

ORAL REHYDRATION THERAPY

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Thank you for making possible my first trip to your beautiful country and for the opportunity to participate in the thrilling endeavor to help save the lives of infants who continue to die from preventable and treatable conditions. First, let me congratulate you on the enormous success of your immunization program. It will stand as a model for all countries who face the problem of reaching populations dispersed in relatively isolated areas as well as those in overcrowded and underserved cities. I salute the leaders of your country who had the vision to endorse the undertaking and the thousands of health care workers who implemented the goal. I hope the infrastructure is in place to continue universal immunization for every infant born this year and in the years to come.

My purpose in being with you on this occasion is to endorse another initiative, oral rehydration and maintenance fluid therapy for the multitude of infants whose lives are being lost through lack of adequate, appropriately balanced fluids to restore and maintain body fluids lost through infectious diarrhea.

We must admit to the unfortunate situation that clean water, and clean hands to prepare foods, are not always present to prevent infectious diarrhea. Continued efforts at improved sanitation deserve a high priority in every society. But given the inability to achieve prevention in all instances, including in the United States, we as physicians need to understand how to treat the dehydration that is inevitable with any sort of diarrhea.

Historically, I am sure you know, one of the great advances in pediatrics was understanding the chemical nature of extracellular fluid and the ability to restore losses safely and effectively with intravenous replacement. In our pride in that accomplishment, we neglected to consider alternate and even safer and less expensive ways to achieve the same end.

We were greatly encouraged by a refreshing new point of view when the studies of Hirschhorn and others, reported in 1968, showed that even cholera, where intestinal water losses are enormous, can be treated with oral solutions that have a concentration of sodium and glucose that permits their co-transport across the intestinal mucosa¹.

The observations are straightforward. Oral solutions of clear liquids, long advocated for mild diarrhea, can vary greatly in carbohydrate and electrolyte concentration. Tea, for example, differs little from plain water except that it has been boiled, which is its only benefit. Soft drinks such as Coca Cola® and ginger

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ale contain very few electrolytes and much sugar, which increases their osmolarity and may even aggravate gastrointestinal fluid losses. Fruit juices have the same problem (Table I). Watermelons contain some potassium, but so little sodium that electrolyte losses are not replaced. Thus the traditional treatment of clear liquids by mouth is an imprecise and inappropriate approach to rehydration.

TABLE I

	Sugar	Na ⁺ (mEq/L)	K ⁺ (mEq/L)	HCO ₃ ⁻ (mEq/L)	Osmolarity (mOsm/kg)
WHO solution (ORS)	20 g/L glucose	90	20	30	330
<i>Clear liquids</i>					
Cola Cola ^a	50 to 100 g/L glucose + fructose	4	0.1	13	660
Ginger ale	"	3.5	0.1	3.6	560
Apple juice	100 to 150 g/L glucose + fructose	0.4	26	0	700
Chicken broth	0	250	8	0	450
Tea	0	0	0	0	5

It is to the great credit of UNICEF, that they recognized the importance of oral rehydration with such appropriate solutions as had proved so successful in the 1970's, and in their 1982 - 1983 report endorsed its wide implementation as one of their strategies to save the lives of as many as an estimated 20,000 children each day throughout the world². These figures are staggering. Think how we would feel if a single disaster wiped out so many children, and how unbelieving or uncaring we have been not to mobilize all societies to learn about oral rehydration and implement it in their own countries. The published literature concerning the beneficial results is very large, and now no one questions the efficacy of this approach.

Some of you may ask whether we in the United States practice what we preach. How do we treat an infant with dehydration? Do we use the WHO packets of sodium and potassium chloride, bicarbonate and glucose?

The answer is that we are being increasingly converted to oral rehydration and maintenance therapy. The Committee on Nutrition of the American Academy of Pediatrics published a report in the February 1985 issue of its journal, *Pediatrics*, on the implementation of oral rehydration in a "developed" country, where we do not usually face the problem of contaminated water or severe malnutrition, but we do face the cost of hospitalization for intravenous therapy³. The committee report acknowledged the exceeding usefulness of the WHO oral rehydration solution for restoration of deficits of fluids. They advocated a modified oral solution for maintenance in the face of ongoing losses with a sodium

concentration of 40-60 mEq/L instead of the 90 mEq/L in the WHO solution. However, extensive experience around the world (including in the USA), has shown the safety and efficacy of the WHO solution. In other words, the WHO solution is most appropriate during the first 8-24 hours of meeting deficits and ongoing stool losses; other sources of liquid such as breast milk or rice water should be offered to satisfy thirst thereafter, whenever rehydration is accomplished.

The American pediatric journals have published reports of a number of experiences with oral rehydration, one of the most recent of which came from the Children's Memorial Hospital in Chicago and appeared in March 1986, in the *American Journal of Diseases in Children*⁴. The investigators undertook a randomized study that compared safety, efficacy and costs of oral rehydration with a solution of 60 mEq/L sodium, which is commercially available as a liquid preparation in stores in the States. The reason for the lower sodium concentration was that with most of the diarrheas encountered in the United States less severe dehydration and sodium losses are involved than is the case where cholera is prevalent. The Chicago investigators kept the mothers and infants in the outpatient department for 8-12 hours and gave 20 ml/kg of the solution in the first hour, and amounts dictated by thirst in the subsequent hours. Their results showed that a few infants in shock required intravenous therapy, as did 2 of 15 infants who had persistent vomiting in association with urinary tract infections. The study showed a highly significant benefit and cost-effectiveness of oral rehydration. Their conclusion was that "the widespread use of oral rehydration solutions promises to eliminate most hospitalizations of dehydrated children". A report from Johns Hopkins showed that 98 percent of children could be treated successfully with the WHO oral solution, as well as solutions with a lower sodium content. They confirmed that vomiting was not a contraindication as long as the solution was offered frequently in small volumes⁵.

At the Children's Hospital, Boston, we too are using oral rehydration therapy in our outpatient department with results similar to those reported from Chicago. Perhaps of significance is the use of oral electrolyte solutions at the onset of diarrhea before dehydration becomes a problem. Our practicing pediatricians and those in health centers have educated many of their patients to substitute oral electrolyte solutions for milk or other fluids and solids at home. The cautious reintroduction of milk is undertaken when the diarrhea abates, which is usually within 12 to 24 hours. For older infants and children, dilute milk, bananas, potatoes or other non-lactose, carbohydrate-rich foods are offered by 24 hours after starting oral electrolyte solutions. Because of the wide practice of oral rehydration, admission to our hospital for intravenous therapy for dehydration from diarrhea is an increasingly unusual event.

Thus the so-called "developed" world owes a debt of gratitude to those who conducted careful studies in the "underdeveloped" world that showed that

adherence to some very basic principles could provide benefit to all children. What are these principles? Once again they are that an appropriate sodium and potassium concentration, with 2 percent glucose, facilitates absorption across the intestinal mucosa without an increase in the intraluminal osmotic load that could do the opposite, that is potentiate diarrhea. Calories need to be provided within 24 hours of the initiation of oral rehydration, especially in malnourished infants. Clean water, or at least whatever is considered drinking water, is essential if infection is to be overcome. Medications to slow intestinal motility are not indicated in infants and children, since diarrhea helps to eliminate offending organisms and their toxins. Antibiotics are rarely indicated since most diarrheas are caused by viruses, or are self-limited if systemic hydration is maintained. The course of most bacterial diarrheas is not altered by antibiotics.

Surely one of the reasons for the relatively slow acceptance of oral rehydration has been past success with intravenous hydration and our teaching of methods of appropriate intravenous therapy based on calculations of deficits and maintenance requirements. At this stage in our experience and knowledge the time has come to relegate to history professional pride in past accomplishments and to acknowledge that the simple measures advocated by WHO-UNICEF are based on sound physiological studies and wide experience throughout the world.

I wish Turkey well as this country undertakes to build on the momentum established by the national immunization campaign, to add another great achievement with oral rehydration, and to show the world that Turkey can be a leader in the worldwide program to promote child survival.

Summary

In a lecture presented at the XXXth Congress of the Turkish National Pediatric Society in March 1986 in Ankara, the author describes how oral rehydration therapy, a practice which was first used by health workers in the lesser developed areas of the world, has proved itself and been adopted by physicians even in highly sophisticated hospitals of the "developed" world.

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