CASE REPORT

Oral Rehydration Therapy as an Alternative to Intravenous Therapy in Dehydrated Older People

Fatima Sheikh, MD • Jessica Colburn, MD • Adrienne E. Shapiro, MD, PhD • William B. Greenough III, MD

Affiliation:
Johns Hopkins University, Baltimore, MD

Disclosures:
The authors report no relevant financial relationships.

Acknowledgements:
We thank Mrs. Shannon Meise for assisting in preparation of the manuscript and the staff of the Harrison Library at Johns Hopkins Bayview Medical Center for assistance with the literature search.

Address correspondence to:
William B. Greenough, MD
Professor of Medicine, Johns Hopkins University School of Medicine
Johns Hopkins Burton Pavilion
5505 Hopkins Bayview Circle
Baltimore, MD 21224
Phone: 410-550-0782
Fax: 410-550-2513
Email: Wgreeno2@jhmi.edu

Abstract: Oral rehydration therapy (ORT) using recommended oral rehydration solutions has become the standard treatment for all forms of diarrheas in children since the 1970s. However, little research has been done to evaluate the efficacy of ORT for treating dehydration in older populations. The authors describe a case of a 68-year-old man with dehydration and a high risk of intravenous fluid overload who was successfully treated with ORT. The existing literature of the application of ORT in the elderly is reviewed, and considerations for translating this simple solution for dehydration from pediatrics into geriatric practice are discussed. Our experience suggests that ORT may be a safer and less costly way to replace volume losses in older individuals, as it has proven to be in children.

Key words: dehydration, diarrhea, oral rehydration therapy, older adults

Citation: *Annals of Long-Term Care: Clinical Care and Aging*. 2016;24(2):xx-xx.
Received March 26, 2015; accepted September 14, 2015.

Outbreaks of diarrhea are common in long-term care settings.[1] An example of such an outbreak was the Gould nursing home diarrhea outbreak that occurred in Baltimore from July 26 to August 3, 1970. It resulted in a 72% attack rate among patients, 29% among staff, and was noted to be due to salmonella food poisoning. The mortality among patients was 23%, with no deaths in younger healthy staff.[2] Diarrhea can be very severe and life threatening without prompt hydration. National data in the United States demonstrate that the risk of a fatal outcome due to diarrhea increases with age, with the majority of deaths occurring over the age of 55 years.[3] Furthermore, fluid loss for prolonged periods from ileostomies or colostomies are common and require recurring visits to emergency rooms and hospitalizations.[4]

Water and electrolyte losses from the gastrointestinal tract due to diarrhea or high output ileostomies and/or colostomies in older people commonly cause loss of circulating blood volume. The resulting circulatory collapse can have severe consequences, including damage to vital organs, causing hospitalization and death.[4] Rehydration in diarrheal illness can be achieved by intravenous (IV) therapy or with oral hydration. However, IV hydration therapy is costly and can potentially have serious complications.[5] IV hydration therapy has the risks of serious infection, hemorrhage, pneumothorax or hemothorax, and pain.[5]

Oral rehydration therapy (ORT), is recommended by the World Health Organization (WHO) for dehydration associated with diarrheal illness and involves the use of oral rehydration solutions (ORS), including the recommended WHO formulation consisting of the oral rehydration glucose-salt formula.[6] ORT can reduce the need for IV hydration therapy, preventing such serious complications from occurring. Since its discovery in the 1960s, ORT contin-

ues to save the lives of children with all forms of diarrheas in Bangladesh (then, East Pakistan) and India, and deaths due to diarrhea in children in resource-poor countries have steadily declined since the ORT began to be widely used in the 1970s.[7-10] However, this simple, noninvasive way to replace fluid losses has not been studied or advocated for in older people, although anecdotal data suggests that what works in children could also be effective in older people.[11]

We describe a case report to illustrate our own experience with using ORT to treat dehydration in a geriatric patient. We suggest that ORT, in many circumstances, can be a safer, less costly way to replace volume losses in older individuals.

Case Report

A 68-year-old man was admitted to our acute rehabilitation service for wound care, debility, and continuation of total parenteral nutrition (TPN). He had undergone a cholecystectomy and subsequent endoscopic retrograde cholangiopancreatography (ERCP), resulting in duodenal perforation and several months of recurrent abdominal abscesses, ultimately necessitating a diverting ileostomy with continuing severe fluid losses. Prior to his admission to long-term care at John Hopkins Bayview Specialty Hospital, he had several hospitalizations for additional abdominal procedures and for periodic administration of TPN in addition to IV hydration. Given his non-ischemic cardiomyopathy, with an ejection fraction of 35%, the risk of IV fluid overload was substantial. He was admitted to acute inpatient care with volume depletion and a creatinine level of 1.5 mg/dL. His creatinine normalized with IV hydration. Because of ongoing poor oral intake, TPN that included sufficient volume to replace gut fluid losses was started. After 8 days in the acute hospital, he was transferred to the Johns Hopkins Bayview Specialty Hospital for rehabilitation.

On the rehabilitation service, he was continued on cycled TPN (1620 kcals) and encouraged to resume oral intake with a regular diet and supplemental nutrition. His oral intake continued to be poor, and he developed a progressive mild azotemia without an elevation in creatinine. After 10 days, in order to reduce the need for TPN and IV replacement of electrolytes and water, we initiated ORT sufficient to compensate for his ileostomy fluid losses of 1–2 L per day. We used a rice digest–based ORS consisting of Ceralyte 70 (70 mEq/L sodium, 20 mEq/L potassium, 60 mEq/L chloride, and 30 mEq/L citrate) and 40 g rice digest. This was titrated daily to match the patient's ileostomy output volume and ensure adequate urine output.

Two weeks after admission, he was able to tolerate ORT and food and was receiving TPN only at night. Soon he was transitioned to a full oral diet (including protein supplements) and continued on ORT (with Ceralyte 70) to replace ileostomy losses, which subsequently decreased to between 800 ml and 1 L per day. Azotemia resolved. Electrolytes were stable while using ORT, although there was a decrease in magnesium to 1.4 mEq/L, which was restored to normal levels through supplementation. This likely reflected the lack of this element in current ORT formulae. The patient progressed well with physical therapy and rehabilitation and was discharged home. At discharge, he was able to take his medications and nutrition by mouth. He was fully sustained on ORT as he began to eat and came off his TPN and supplementary IV fluids over a period of 35 days.

Discussion

Our team has been using ORT in the form of a rice-based preparation to replace intestinal fluid losses from diarrhea or short bowel syndromes since the 1990s in our geriatric medicine services to treat intestinal fluid losses in an older population in a long-term care setting.[12,13] Our use rate over a period of 1.5 years has averaged 108 L per month or 3.6 L per day for an average census of 36 patients in the long-term care setting.

The physiologic basis for ORS is carrier mediated transport, by which sodium is coupled to the absorption of glucose.[14] In diarrheal diseases due to enterotoxins or inflammation, adenylate cyclase is stimulated and increases intercellular cyclic adenosine monophosphate (AMP) and cyclic guanosine monophosphate (GMP), blocking the absorption of sodium at the brush border. However, the cotransport of sodium with organic solutes such as glucose and amino acids is preserved.[15] The efficacy of ORS depends not only on the sodium-glucose linked transport but also on solutions having low osmolarity, because the small intestine is highly permeable and rapidly adjusts to osmotic and electrochemical gradients between the portal bloodstream and gut lumen. Solutions with osmolarity greater than that of circulating blood result in water and solutes rapidly moving from the blood into the intestinal lumen, reducing circulating volume and increasing diarrhea. This was demonstrated in early trials with ORS of higher osmolarity, in which the volume of stools and duration of diarrhea and episodes of vomiting were not reduced.[16]

WHO introduced ORS globally in 1975 with the Control Program for Diarrheal Disease (CDD) as the standard treatment for children with cholera and other diarrheas.[6] Originally, WHO ORS had an osmolarity of 311 mOsm/L with high concentration of sodium (90 mEq/L). Although this formulation was effective and lifesaving in cholera, its higher osmolarity often increased the stool volume, requiring more ORS to be taken, and did not shorten the duration of the diarrheal illness. As a result, caregivers and patients, many of whom expected the treatment would reduce both the severity and duration of illness, were discouraged. The failure of the higher osmolar ORS to accomplish this was a psychological barrier to its use. Furthermore, the most

common diarrheas have lower sodium losses.[17]

In 2002, WHO reduced the concentration of salt and glucose in ORS, bringing it to an osmolarity of less than 250 mOsm/L. Reduced-osmolarity ORS was more effective in reducing stool output and duration of diarrhea.[16] It also decreased vomiting and increased water absorption compared to the original WHO ORS, reducing the need for IV hydration. At present, WHO recommends reduced osmolarity ORS for treatment of dehydration of children suffering from all diarrheas. Low-osmolarity ORS are available, either with reduced glucose and salt content (WHO) or by using digestible food polymers (starches and proteins) in place of glucose as a source for the carrier molecules (glucose and amino acids).[18] The John Hopkins Bayview Medical Center Specialty Hospital has been using a rice-based ORS with osmolarity less than 220 mOsm/L.

Effective use of ORT requires a caregiver with the time to encourage and help patients drink. However, in hospital settings, which may exclude family from administering fluids, a substantial barrier exists. In high-technology medical centers, non-medically trained people or family members may not be permitted to administer ORS to the patient, but this barrier is artificial. If a gastrostomy tube is present, ORS can be given conveniently as required. If given by a gastrostomy or nasogastric tube, intake must match continuing losses.

There is a higher risk of renal failure in older, chronically ill patients with volume losses with the attendant risk of hyperkalemia with ORT. ORS products contain 20 mEq/L of potassium, so use in patients with hyperkalemia may have some risks. ORS without potassium can be made by mixing 1 L saline + 5% dextrose with 1 L tap water. A formulation of a potassium-free ORS is available and could be considered for use in patients with hyperkalemia (personal communication; Cera Products, Inc).

A further common issue in older patients is the risk of congestive heart failure. Overenthusiastic replacement of any salt-containing solution may increase congestive heart failure. However, the risk of sudden fluid overload is far greater with IV therapy because even flavored ORS are not so palatable as to encourage excessive intake. **Table 1** lists the composition of some ORS available in the United States. Of note, sports drinks should not be used for ORT as they have higher sugar content and osmolarity and lower electrolyte content than recommended for rehydration in volume loss from diarrheal illness and high output ilostomies/colostomies.

The risks of vomiting and aspiration could be increased by ORS administration and increase risk aspiration in older patients. However, the risks of central line insertions and line infections are likely to be more severe. Studies to evaluate the relative risks and benefits of oral versus IV treatment of volume depletion are needed.

Optimal use of ORT in patients with mild to moderate GI fluid losses is to administer a sufficient amount of ORS to replace the estimated GI fluid losses before serious depletion occurs. For severe volume depletion, initial IV hydration is necessary. The concept of "dose" should not be used in ORT since replacement of volume losses varies from patient to patient and day to day. ORT should

Table 1. Comparison of ORS Product Composition[20]

Available ORS Products	Forms of sugar	Carbohydrate, g	Sodium, mEq/L	Chloride, mEq/L	Potassium, mEq/L	Base, mEq/L	Osmolarity, mOsm/L
Ceralyte70	Rice starch	40	70	60	20	30	<220
WHO/UNICEF ORS "Reduced-Osmolarity Formula"	Glucose	25	45	35	20	30	250
Rehydralyte	Glucose	25	75	65	20	30	310
Enfalyte	Rice starch	30	50	40	25	30	200
PediaLyte®	Glucose	25	45	35	20	30	250

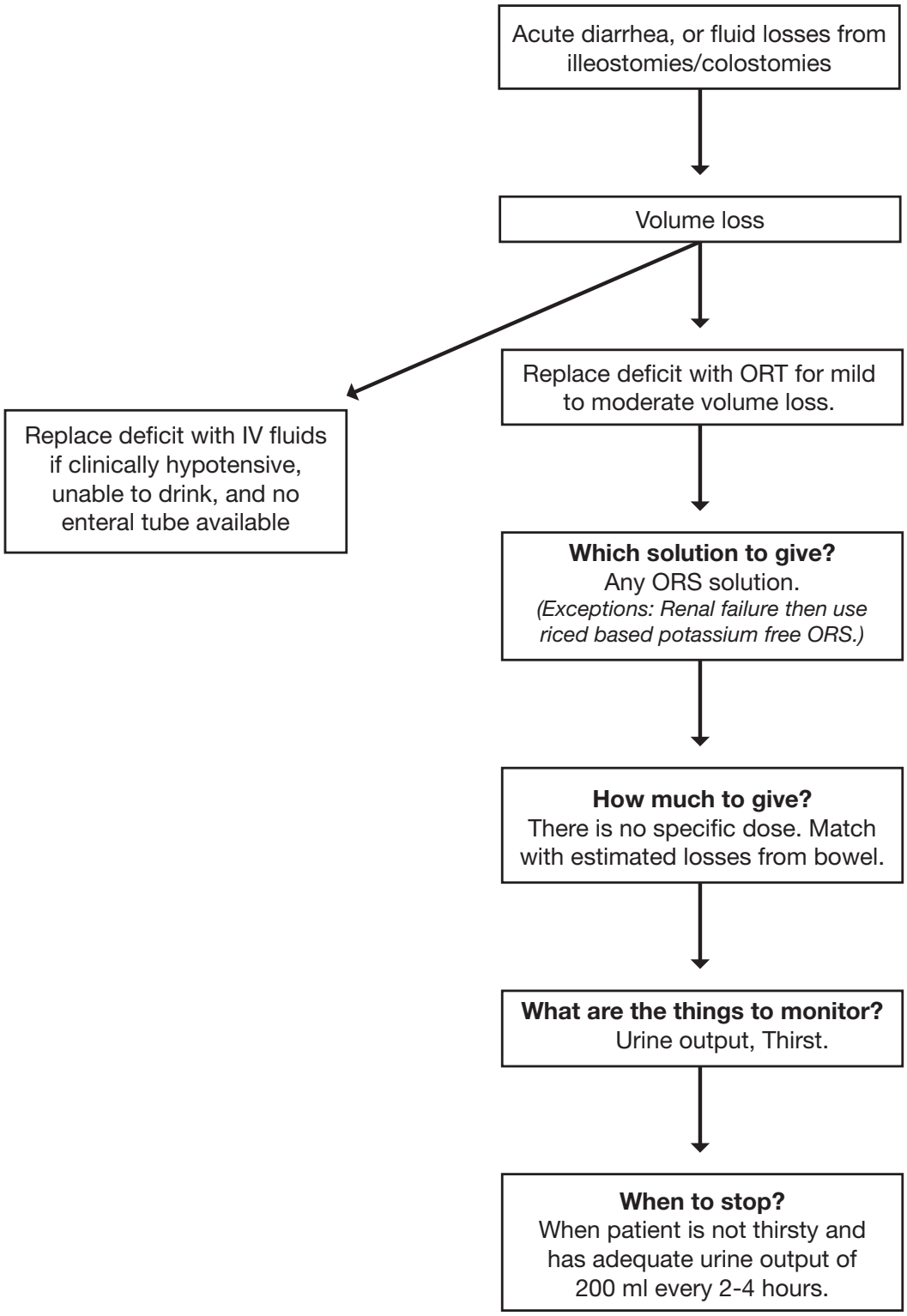

Figure 1. Decision Tree for Treatment of Acute Diarrhea in Older Individuals

be started promptly with the first watery stool and should be taken in small amounts (at least 2-4 oz of ORT every 2-4 minutes) to minimize vomiting. In children, thirst is sufficient to judge how much is needed.[19] In older adults, thirst drive may be diminished, and, in patients with cognitive impairment, this may be an even greater problem; thus, monitoring a urine volume of approximately 200 ml of urine every 2–4 hours may be used as a guide. We suggest using a simple decision tree for the treatment of intestinal fluid loss in older individuals (**Figure 1**).

Conclusion

The risks and costs of IV therapy would seem to argue for alternative approaches. Since the 1970s, studies on cholera, the most extreme of diarrheal disease, have shown ORT to be highly effective and lifesaving in adults as well as children. We suggest that the use of ORT in older individuals could reduce the need for IV therapy and total parenteral nutrition and the complications associated with them. The clinical case presented suggests that ORT is a practical and safe alternative to IV therapy.

Because diarrhea is common in the elderly and the risk of death is greater, the lack of attention to such a well-established and simple therapy as ORT seems puzzling. The physiology of fluid losses and their replacement have been well documented in children. Because the underlying physiology is well understood, the challenge of achieving use of ORT in older individuals rests as much on education as research. An educational effort will entail persuading physicians and health workers that ORT is indeed highly effective, especially when used early, and may substitute for the more costly use of IV therapy with its attendant risks and costs. Education of health professionals should target physicians, nurse practitioners, surgeons, nurses, dieticians, and physician assistants, but, in the end, it will be family members and other caregivers that will be the front line of ORT use. The structure of educational approaches must include awareness of risks specific to older individuals compared to children. Pilot studies to assess efficacy of different educational strategies and approaches are necessary.

At the same time, well-controlled studies to show that ORT can effectively treat intestinal volume losses from diarrhea, short bowel syndromes, and inflammatory bowel disease in older patients are both lacking and are needed. However, in our view, such studies need not precede the application of this approach. Translation of ORT from pediatric into geriatric practice may be an inexpensive and highly effective means to avert volume depletion with the associated hazards of hospitalization. The scientific and educational challenge is to test in a reasonable and effective manner whether implementing widespread use of ORT in older populations can improve outcomes and reduce morbidity and mortality. ◆

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