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Clinical comparison between glucose and sucrose additions to a basic electrolyte mixture in the outpatient management of acute gastroenteritis in children

Outpatient treatment of infantile gastroenteritis with an oral glucose electrolyte mixture has long been accepted (Darrow *et al.*, 1949), although Ironside (1973) drew attention to the risk of osmotic diarrhoea with unrestricted use of glucose. Oral glucose reverses the hypersecretory state in cholera (Hirschhorn *et al.*, 1968), in which oral sucrose is less effective (Nalin, 1975). Hirschhorn *et al.* (1973) recommended an oral glucose electrolyte solution for all children with acute gastroenteritis. Barnes and Townley (1973) showed that not only lactase but also, to a lesser extent, sucrase activity is depressed in the small intestinal mucosa of children with acute gastroenteritis. Clinical sucrose and lactose intolerance may result (Clayton, Arthur, and Francis, 1966).

Since 1953 a glucose electrolyte mixture (GEM) has been used effectively in the inpatient management of children with acute gastroenteritis in the Queen Elizabeth Hospital for Children. GEM however, once opened, has a short 'shelf life' because of the risk of bacterial contamination, so for outpatient management a basic electrolyte mixture to which sucrose is added for each feed has been used. In view of the reported benefits of oral glucose and the possible disadvantages of oral sucrose, we carried out a clinical trial of the relative merits of glucose or sucrose additions to a basic electrolyte mixture for treating children with acute gastroenteritis as outpatients.

Methods

From 2 January to 21 February 1975 all children attending the casualty department with acute gastroenteritis who did not require immediate admission were included in the trial. A total of 120 children were studied. Rectal swabs were taken in all cases. Treatment was by a standard regimen with initially a carbohydrate electrolyte solution, 150–170 ml/kg per 24 hours, followed by regrading by increments of one-fifth strength to the patients' normal milks. Toddlers were given a modified regimen with gradual reintroduction of a toddler diet.

In a randomized, double-blind fashion one half of the mothers were given sucrose and the other half glucose to add to the basic electrolyte solution. Feeds made up to 120 ml had one flat 5 ml-measure of carbohydrate added, giving solutions of about 5% sucrose or glucose (see Table I). All the children were seen daily by one of us until they had clinically recovered. Recovery was assessed on the following criteria: no vomiting, no dehydration, clinically well, weight gain from onset, and stools returned to normal or to two to three soft stools a day—the pattern often seen for a time after acute gastroenteritis. The time taken to recover was noted in every child. Those who failed to recover were admitted to hospital (clinical failures.)

TABLE I

Composition of electrolyte mixture with either glucose 5% or sucrose 5% added

Electrolytes (mEq/l)	
Potassium	28
Sodium	26
Hydrogen	4
Chloride	24
Phosphate	9
Citrate	3
Osmolality (mOsm/l)	
with sucrose 5%	216
with glucose 5%	351

Note: The electrolyte solution was supplied in concentrated form containing potassium chloride 310 mg, potassium citrate 1·35 g, sodium chloride 610 mg, and sodium dihydrogen phosphate 470 mg in 100 ml distilled water. Before use it was diluted five times with water, and sugar added as directed.

Results

Out of the 120 children 26 were excluded for various reasons (Table II). The ages of the remaining 94 children are listed in Table III. The outcome and the number of days taken to recover are shown in Table IV. Five (10%) of the

TABLE II

Reasons for excluding 26 patients from trial

	Sucrose group	Glucose group
Failure to attend	8	8
Nonco-operation	3	4
Misdiagnosis (spurious diarrhoea)	1	2
Total	12	14

TABLE III

Ages of patients studied

Age (m)	No.
<6	28
6–11	21
12–23	25
24–	20
All ages	94

TABLE IV

Outcome of illness and time to recovery in 94 cases of gastroenteritis

	Group		Total
	Sucrose (n=50)	Glucose (n=44)	
Recovery	45	32	77
Clinical failures	5	12	17
Time (mean) to recovery (d)	3·44	3·78	

50 children in the sucrose-treated group and 12 (27%) of the 44 children in the glucose-treated group were clinical failures. The number of failures in the glucose-treated group was significantly greater than in the sucrose-treated group ($P=0·05$). The difference between the two groups in relation to time to recovery was not significant.

The failures were chiefly in the younger age group, in whom dehydration is more important, but none required intravenous fluids and none had disaccharide intolerance. Bacterial pathogens were isolated from only two children, (one salmonella and one shigella) who were managed as outpatients.

Discussion

These results show that despite the theoretical advantages there was no practical advantage in using glucose rather than sucrose as the carbohydrate additive to the oral electrolyte mixture in these cases. Hirschhorn and his colleagues' recommendation of an oral glucose electrolyte mixture for such children (Hirschhorn *et al.*, 1973) was based on their experience of treating more severe gastroenteritis in children in undeveloped communities. In our study of children with milder disease there were significantly more clinical failures in the glucose-treated group. The higher osmolality of the glucose mixture may have accounted for this. Nevertheless, all 'failures' subsequently recovered in hospital on an oral glucose and electroluyte mixture. The complete absence of disaccharide intolerance in this group of children was surprising and no doubt contributed to the success of oral sucrose.

It is often difficult in general practice to decide on the most appropriate oral fluids for infants and children with acute gastroenteritis. The need for an oral electrolyte mixture is well recognized, but the risks of unsupervised salt addition to the feeds are great (Whitelaw, Dillon, and Tripp, 1975.). The simple solution used in this trial can be made on prescription by any pharmacist and carbohydrate may be added by the mother. A 5% sucrose electrolyte solution with its low osmolality, ready availability of sucrose, and ease of preparation is therefore recommended for the oral fluid management of infants with acute gastroenteritis not requiring hospital admission.

Summary

In a double-blind trial in 94 children attending outpatients the value of glucose or a sucrose addition to a basic electrolyte mixture for the management of acute gastroenteritis was compared. Of the children treated with added sucrose 10% failed to respond compared with 27% of those treated with added glucose. This difference was significant ($P=0·05$), but the time to recovery in those in the two groups who responded to treatment was not significantly different. Thus, despite theoretical advantages, there was no practical advantage in using glucose rather than sucrose. A 5% sucrose electrolyte solution with its relatively low osmolality, ready availability, and ease of preparation is recommended as the treatment of choice in the outpatient management of acute gastroenteritis in infancy.

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Recurrent thrombocytopenic purpura associated with accessory spleen

The course of most cases of childhood idiopathic thrombocytopenic purpura (ITP) is acute and self-limiting but a few patients, mostly older children, have a chronic form requiring splenectomy, as in adults. Macpherson and Richmond (1975) differentiated the chronic form, with its long history of episodic purpura, from the acute form, which is more common in children and has a history from onset of symptoms to diagnosis of less than 100 days. The acute form has a strong tendency to spontaneous and permanent remission. Finkelstein (1921) suggested that accessory spleens might be a cause of recurrence of ITP after splenectomy. Since then many others have commented on this association. We report a case of ITP which recurred after splenectomy. The removal of an accessory spleen produced a partial remission.

Case report

A 12-year-old boy presented in 1967 with epistaxis and conjunctival haemorrhages. He had bruised easily for 6 months before admission. He had had no significant illnesses and no family history of any bleeding disorder. A blood count showed Hb 8·6 g/dl, platelets $<10\,000/mm^3$, WBC $5000/mm^3$, with a normal differential. The bone marrow showed moderate cellularity with increase in megakaryocytes but was otherwise normal. Treatment with dexamethasone 2 mg three times a day produced no response after 3 months, and splenectomy was performed in January 1968. Splenic histology was normal. The platelet count rose to 1 million/mm^3 by the second postoperative week (Fig. 1). After a further 6 weeks he was asymptomatic and the platelet count was $400\,000/mm^3$. He was not seen again for a year, when he presented with a history of bruising and epistaxis for 3 weeks. His platelet count was $10\,000/mm^3$. Within 2 weeks of starting a 4-month

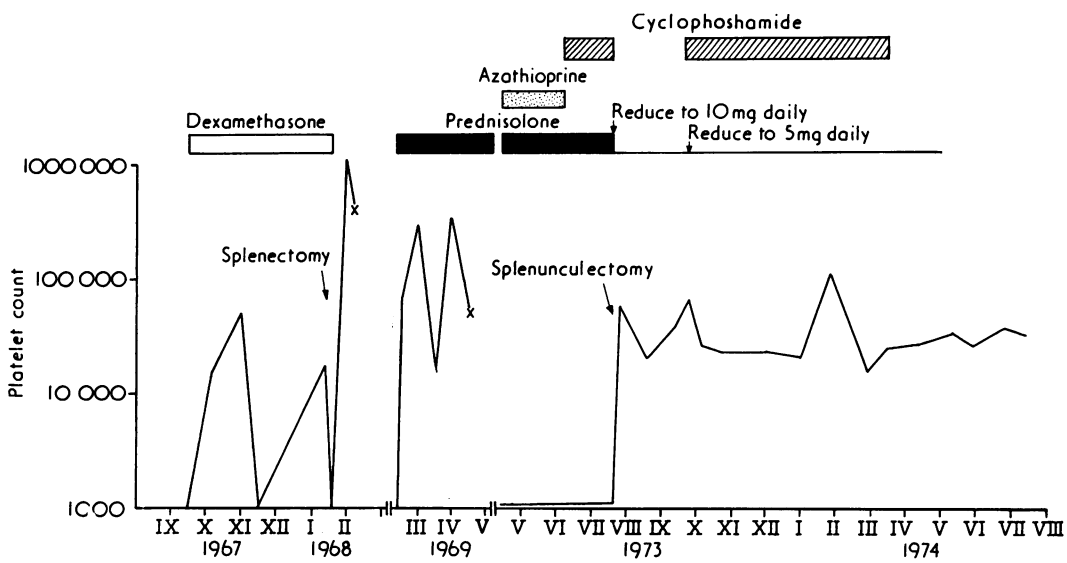

FIG. 1.—*Graph of platelet counts throughout course of illness.*