Oral rehydration therapy for treatment of rotavirus diarrhoea in a rural treatment centre in Bangladesh

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SUMMARY In November 1977, an enzyme-linked immunosorbent assay for detecting rotavirus antigen was introduced in the laboratory of a rural treatment centre in Bangladesh. During the next 40 days rotavirus without other pathogens was found in the stools of 216 (45%) of 480 children under age 5 years who visited the centre with a gastrointestinal illness. 188 (87%) of these children were treated with oral rehydration alone, using the solution currently recommended by the World Health Organisation, while 28 (13%) also required some intravenous rehydration; there were no deaths. Oral rehydration treatment was judged successful in 205 (95%) of the rotavirus patients and was not associated with any serious side effects. Oral rehydration treatment, with this solution, has been used extensively and successfully in the treatment of enterotoxin-mediated diarrhoea and can also safely be used for treating rotavirus diarrhoea in infants and young children.

Rotaviruses have been identified as a cause of gastroenteritis in infancy and early childhood in many parts of the world including some developing countries.¹⁻⁴ Because rotavirus disrupts the structure of the small intestine and generally causes diarrhoea in infants and young children, there is concern about whether the oral glucose electrolyte solution recommended by the World Health Organisation (WHO)⁵ (which contains 90 mmol/l sodium and 111 mmol/l glucose) can be used on a large scale for standard treatment of rotavirus diarrhoea.⁶⁻⁷ An enzyme-linked immunosorbent assay (ELISA) for

rotavirus detection was recently developed; it has been described as being rapid, accurate, sensitive, and suitable for field work.⁸⁻⁹ In November 1977 we introduced ELISA in the laboratory of our rural treatment centre for use when routinely examining stools from patients with gastroenteritis. We describe here the outcome of rehydration treatment during the subsequent 40-day period, using the solution recommended by WHO, on 216 children aged under 5 years.

Materials and methods

Matlab Hospital is the rural treatment centre of the International Centre for Diarrhoeal Diseases Research, Bangladesh (formerly the Cholera Research Laboratory). It is about 40 miles south-east of Dacca and is the primary treatment centre for gastrointestinal illness, serving a population of about 269 000. Medical care at the centre is given by paramedical staff under supervision of a physician. Before treatment is started, a brief history is obtained and the patient is weighed. All patients are treated on cholera cots to determine the accurate stool volume. At the time of the evaluation patients who did not appear clinically dehydrated on presentation, or who were slightly dehydrated (judged clinically to have lost up to 5% body weight),

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received oral glucose electrolyte solution prepared at the centre following WHO guidelines.⁵ Mothers were instructed to give oral fluid to these children *ad lib.* in frequent small feeds and were encouraged to continue breast feeding. Those patients presenting with moderate (5–10% body weight loss) or severe (>10% body weight loss) dehydration were initially given intravenous rehydration fluid according to a standard regimen to replace initial losses, and then given the oral rehydration solution *ad lib.* to replace continuing losses. Plain water was offered later in the course of treatment to any child who appeared thirsty but showed no evidence of dehydration, or if requested by his mother.

In the course of receiving oral rehydration treatment, any patient in either group who was judged by the staff to be unable to consume enough oral fluid to match fluid loss (diarrhoea and vomitus) because of persisting vomiting or high purging rates, or both, was considered an oral treatment failure and was then given fluid intravenously. Patients were sent home when they were fully rehydrated and their diarrhoea minimal (generally less than 5–10 ml/kg and usually no diarrhoea in the previous 8-hour period). Before discharge each patient was weighed.

From 17 November 1977 two rectal swabs were obtained before treatment from any patient living in our vaccine trial surveillance area. The first rectal swab was used to test for bacterial pathogens including vibrio, salmonellae, and shigellae using standard procedure¹⁰ and for enterotoxigenic *Escherichia coli* as previously described.¹¹ The second rectal swab was placed in phosphate buffered saline pH 7.4 and tested for rotavirus antigen by the ELISA of Yolken *et al.*⁸ using the 2-antibody technique.⁹ Blocking tests were performed in specimens from 120 cases and were positive in all. Any patient in whom rotavirus was identified in his stools was defined as a case of rotavirus.

Results

480 patients under age 5 years who visited the treatment centre with gastroenteritis between 17 November and 26 December 1977 were studied. Rotavirus was identified in 232 (48%) of them. In 16 (3%) of the 232 cases a bacterial pathogen was also isolated; these cases were excluded from this analysis.

The mean age of patients with rotavirus was 11.8 months; 99% of the children were younger than 2 years and 93% were between 6 and 23 months. The highest frequency of detection was in the 12- to 17-month age group where 97 (64%) of 152 children had rotavirus infection. The male to female ratio was 1.2:1.

Clinical features of the rotavirus cases are shown in Table 1. Diarrhoea and vomiting were almost universal. The diarrhoea was described as watery in most cases; bloody diarrhoea was reported by only one. 62 (29%) patients reported a history of fever, and fever (>37.8°C rectally) was documented in 45 (22%) cases. On presentation to the centre most of the rotavirus cases had slight dehydration or none; only 9% had moderate or severe dehydration. Patients were treated a mean of 16 hours and purged on the average 131 ml/kg (excluding 36 patients who did not purge after visiting the centre). The maximum amount of total stool purged was 1990 ml. Average amount of total fluid intake in all patients was 130 ml/kg. Plain water was consumed by 5% of patients. Mean weight gain after rehydration was 100 g, or 1.4% body weight.

The outcome of treatment of these patients is shown in Table 2. Nine (5%) of the 197 cases with slight dehydration or none and treated initially with oral fluid, and 2 (11%) of the 19 moderate or severely dehydrated cases who were treated initially with intravenous fluid were oral fluid failures; the overall oral treatment failure rate was 5%. Oral treatment successes decreased with increasing degree of dehydration and, as expected, were

Table 1 Clinical characteristics of 216 patients with rotavirus

Symptoms and signs	No.	Frequency (%)
Diarrhoea	214	99
Watery	202	94
Mucous	52	24
Bloody	1	<1
Vomiting	207	96
Fever (reported)	62	29
Dehydration		
None	121	56
Slight	76	35
Moderate	17	8
Severe	2	1
Fever (>37.8°C rectal)	45	22

Mean duration diarrhoea before visit, 37 ± 2.1 hours.*

Mean duration of treatment, 16 ± 1.8 hours.

Mean purging rate, 131 ± 21 ml/kg discharge weight.

Mean total fluid intake, 130 ± 17 ml/kg discharge weight.

Mean weight gain after rehydration, 100 ± 21 g (1.4 ± 0.4% body weight).

*All mean values recorded with ± 1 SEM.

Table 2 Outcome of oral treatment of 216 patients with rotavirus

Initial treatment	Oral treatment	
	Success	Failure*
Oral (n = 197)	188 (95)	9 (5)
Intravenous (n = 19)	17 (89)	2 (11)
Total (n = 206)	205 (95)	11 (5)

*Requiring unscheduled treatment intravenously. Percentages are given in parentheses.

Table 3 Frequency of oral rehydration successes by dehydration status in rotavirus cases

Dehydration	No. cases	Successes with oral treatment	
		No.	%
None	121	119	98
Slight	76	69	90
Moderate/severe	19	17	90

Success rate higher in group with no dehydration than in those with slight, moderate, and severe dehydration ($\chi^2 = 6.73$, $P < 0.01$).

significantly more common in the group with no dehydration at the time of hospital visit (Table 3). Vomiting occurred during the course of oral treatment in 9 (82%) failures and 65 (32%) oral treatment successes ($P < 0.001$). There were no deaths and no serious side effects associated with the rehydration.

We found that the ELISA was easy to use and could be read with the naked eye. Almost all reactions could be read as clearly positive or negative within 10–15 minutes after adding the substrate to the plate. The average room temperature in our field laboratory was 35°C.

Discussion

The use of the ELISA in our field laboratory has shown us the great importance of rotavirus as an aetiological agent in infants and young children in our population and has helped to evaluate the effectiveness of oral rehydration in the treatment of rotavirus diarrhoea. Our finding that during this 40-day period 48% of cases in children below age 5, most of whom were 6–24 months, were associated with this pathogen is similar to results reported from other developing³ and developed countries.^{12–13} We are currently studying the seasonal pattern of the disease to see what proportion of persons with rotavirus infection in our field area visit our centre for treatment. The almost universal symptoms were diarrhoea with vomiting, sometimes with fever, as has been described by others.^{2,14–16} However, unlike the impression given in other studies, we found that the disease has a broad clinical spectrum; 56% of our patients had no evidence of dehydration on presentation and 17% did not purge while under treatment.

Oral rehydration treatment was successful for treating rotavirus diarrhoea in 95% of children. Intravenous rehydration was required initially in only 9% of cases and eventually in only 13%. These numbers are a little higher than those reported previously in other carefully controlled studies of rotavirus diarrhoea in our urban hospital¹⁴ and at another hospital¹⁷ but this can be attributed to the more difficult circumstances in our rural centre

where our paramedical staff are faced with treating a much greater number of patients under less closely supervised conditions. Those who failed on oral treatment in our centre generally had some dehydration on initial presentation or had repeated attacks of vomiting. Vomiting however was not a major problem; 88% of children who vomited in the hospital were successfully treated orally.

We found that in our treatment centre, where infants and young children are generally breast fed, the oral rehydration fluid, which has the electrolyte composition currently recommended by WHO and contains 90 mmol/l sodium and 111 mmol/l glucose, can be used without serious side effects for treatment of rotavirus diarrhoea. Since this formulation has now been demonstrated to be safe and efficacious in adults and in infants and young children with enterotoxin-mediated diarrhoea^{17–18} (enterotoxigenic *E. coli* diarrhoea, and cholera), which together with rotavirus are responsible for about 75–80% cases of diarrhoea seen at our treatment centre,¹⁹ we feel that its use can be justified for treatment of all our cases of acute diarrhoea.

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