 1.7 days mean duration of diarrhea which is close to our results. Okposio et al[23] from Nigeria has also reported similar results.

Fever was present in 65 (60.7%) and associated vomiting was present in 91 (85%) our study cases. Okposio et al [23] from Nigeria has also reported fever in 58.9 % children with acute diarrhea while vomiting in 83.8 % which is same as that of our study results. Rocha et al [24] from Brazil also reported fever in 63.8 % while vomiting was present in 88.7 % children with diarrhea which is close to our study results.

Mean serum sodium level in our study was 133.65 ± 3.18 nmol/L and hyponatremia was present in 61.6 % our study cases. while mean serum potassium level was 3.82 ± 0.625 nmol/L and hypokalemia was present in 42 (39.3%) our study cases. Bilal et al [22] from Rawalpindi has also reported 32.5 % hyponatremia and 55 % hypokalemia, hence indicating majority of patients having serum electrolyte derangement which is in compliance with our findings. Okposio et al [23] from Nigeria has also reported 60.5% hyponatremia while hypokalemia was present in 35.1 % which is same as that of our study results.

Dehydration was mild in 14.9 %, moderate in 53.27 % and severe in 31.8 % our study cases. In our study, ANOVA revealed that there was significant association between severity of dehydration and serum electrolyte derangement (p = 0.001). Okposio et al [23] from Nigeria has also reported mild dehydration in 22.2%, moderate in 61.6% and severe in 16.2 % which is similar to our study results. Okposio et al [23] from Nigeria has also observed increasing serum electrolyte derangement with increasing severity of the dehydration which is similar to our study results.

CONCLUSION

High frequencies of serum electrolyte derangement was noted in our study and this serum electrolyte derangement (hyponatremia and hypokalemia) was significantly associated with severity of the dehydration. Severity of dehydration is a predictor of hyponatremia and hypokalemia which ultimately lead to disease morbidity and mortality, hence these patients need to be monitored appropriately for better clinical outcomes.

Conflict of Interest: The study has no conflict of interest to declare by any author.

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