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ORS: The Solutions to Optimize Hydration in Short Bowel Syndrome



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Short bowel syndrome is a rare disorder characterized by malabsorption and dehydration. The degree of fluid and electrolyte losses will depend on the condition, length, and sites of remaining intestine. Recognition of the need for hydration in this population is imperative to prevent long term consequences of kidney injury. Home IV hydration therapy is possible, though expensive and laborious, and can result in undue burden to patients. Oral rehydration therapy is a non-invasive and relatively inexpensive alternative to maintain hydration in some patients. The question remains, who will benefit from oral rehydration (ORS)? This article will focus on assessment of hydration status in patients with short bowel syndrome, identification of patients who may benefit from ORS, and it will provide guidelines for the use of ORS.

INTRODUCTION

Short bowel syndrome (SBS) is a rare disorder characterized by malabsorption and dehydration after extensive surgical resection of the small bowel (SB); the resection may also include part or all of the colon.¹ The degree of malabsorption and fluid loss will depend on length, location, and condition of the remaining SB, and the presence or absence of not only the ileocecal valve, but more importantly, the colon as well. Small bowel length < 200 cm and/or ostomy effluent > 1.5L/d will result in malabsorption of nutrients, fluid, and electrolytes, and therefore defines SBS (2-4), although Medicare defines SBS as < 150 cm.⁵

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Under normal conditions the intestinal tract secretes 6-7 L of fluid daily, reabsorbing virtually all, in addition to the 1-2 L of ingested fluid.⁶ After SB resection, patients have net losses of fluid and electrolytes; those without a colon will have an even greater net loss. Negative fluid balance can develop soon after surgery and progress rapidly to dehydration and acute kidney injury necessitating medical attention and fluid resuscitation.⁷ Some patients will “survive” in a state of chronic dehydration, without overt signs of kidney injury, but over time negative fluid balance can lead to nephrolithiasis and chronic kidney injury.^{8,9} Long term parenteral support (PS) can replace electrolyte losses and prevent dehydration, but it is associated with serious risks such as infection

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and injury to central blood vessels, not to mention the impact on lifestyle and healthcare expenses.¹⁰ The long term goal for hydration management is to optimize enteral intake and reduce need for PS. Oral rehydration solutions (ORS) can help achieve this goal for many.

Intestinal resections disrupt neuroendocrine hormone signaling to the gastrointestinal tract and related organs.² The dysregulation of post-prandial hormone responses affects motility and absorption. It is not uncommon for SBS patients to have rapid gastric emptying (dumping) of hypo- or hypertonic chyme into the SB. The proximal SB reacts to this by secreting sodium or water to adjust the luminal fluid concentration to isotonicity, thus increasing the total volume of fluid needing to be absorbed.² Water absorption across the SB epithelium is dependent on a sodium-glucose co-transport system; sodium and glucose molecules are transported together across the SB epithelium, dragging along water molecules.^{6,11} The ileum is more efficient than jejunum in reabsorbing water, but many with SBS have little or no ileum. Table 1 lists the expected daily volume of ostomy/stool output.^{3,11}

Oral rehydration solutions were developed to utilize the sodium-glucose co-transport system and are found to be effective in many patients with SBS.¹² The ideal solution contains 20-40 g (5-10

Table 1. Expected Ostomy/Stool Output

Ostomy Type	24 hr Output (mL)
Jejunostomy	1500-6000
Ileostomy	600-1500
Colostomy	200-800
Per rectum (normal)	200

Source: 3,11

teaspoons) of sugar and 90-120 mEq sodium/L (1 teaspoon of salt = 104mEq of Na).¹³ The concentration of sodium makes these solutions unpalatable; therefore commercially available ORS products contain slightly less sodium to improve taste without loss of effectiveness. Pediatric ORS contain lower concentrations of both glucose and sodium. Table 2 lists ORS products commercially available in the United States.^{14,15}

Assessing Hydration Status in SBS

Accurate assessment of hydration status is imperative when considering ORS therapy, however the typical indicators of dehydration may not be accurate in SBS. The kidneys work to preserve blood volume despite total body water depletion from excessive gastrointestinal losses of sodium and water; serum sodium and blood urea nitrogen to creatinine ratio can remain normal until the patient is severely dehydrated.^{12,16} Common signs of dehydration can be factitious in SBS

Table 2. Commercially Available Oral Rehydration Solutions

Solution	Carbohydrate (g/L)	Sodium (mEq/L)	Osmolarity (mOsm/L)	Company
WHO Packet	20	90	330	Jianas Brother's
Reduced Osmolarity ORS	13.5	75	245	Jianas Brother's
Rehydralyte®	25	75	310	Abbott Nutrition
Equalyte®	25	78	305	Abbott Nutrition
Drip Drop®	33	60	235	Drip Drop Hydration, PBC.
CeraLyte 70®	40	70	<260	CeraLyte®
CeraLyte 90®	40	90	<275	CeraLyte®
Pedialyte®	25	45	250	Abbott Nutrition
Parent's Choice Pediatric Electrolyte	20	45	262	Wal-Mart Stores, Inc.

Source:14,15

including: deep yellow urine from multivitamin ingestion, muscle cramps from hypomagnesemia, and dry mouth from narcotic-based anti-motility or other medications.

Physical exam with attention to clinical signs of dehydration (dry mucus membranes, skin tenting, dry or peeling skin) in conjunction with a downward spiral of serial weights, 24 hour volume of urine and ostomy/stool outputs, and spot urine sodium concentration are all helpful to assess true hydration status in this population.¹⁷ Table 3 lists physical signs of dehydration commonly experienced by SBS patients. Adequate hydration is indicated by urine volume > 1200mL/day and spot urine sodium > 20 mEq/L.¹⁷

Patient Selection

Many patients with SB ostomy, or those with only a small portion of colon in continuity, may benefit from ORS therapy; those with most of their colon usually do not need ORS to maintain hydration. Ideal candidates have insatiable thirst and drink large volumes of water (hypotonic fluids) without relief, have low urine volume and escalating ostomy/stool output. Patients who can accurately measure and track their weight, PS/enteral/oral intake, and output (urine and ostomy/stool) to determine efficacy of ORS are more likely to be successful with the therapy. If the patient has an ostomy, measurement of the pouch volume will help ease data collection by simply counting the number of times it is emptied in 24 hours; however

Table 3. Indicators of Dehydration in Patients with Short Bowel Syndrome

- Urine – low output (< 1200 mL/24 hr), dark color; spot Na+ < 20 mEq/L
- Thirst (insatiable, not improved by drinking)
- Dry, pasty mouth
- Rapid weight loss
- Lethargy, debilitating fatigue
- Muscle cramps and weakness
- Orthostatic hypotension
- Dizziness upon standing
- Headache
- Recurrent encounters for IV hydration
- Reduced kidney function

actual measurement of the volume with a canister with ounces or mL marked on the outside is better, at least initially.

Using Oral Rehydration Solutions

In combination with anti-motility medications and strict adherence to recommended meal patterns, ORS can facilitate fluid absorption, but it will not necessarily decrease ostomy/stool output.¹⁷ Patients should start by sipping a low volume of ORS, 500-750mL/d, to gain acceptance to the taste, learn how to sip between meals throughout the

Table 4. Keys to Success with ORS

Who	Why	How
Motivated Patients	Patients with Understanding of	Patient Support Needed
<ul style="list-style-type: none"> • Urine < 1L/24 hr • Stool/ostomy > 1 L/24 hr • Signs of dehydration • Multiple encounters for dehydration • Can follow instructions explicitly • Autonomous to adjust volume based on urine volume 	<ul style="list-style-type: none"> • Hydration importance • Combined therapies – ORS, diet and medications • Monitor, record weight and 24 hr urine and stool/ostomy outputs 	<ul style="list-style-type: none"> • Access to recipes and purchasing information • Tools for mixing ORS • Equipment to monitor hydration • Sip, sip, sip throughout the day, every day

day, all the while ensuring consumption of ORS does not worsen their hydration status (by driving their stool/ostomy volume too high to keep up). If ORS therapy leads to increased urine volume, irrespective of ostomy/stool output, then it can be considered effective. Patients can then gradually increase their consumption to 1-3 L/d while continuing to monitor their hydration. However, if stool/ostomy output increases without an increase in urine output, then ORS therapy is not effective and it should be discontinued, and the patient may require PS to maintain hydration and protect kidney function. Table 4 identifies keys factors for ORS success.

Some patients will try to consume ORS by gulping the daily volume, “just to get it down.” Rapid ingestion of ORS can cause dumping into the SB, exceeding its absorptive capacity, resulting in increased unabsorbed effluent into the ostomy appliance or colon. It is important to train patients to slowly sip ORS throughout the day for maximum absorption. In patients with enteral feeding access, slow infusion of ORS overnight via a pump has proven to be effective in maintaining hydration and weaning from PS.¹⁸

Long term adherence to ORS regimens is often poor due to unpalatable flavors and the expense of commercially prepared products.¹⁹ To overcome these barriers patients can mix their own solutions and reserve use of commercial ORS for times when self-preparation is not feasible (traveling). Recipes for homemade ORS are listed in Table 5.^{14,15} It must be emphasized that these recipes are designed with specific balance between sugars and sodium for optimal absorption. Inaccurate measurement of ingredients or enhancing ORS with additional water, ice, juice or sugar-containing flavorings will alter the sodium to carbohydrate ratio making the beverage less effective. Non-nutritive flavorings and sweeteners (e.g., Crystal Light®, Zero Sugar Sunkist®, Kool-Aid Liquid Drops®, or Water Drops™) can be added without altering the sodium-carbohydrate ratio; use of these products will help to prevent taste fatigue and maintain intake. Compliance improves when clinicians encourage creativity with ORS consistency and temperature such as freezing in ice cube trays, mixing with plain gelatin, and using a thermos to maintain warm or cool temperatures throughout the day.

Table 5. Oral Rehydration Solution Recipes

Plain	4 cups water ½ teaspoon table salt 2 Tablespoons sugar Optional – add artificial flavor or sweetener to taste
Gatorade®	2 cups Gatorade 2 cups water ½ teaspoon table salt
Gatorade G2®	4 cups Gatorade ½ - ¾ teaspoon table salt*
Bouillon Cube	4 cups water 1 bouillon cube ¼ teaspoon table salt 2 Tablespoons sugar
Broth	2 cups liquid broth 2 cups water 2 Tablespoons sugar
Tomato Juice	2 ½ cups tomato juice (not V8 or Bloody Mary mix) 1 ½ cups water
Fruit Juice	¾ cup fruit juice 3 ¼ cups water ½ - ¾ teaspoon table salt*
Baby Cereal	½ to 1 cup precooked baby rice cereal 2 cups water ½ teaspoon table salt Combine ingredients until dissolved and smooth Refrigerate

* Start with ½ teaspoon table salt and gradually increase to ¾ teaspoon table salt

Source:14,15

Success of ORS therapy can be dependent on a patient’s access to proper tools for mixing of ORS ingredients and equipment to monitor their hydration status (Table 6). When trialing or adjusting daily volume of ORS the patient should record daily weight and 24 hour intake (including ORS) and output measurements (see Table 7). These

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Table 6. Essential Tools for Successful ORS Therapy

Tools to Monitor Hydration	Equipment to Mix ORS
Journal or calendar to record data	Measuring spoons
Accurate floor scale	Measuring cups
Toilet hat for urine or urinal (male or female)	Large pitcher (≥ 32 oz., lid preferred)
Toilet hat for stool or graduated cylinder (ostomy)	Long kitchen spoon
	ORS recipes
	Cup or Thermos (optional)

Table 7. Sample Patient Log – Weight, 24 Hour Intake and Output Measurements

Date	Weight	Oral Fluid Intake (mL or oz)	Stool/Ostomy Output (mL or oz)	Urine Output (mL or oz)

data will help the patient and clinician ascertain whether or not ORS is an effective therapy for that patient.

Other Fluids

What about fluids other than ORS? Sugary or hypertonic fluids (soda, sweet tea, juice, fruit drinks, flavored coffees) will rapidly pass into the jejunum where water will be secreted into the SB lumen to dilute the chyme to isotonicity. Likewise, consumption of hypotonic fluids (plain water, diet soda, plain tea or coffee, dilute juices) leads to jejunal secretion of sodium (and water) to adjust the chyme to isotonicity. Both scenarios increase ostomy/stool output and result in net fluid and sodium losses.

In the case of patients who are unable to tolerate, or refuse to drink ORS, the next “best” fluid options are hypotonic fluids that contain lower amounts of carbohydrate and sodium compared to ORS (e.g., G2 Gatorade® or Powerade® [not the “zero calorie” variety]). Electrolyte powders and waters such as Triorial Oral Rehydration Salts® and Propel Electrolyte Water® are sugar free and can be

sipped while snacking on small portions of salty-starchy snack foods like pretzels, soda crackers, potato or corn chips. Small volumes (4-8 oz.) of these fluids or plain water are generally tolerated with meals.

Caffeine and alcohol act as diuretics and can exacerbate dehydration in SBS. As discussed above, sports and electrolyte drinks contain the wrong proportions of carbohydrate and sodium and therefore are not considered ORS. Oral nutrition supplements (e.g., Boost® or Ensure® and store bought equivalents) are high in sugar and low in sodium, leading to water and sodium losses with increased stool/ostomy output. These supplements should not be offered to those with SBS or high volume ostomy output.

CONCLUSION

Maintaining hydration is a chronic issue for SBS patients. Although PS is available for most patients, it is associated with high costs, health risks and lifestyle burden. Oral rehydration therapy can be a viable option to reduce or eliminate the need for PS for many with SBS. To maximize benefits from

ORS, it is essential that patients receive education and ongoing support from a knowledgeable provider. Patients must have proper tools to prepare the ORS and ability to self-monitor their response to sipping ORS throughout the day. Creativity and experimentation with flavors and consistency can improve acceptance and adherence to the therapy. Although ORS is not effective for all patients, in those with benefit, transition from PS to ORS will reduce risks of iatrogenic complications and overall healthcare expense, while permitting a more normal lifestyle. ■

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Answers to this month’s crossword puzzle:

