STOOL ELECTROLYTES IN ACUTE DEHYDRATING GASTROENTERITIS

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ABSTRACT

Stool electrolytes were studied in 100 cases of gastroenteritis. The duration of illness was 24-48 hours in 32% and 72-96 hours in 28% of the cases. On stool culture, 43% children had no growth, 23% had Enteropathogenic E. coli and 10% had cholera and rotavirus each. The stool sodium loss was more in cholera and shigella cases, diarrhea of shorter duration and in children between 24-30 months of age. Potassium loss in the stool was more in shiegella cases, diarrhea of short duration and in children between 30-36 months of age. In cases of gastroenteritis with severe malnutrition, stool sodium loss was less; stool potassium loss was not affected by the nutritional status. Total electrolytes lost in stools can be estimated by knowing purging rate and rehydration therapy can be planned accordingly.

Key words: *Gastroenteritis, Stool electrolytes.*

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Acute gastroenteritis is a common but potentially serious illness and a leading cause of death in children under 5 years of age(1). Development of oral hydration for acute diarrheal diseases has emerged as a major therapeutic advance(2-4). The WHO has recommended a single universal oral rehydration solution (ORS) having a sodium concentration of 90 meq/L for rehydration in all age groups with acute diarrhea of all causes(5). This concept has been criticised by various workers(6,7). We undertook this study of stool electrolyte losses to ascertain the extent to which etiological factors and other parameters like duration of diarrhea, nutritional status, age, and degree of dehydration influence the stool electrolyte losses, so that a more rational basis for rehydration therapy may be evolved.

Material and Methods

One hundred consecutive cases of acute gastroenteritis admitted to Pediatric ward, Dayanand Medical College and Hospital, Ludhiana were taken for the study. Acute gastroenteritis in this series, was defined as acute onset of watery diarrhea, with or without vomiting, dehydration and electrolyte imbalance in children between the ages of six months to three years and fecal leucocyte count of 0-5/high power field.

Detailed history and physical examination was performed at the time of admission, before starting rehydration therapy. The cases were clinically assessed for the degree and type of dehydration.

In addition to naked eye examination, microscopic examination of methylene blue stained film for fecal leucocytes was also done. Cholera was identified by hanging drop method and confirmed by motility inhibition test. Stool for Giardia and *E. histolytia* was tested by standard tech-

niques. Rotarvirus was isolated by Rotalax slide Agglutination test (Oriom Diagnistica, Espoo, Rinland). Stool culture was carried out in all cases. *E. coli* organisms were identified by morphology and biochemical reactions. Enteropathogenic *E. coli* were confirmed by doing serotyping with polyvalent sera. Estimation of stool sodium and potassium was done before starting rehydration therapy, by methods of Ludnilla using atomic absorption spectrophotometer.

Results

Maximum number (47%) of cases were in the age group of 6-12 months. Children in the age group of 12-18 months constituted 23% of the study population. Male to female ratio was 2 : 1. Sixty one per cent of the cases were normally nourished and 39% were malnourished. The maximum number of cases reported with a duration of diarrhea of 24 to 48 hours (32%) and 28% between 72 to 96 hours. Of the 100 children studied, 43 children did not show growth of any organism on stool culture, 23 grow enteropathogenic *E. coli*, 10 had rotavirus, 4 grew *Salmonella typhimurium,* 3 grew *klebsiella* and 2 grew *Shigella dysenteri.*

The maximum stool sodium loss occurred in cholera cases and it was significantly more as compared to other pathogens. Loss due to shigella was significantly more than that in rotavirus diarrhea. The stool potassium loss was significantly more in shigella gastroenteritis as compared to other pathogens. There was no significant difference in stool potassium loss among other pathogens (*Table I*).

The maximum stool sodium loss occurred in cases with illness of less than 24 hours duration and it was significantly more than that occuring in cases with illness of 72 hours duration or more in non cholera cases. Sodium loss after 96 hours of illness was significantly less as compared with illness of less than 72 hours duration (*Table II*). In cholera cases also, the stool sodium loss occuring with illness of less than 48 hours was significantly more than that in cases admitted later than 48 hours of onset of illness. In non-cholera cases, the stool potassium loss after 96 hour of illness was significantly less than that occuring in cases with less than 48 hours of illness. In cholera cases, no significant difference was observed with varying duration of diarrhea (*Table II*). Mean stool sodium loss in noncholera cases was 33.72 meq/L in Grade I of protein energy malnutrition, 29.16 in Grade II and 23.57 in Grades III and IV respectively whereas in cholera cases these were 101.94 in Grade I PEM and 85.23 in Grades II, III and IV, respectively. There was significant difference between the stool sodium loss in PEM Grades I, III and IV and normal.

TABLE I—*Stool Sodium and Potassium Losses in Relation to Etiology*

Pathogens	Rotavirus	Klebsiella	Salmonella	EPEC	No growth	Shigella	Cholera
Number of cases	10	3	4	28	43	2	10
Mean stool sodium (mEq/L)	29.7	30.2	37.2	38.8	38.1	60.4	95.3
Mean stool potassium (mEq/L)	21.0	19.6	20.5	23.7	22.5	40.9	25.3

Among the non-cholera cases, the age group of 24-30 months had significantly more mean stool sodium loss than in children of 6-12 months. Children in the age group of 30-36 months had significantly more sodium loss as compared to other age groups. The mean stool potassium loss was also significantly more in the age group of 30-36 months as compared to other age groups in non cholera cases (*Table III*). The electrolyte loss did not differ significantly with age in cholera cases.

Discussion

The stool sodium loss in cases of cholera were significantly higher than in diarrhea caused by other agents. In case of EPEC and Klebsiella the mean sodium loss in our study was less than that reported by Deorari *et al.*(8). However, in case of Klebsiella the number of cases in both the studies was too small to be taken as valid comparison. There are no studies available for comparison of stool sodium loss in cases of shigella and salmonella.

Mean stool sodium loss both in non-cholera and cholera groups was significantly higher in the early stage as compared to that in the later stage of illness. Molla *et al.*(9) and Gabha *et al.*(10) also reported the same. In non-cholera cases, the stool potassium was significantly low in cases presenting late in illness. This is in accordance with study of Griffith *et al.*(11). In cholera cases, no significant difference was found in potassium loss at different stages of illness. These observations with that reported by are in accordance with others(1,10). The sodium and potasium

TABLE II—*Sodium and Potassium in Relation to Duration of Diarrhea*

	Non cholera (n = 90)					Cholera (n = 10)	
Duration (h) hours	24	24-48	48-72	72-96	>96	<48	>48
Number of cases	5	32	18	25	10	5	5
Mean stool sodium (mEq/L)	50.1	40.8	40.6	33.4	23.1	105.4	85.1
Mean stool potassium (mEq/L)	29.7	25.2	21.9	21.5	17.0	24.1	26.6

TABLE III—*Stool Sodium and Potassium (Non-cholera) in Relation to Age*

Age (mo)	6-12	12-18	18-24	24-30	30-36
Number of cases (Total 90)	46	22	5	9	8
Mean stool sodium (mEq/L)	31.2	35.9	41.6	46.1	66.9
Mean stool potassium (mEq/L)	23.2	21.3	18.8	18.7	33.9

requirements may, therefore, be more in early stage of the disease as compared to the later part especially in noncholera cases.

The mean stool sodium loss in well-nourished children or children with milder grades of PEM both in cholera and non-cholera cases was significantly more as compared to that in severe grades of PEM. This is probably a reflection of low serum sodium in children with PEM. This observation of low stool sodium concentration should indicate therapy with low sodium containing rehydrating solution, if one has to take stool sodium loss as a parameter for planning therapy. In practice, however it is the reverse. Sodium requirements are higher in the treatment of dehydration in malnourished children. Thus, a single reading of stool sodium concentration can give a fallacious idea and must be related to the volume or quantity of purging to assess the actual magnitude of sodium loss. Only then, it may form a relevant basis for planning rehydration therapy.

The mean stool potassium loss, both in non-cholera and cholera group did not differ significantly in normally nourished and those with severe grades of PEM. The only other study(10) which has tried to correlate stool electrolyte loss with nutritional status is in accordance with our observations.

In the present study, the mean stool sodium and potassium loss increased with age in non-cholera group, but this was not so in the cholera group and there was no significant difference in the stool electrolyte losses at different ages. Studies of Griffith *et al.*(11) and Mahalanabis *et al.*(12) have shown higher sodium and lower potassium losses in adults with cholera as compared to children with cholera. Possibly, this difference is because in the present study, the age comparison is limited between the children themselves of ages 6 months to 3 years, whereas in other studies, it is between older children and adults.

To conclude, stool electrolyte losses are affected upto certain extent, by the type of organisms, duration of the disease process, age of the children and their nutritional status and these should be taken into consideration during planning rehydration therapy.

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