Key Points of Oral Rehydration Therapy (ORT)

- Most children are not clinically dehydrated and do not require “PO trials” in order to “prove they can tolerate PO” prior to discharge
- Oral rehydration, using an appropriate oral rehydration solution (ORS) is the preferred method of choice
- Rehydration should be performed rapidly (over 2-4 hours)
- Once started, rehydration is continued in the ED and then continued at home by the parents/guardians
- Successful ORT involves several phases:
  - Rehydration
  - Maintenance and prevention of dehydration
  - Realimentation
- Laboratory testing is usually not necessary
- Medications are usually not necessary
- Following rehydration, rapid realimentation involves using an age-appropriate, unrestricted diet that should begin as soon as possible.
  - Both formula and breastfed infants should be started back on their usual feedings as soon as possible.
  - Partial dilution of formula, and restriction of lactose are not necessary.

Essentials of Oral Rehydration Therapy

1. Select an appropriate fluid (Pedialyte if <2yo; Gatorade if >2yo). Do Not use plain water, juices, or soda.
2. Begin with a proscribed amount, at a proscribed interval (for example, 5-10 cc every 5 minutes [see Table 3]).
3. A syringe is recommended for ease of administration.
4. Increase the volume and/or frequency of the fluid as tolerated
5. The initial goal is to give minimum 10cc/kg bolus over first hour
6. Overall goal is to replace the total estimated deficit for the patient in a maximum of 4 hours
Clinical Pathway: Evaluation & Management of Rehydration in Children

Is the child dehydrated?

- Yes
  - Fluid resuscitation
    - Mild or Moderate (< 10%)
      - Oral Rehydration Therapy (ORT)
      - Bolus therapy can be completed rapidly over 2-4 hour period
      - Started in the ED, parents are educated, observe, and perform the procedure
    - Severe (≥ 10%)
      - Intravenous Rehydration
      - 20cc/kg boluses repeated as needed to restore perfusion
      - Begin ORT once organ perfusion is restored
  - Reassess

- No
  - Reassess

Disposition & Discharge
- No further ED treatment necessary
- Give anticipatory guidance on preventing dehydration using ORT
- Ensure continued feeding and/or begin realimentation as soon as possible
- Provide detailed discharge instructions

Laboratory testing
- Usually not indicated
- May be indicated for:
  - Children in the Severe category
  - Altered Mental Status
  - Infants less than 3-6 months
  - Patients receiving IVF’s
Table 1. Clinical Criteria Commonly used for Classifying Dehydration Severity

<table>
<thead>
<tr>
<th></th>
<th>Mild (3-5%)</th>
<th>Moderate (6-9%)</th>
<th>Severe (&gt; 10%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Appearance/</td>
<td>Well-appearing</td>
<td>Ill-appearing, non-toxic</td>
<td>Lethargic, toxic</td>
</tr>
<tr>
<td>Level of consciousness*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart Rate</td>
<td>Normal to increased</td>
<td>Tachycardic</td>
<td>Marked tachycardia</td>
</tr>
<tr>
<td>Breathing pattern*</td>
<td>Normal</td>
<td>Increased</td>
<td>Increased, deep</td>
</tr>
<tr>
<td>Pulses</td>
<td>Normal quality</td>
<td>Normal to decr quality</td>
<td>Poor quality</td>
</tr>
<tr>
<td>Capillary refill*</td>
<td>Normal (&lt; 2sec)</td>
<td>Normal to sl prolonged (2-4sec)</td>
<td>Markedly prolonged</td>
</tr>
<tr>
<td>Perfusion</td>
<td>Warm</td>
<td>Cool</td>
<td>Cold, mottled</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>Normal</td>
<td>Normal</td>
<td>Hypotensive</td>
</tr>
<tr>
<td>Eyes</td>
<td>Normal</td>
<td>Slightly sunken</td>
<td>Very sunken</td>
</tr>
<tr>
<td>Tears</td>
<td>Normal</td>
<td>Decreased</td>
<td>Absent</td>
</tr>
<tr>
<td>Mucous membranes</td>
<td>Moist</td>
<td>Tacky</td>
<td>Very Dry</td>
</tr>
<tr>
<td>Skin turgor/recoil*</td>
<td>Instant recoil</td>
<td>Delayed (2 sec)</td>
<td>Very prolonged (&gt; 2sec)</td>
</tr>
<tr>
<td>Urine output</td>
<td>Normal to slightly decreased</td>
<td>Decreased</td>
<td>Minimal</td>
</tr>
</tbody>
</table>

Adapted as a composite from WHO 1995, Gorelick 1997, Friedman 2004

* 4 items with the highest predictive value for dehydration: general appearance, breathing pattern, capillary refill, and skin turgor/recoil.
Table 2. Constituent components and Recommendations for Oral Rehydration Therapy (ORT)

<table>
<thead>
<tr>
<th></th>
<th>Osmolality (mOsm/kg)</th>
<th>Glucose (mmol/L)</th>
<th>Sodium (mmol/L)</th>
<th>Potassium (mmol/L)</th>
<th>Recommendation as an ORS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WHO</strong></td>
<td>331</td>
<td>111</td>
<td>90</td>
<td>20</td>
<td>Recommended for All ages</td>
</tr>
<tr>
<td><strong>Low Osmolarity WHO</strong></td>
<td>245</td>
<td>75</td>
<td>75</td>
<td>20</td>
<td>Recommended for All ages</td>
</tr>
<tr>
<td><strong>Commercial ORS (i.e., Pedialyte®)</strong></td>
<td>250</td>
<td>139</td>
<td>45</td>
<td>20</td>
<td>Recommended for All ages</td>
</tr>
<tr>
<td><strong>Sports Drink (i.e., Gatorade®)</strong></td>
<td>330</td>
<td>255</td>
<td>20</td>
<td>3</td>
<td>Not recommended for children less than 2 yrs</td>
</tr>
<tr>
<td><strong>Cola</strong></td>
<td>500</td>
<td>700</td>
<td>2</td>
<td>0.1</td>
<td>Not recommended</td>
</tr>
<tr>
<td><strong>Seven-up</strong></td>
<td>388</td>
<td>500</td>
<td>4</td>
<td>0</td>
<td>Not recommended</td>
</tr>
<tr>
<td><strong>Orange juice</strong></td>
<td>687</td>
<td>680</td>
<td>1</td>
<td>486</td>
<td>Not recommended</td>
</tr>
<tr>
<td><strong>Apple juice</strong></td>
<td>694</td>
<td>690</td>
<td>0</td>
<td>27</td>
<td>Not recommended</td>
</tr>
</tbody>
</table>

Adapted from Sandhu 2001 pg S37
Table 3. Age and Weight-based ORT Dosing Guidelines

<table>
<thead>
<tr>
<th>Age</th>
<th>Weight</th>
<th>Initial Dosing</th>
<th>Volume/hr</th>
<th>First Advance</th>
<th>Next Advance</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-6mo</td>
<td>8kg</td>
<td>5cc every 5min</td>
<td>60cc (10cc/kg)</td>
<td>15cc every 15min</td>
<td>30cc every 1/2hr</td>
</tr>
<tr>
<td>6mo-3yrs</td>
<td>10-15kg</td>
<td>10cc every 5min</td>
<td>120cc (10cc/kg)</td>
<td>30cc every 15min</td>
<td>60cc every 1/2hr</td>
</tr>
<tr>
<td>3-8yrs</td>
<td>20-25kg</td>
<td>15cc every 5min</td>
<td>180cc (10cc/kg)</td>
<td>45cc every 15min</td>
<td>90cc every 1/2hr</td>
</tr>
<tr>
<td>8-15yrs</td>
<td>&gt;30kg</td>
<td>15cc every 2min</td>
<td>450cc (10cc/kg)</td>
<td>90cc every 15min</td>
<td>120cc every 1/2hr</td>
</tr>
</tbody>
</table>
Common Questions & Pitfalls to Avoid

1) A well appearing child with no clinical evidence of dehydration gets a “PO challenge” that is given ad lib. The child guzzles the entire 2 containers of apple juice immediately, and shortly thereafter the child vomits, followed by the mother proudly showing you the emesis. The mother and nurse form a united front to insist that the child has confirmed the need for an IV.
   a. The fact that the child vomited is a normal part of the disease process. It proves that he was given an inappropriate fluid, with inadequate directions, not that the child needs an IV.

2) I thought vomiting was a contraindication to ORT.
   a. By definition all patients with gastroenteritis vomit. All patients with mild or moderate dehydration are eligible to receive ORT. The goal with ORT is to start with small amounts of fluid that are able to be absorbed by the gastric mucosa before they are able to be vomited, and then increase as tolerated.

3) I didn’t want to use oral rehydration because I thought it would take too long, and putting in an IV would just be a lot quicker.
   a. Incorrect. The data clearly support the use of oral rehydration over intravenous rehydration with overall shorter length of stay and fewer admissions.

4) I thought moderate dehydration was a contraindication to oral rehydration.
   a. Incorrect. Oral rehydration is indicated for mild or moderate dehydration.

5) I know the kid was only 2 months old, but her mom had the stomach flu too, so I figured she just had the stomach flu as well.
   a. Not all that vomits is gastroenteritis. Gastroenteritis in the neonatal period is relatively uncommon, and in that age group it should be considered almost a diagnosis of exclusion. Be very careful in a 2 month old before making the diagnosis of gastroenteritis. It may be, but exclude other potentially more serious causes first.

6) She looked pretty dry, but I tanked her up pretty good, and I thought she looked great before she left.
   a. Great care should be taken before sending home an infant after fluid resuscitation with a high risk of failing at home. This 6 month old ex-premie with severe rotaviral disease returned the next day in severe shock requiring resuscitation. She was having 1-2 voluminous watery diarrheal stools every couple of hours while still in the ED, and there was little likelihood that she would have been able to keep up at home with that degree of ongoing volume loss, particularly in view of her history of prematurity. All things considered, she should more than likely have been
admitted for observation and IV therapy. ORT is a great thing, but try as we might, it doesn’t work in everyone.

7) *The patient is discharged with a set of old pre-printed discharge instructions from the middle-ages. It instructs families to only give clear fluids and to stop all formula and milk products, and there are no timelines as to when to stop. The child returns a week later with persistent diarrhea.*
   a. Patients and families require accurate and informative instructions that include specific information on appropriate rehydration fluids and techniques as well as the importance of rapid return to realimentation as soon as possible. ORS ad libitum without realimentation for an extended period can in and of itself cause chronic diarrhea.

8) *I thought his abdominal pain and tenderness were just related to his gastroenteritis.*
   a. Again, not all that vomits is gastroenteritis. In the absence of classic symptoms, or in the presence of other concerning symptoms, other causes should be excluded, for example surgical causes such as acute appendicitis or intussusception.

9) *I though antiemetics were contraindicated in children. Or, they’re too expensive, or have too many side-effects.*
   a. The use of ondansetron has been found to be safe and effective as an adjunct to ORT to decrease vomiting in patients with severe refractory vomiting.

10) *There is no reason to use a clinical pathway or guideline.*
    Multiple studies have shown that the evaluation and management of dehydration in children using a well-developed clinical pathway is an excellent means of streamlining care, reduce variation, and improving care. Added benefits include reducing admissions, saving money and improving satisfaction.
**Discharge Teaching & Instructions**

**How to Prevent your Child from becoming Dehydrated**

- Use plenty of oral rehydration fluids
- **Acceptable fluids include:**
  - Over the counter oral rehydration solutions (Pedialyte®, Infalyte®, Rehydralyte®)
  - If necessary, you may add a small amount of your child’s favorite flavoring or juice to the oral rehydration solution if that increases the child’s interest in drinking the oral rehydration solution
  - Freezer rehydration popcicles (do not use regular popcicles – they are mainly just pure sugar and do not contain the necessary salts and electrolytes)
- **Do not use:**
  - Pure juices – they have too much sugar and can cause worsening diarrhea
  - Plain water – they do not have any sugar or salts and can cause electrolyte changes. Be especially careful about giving plain water to small babies as they can sometimes cause changes resulting in seizures
  - Soda – they are also just water and sugar and have the wrong concentration of salts and electrolytes
- If your child is vomiting, start with small amounts of oral rehydration fluid. Give 1 teaspoon (or 5cc in syringe) every 5 minutes, and then increase gradually as tolerated by your child.

**You should return to your child’s normal diet as soon as possible**

- You do not need to stop milk or formula products
- You may continue breastfeeding
- You can still expect to see some vomiting and diarrhea. That is part of the normal disease process. Your child still needs to continue to receive adequate nutrition.

**Signs of Dehydration**

- Your child may appear less active, sleepy, or lethargic
- Your child cries, but has no tears
- Decreased frequency of urination, or wetting diapers
• Sunken eyes
• Cool, clammy skin

➔ If these appear, you need to increase the amount and frequency of the oral rehydration solution you are giving and speak with your doctor or clinic for a follow-up appointment.

You should Return to the Emergency Department if your child
• Appears very sleepy, lethargic, or is difficult to arouse
• Has not urinated or wet a diaper in 8 hours
• Appears to be breathing either very fast, or has very deep and slow breathing
• If the vomiting or diarrhea becomes bloody
• If your child’s abdomen becomes distended or appears to be tender or painful to the touch
Addenda

Table A. Infectious etiologies among patients admitted with dehydration (in descending order of frequency)

<table>
<thead>
<tr>
<th>Description</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viral enteritis NOS*</td>
<td>21.9</td>
</tr>
<tr>
<td>Rotavirus</td>
<td>1.9</td>
</tr>
<tr>
<td>Salmonella spp.</td>
<td>1.0</td>
</tr>
<tr>
<td>Shigella spp.</td>
<td>1.0</td>
</tr>
<tr>
<td>Bacterial enteritis NOS*</td>
<td>0.7</td>
</tr>
<tr>
<td>Clostridium spp.</td>
<td>0.6</td>
</tr>
<tr>
<td>E. coli (pathologic/invasive)</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Adapted from McConnochie 1999 pg1236.

*NOS = not otherwise specified

spp = species
Table B. Common Infectious Agents Causing Vomiting & Diarrhea in Children

<table>
<thead>
<tr>
<th>Agent</th>
<th>Source/Symptoms</th>
<th>Antimicrobial Treatment</th>
</tr>
</thead>
</table>
| *Campylobacter jejuni* | Source: contaminated, poorly cooked chicken; unpasteurized milk; fecal-oral contact.  
Symptoms: fever, abdominal pain, diarrhea (occasionally bloody).  
Abdominal pain can mimic that of appendicitis. Mild infection lasts 1-2 days. | Treatment recommended shortens illness and prevents relapse  |
| *E. coli 0157:H7*    | Source: contaminated, poorly cooked meat, often beef; fecal-oral contact.  
Symptoms: diarrhea, which may be bloody and profuse; abdominal pain, which may be severe; nausea and vomiting. Complications including hemolytic-uremic syndrome and renal failure. | Treatment not recommended (may increase risk of hemolytic-uremic syndrome)  |
| *Giardia lamblia*    | Source: contaminated water; fecal-oral contact.  
Symptoms: explosive, foul-smelling stools associated with excessive flatulence, abdominal distention, and anorexia. Fever is usually absent | Treatment recommended for symptomatic infections  |
| *Salmonella spp.*    | Source: Contaminated, poorly cooked food (poultry, eggs, dairy products); fecal-oral contact; reptiles.  
Symptoms: abdominal cramps, vomiting and diarrhea often in association with fever. | Treatment recommended for specific, high-risk patients (very young, very sick, immunocompromised)  |
| *Shigella spp.*      | Source: Contaminated food or water; fecal-oral contact.  
Symptoms: Symptoms vary from mild diarrhea and no constitutional symptoms to patients with severe crampy | Treatment recommended for all patients  |
| **Staphylococcal food poisoning** | **Source:** Contaminated food.  
**Symptoms:** abrupt onset nausea, vomiting, abdominal cramping, and diarrhea usually 2-4 hours after eating contaminated food. | **Treatment not recommended** |
|---|---|---|
| **Norwalk virus** | **Source:** Contaminated food or water; fecal-oral.  
**Symptoms:** Nausea, vomiting, abdominal pain lasting 24-48 hours. | **Treatment not recommended** |
| **Rotavirus** | **Source:** Fecal-oral route  
**Symptoms:** Foul-smelling profuse, non-bloody, watery diarrhea, most common during the winter months, usually lasting 3-8 days. | **Treatment not recommended** |
| **Vibrio spp.** | **Source:** Contaminated water or food  
**Symptoms:** Profuse “rice water” diarrhea with varying degrees of abdominal cramps and fever (but is most often described as being painless and without fever). | **Treatment recommended (results in prompt eradication)** |

**Spp = species**

**DISCLAIMER:**
This clinical guideline has been developed for the purpose of unifying the general emergency care of patients with dehydration and oral rehydration therapy. It is intended to aid, rather than substitute for, professional judgment. It is not intended to serve as a rigid protocol or a written proxy for the standard of care. Failure to comply with this guideline does not represent a breach of the standard of care.