

# Diarrhea

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## Diarrhea Not Related to Travel

### Pathophysiology

Diarrhea is the unusually frequent excretion of watery stools. It is associated with loss of electrolytes and loss of fecal matter at a rate of approximately  $> 200$  gm/24 hours.<sup>1</sup> Losses of greater than 500 mL/24 hours are indicative of *secretory* diarrhea. Decreased fluid absorption or increased fluid secretion can lead to dehydration, which can ultimately lead to death particularly in children and the elderly. Diarrhea can be either acute or chronic. *Acute* diarrhea lasts less than 14 days and is often caused by infectious agents, drugs or food toxins. Diarrhea is considered *chronic* if it lasts longer than 14 days or if there are repeated episodes of diarrhea lasting less than 14 days each. Chronic diarrhea is often indicative of an inflammatory process (e.g., ulcerative colitis). Other causes of chronic diarrhea include ischemia, infections, radiation or chemotherapy, and maldigestion or malabsorption of fat or carbohydrates.

Although there are no specific statistics on the prevalence of diarrhea in adults,<sup>2</sup> the illness is thought to be underreported. Diarrhea is common in the pediatric population. American statistics indicate that children under five years of age experience 1.3 to 2.7 episodes of diarrhea yearly.<sup>3</sup> This data can be extrapolated to the Canadian population.

Aside from dehydration, complications of diarrhea include electrolyte imbalances, hemorrhoids and rectal prolapse. Diarrhea often results in a decreased ability to perform daily activities.

The most common causes of acute diarrhea are bacterial and viral infections. A list of major bacterial agents can be found in the Travelers' Diarrhea section later in this chapter. Infectious viral agents include:<sup>4</sup>

- Rotavirus—responsible for causing severe diarrhea in infants and children, and the most common cause of gastroenteritis among children worldwide.<sup>5</sup>
- Norwalk-like virus—responsible for milder form of diarrhea affecting older children and adults
- Adenovirus
- Astrovirus
- Calcivirus

Acute childhood diarrheal pathogens are transmitted by close contact and in particular the oral-fecal route. Childcare settings are a common place for diarrheal episodes.

Drugs are also a common cause of diarrhea (Table 1). In particular, broad-spectrum antibiotics such as penicillins, cephalosporins and erythromycins are implicated in altering the bacterial flora of the gut resulting in diarrhea. This usually occurs two to three days after starting the antibiotic and resolves when the antibiotic is discontinued. An uncommon but potentially serious adverse reaction to an antibiotic altering gut flora is antibiotic-induced *pseudomembranous colitis*, associated with the anaerobic organism *C. difficile*. The agents most commonly implicated as causes of pseudomembranous colitis are clindamycin, ampicillin and the cephalosporins,<sup>8</sup> although any antimicrobial agent can cause it, including those used to treat it. The condition usually develops 4 to 10 days after initiation of the antibiotic and is characterized by

Table 1: **Drugs Associated with Diarrhea**<sup>6,7</sup>


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|  |
|--|
| Acarbose   |
| Alcohol  |
| Antacids—magnesium salts                                       |
| Antibiotics (most common)                                      |
| Anticoagulants   |
| Antihypertensives—especially propranolol                       |
| Antimetabolites—especially colchicine                          |
| Cardiovascular drugs—especially digoxin                        |
| Cholestyramine   |
| Cholinergics   |
| Cimetidine   |
| Cytotoxic agents—especially 5-FU plus interferon or leucovorin |
| Domperidone  |
| HIV medications—especially nelfinavir                          |
| Lactose-containing pharmaceuticals                             |
| Lactulose  |
| Metoclopramide   |
| Misoprostol  |
| NSAIDs—especially naproxen                                     |
| Orlistat   |
| Potassium supplements  |
| Prostaglandins   |
| SSRIs—especially paroxetine                                    |
| Sulfasalazine  |
| Ticlopidine  |

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significant loss of fluid, fever and abdominal pain. It is most commonly treated with **metronidazole** or oral **vancomycin**.<sup>9</sup>

Diarrhea may be associated with intolerance to food components, such as lactose or gluten, or with food allergies. Foods that contain large amounts of sorbitol or mannitol can cause an osmotic diarrhea.<sup>4</sup>

Other causes of diarrhea include: nervousness or anxiety, tumors, opiate withdrawal, rapid increase of fibre in the diet, enteral nutritional supplements, deficiencies of specific nutrients such as vitamin A and zinc,<sup>10</sup> excesses of specific nutrients such as vitamin C, inflammatory bowel disease, irritable bowel syndrome, diabetes.<sup>4,6</sup>

## Goals of Therapy

- Determine the specific etiology and treat appropriately
- Decrease the symptoms and re-establish normal stools
- Avoid complications such as dehydration

## Patient Assessment

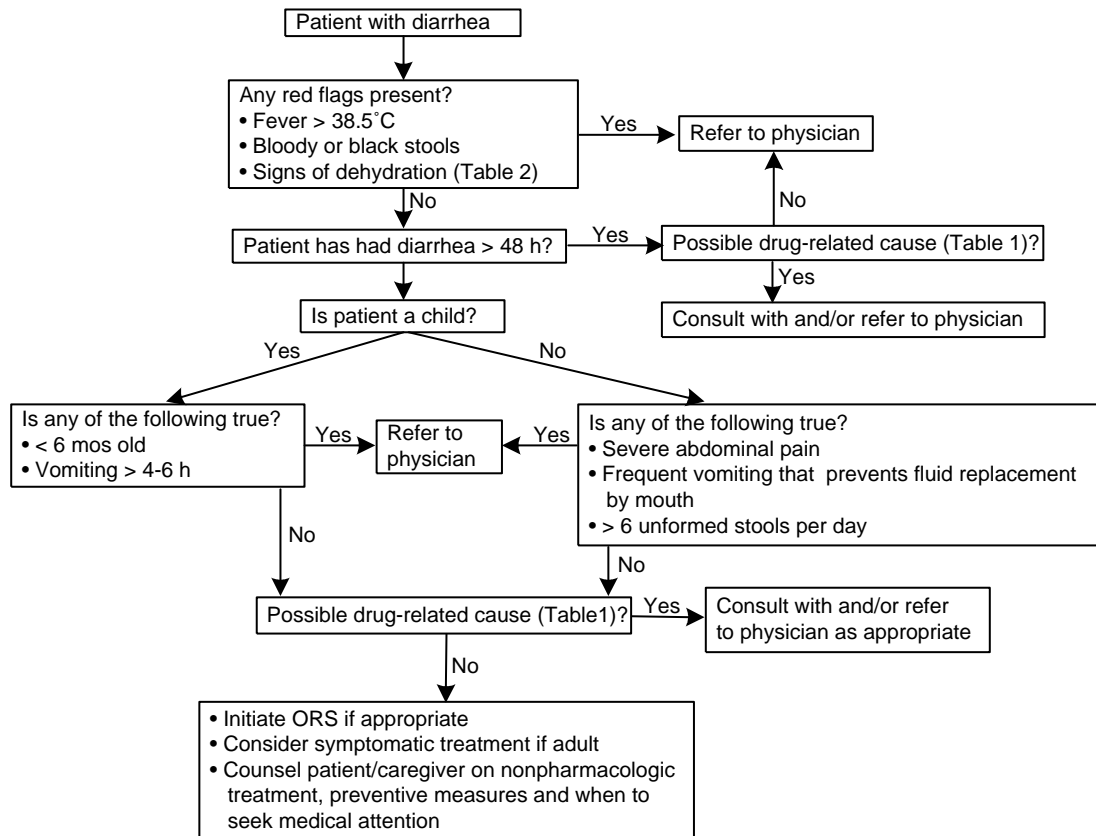
Aside from frequent loose stools, symptoms of infectious diarrhea may include nausea, vomiting, abdominal pain, headache, fever, chills and malaise.

Question patients with repeated episodes of diarrhea about any relationship between symptoms and consumption of dairy or grain products. If such a relationship exists, refer the patient to a physician or dietician to rule out lactose or gluten intolerance (see Nutrition Appendix 1).

An assessment plan for patients suffering from diarrhea not related to travel is illustrated in Figure 1.

## Prevention

- Eliminate/discontinue drugs causing diarrhea.
- Avoid lactose-containing products if lactose intolerance is suspected or diagnosed.
- Avoid gluten-containing products if celiac disease is diagnosed.
- Encourage handwashing after going to the toilet or changing a diaper and before preparing and eating food. Transmission of GI infections in the childcare setting is reduced significantly if infection control procedures are followed. High compliance with handwashing decreases episodes of diarrhea by 66%.<sup>13</sup>
- Prevent food poisoning:<sup>14</sup>
  - Avoid milk and fruit juices that are unpasteurized.
  - Cook foods thoroughly, especially red meat, poultry and eggs.
  - Eat foods soon after they have been cooked so that pathogens do not have time to grow.
  - Rinse foods that are not cooked before they are eaten (i.e., fresh fruits and vegetables) under running water.
  - Keep hot foods hot (60°C) and cold foods cold (4°C).
  - When preparing raw meats and poultry, keep them separated from cooked food, fresh fruits and vegetables.
  - Use separate cutting boards for raw meats and vegetables.
  - Reheat foods completely when serving leftovers.
  - Wash hands with hot, soapy water before and after preparing food.

Figure 1: **Assessment of Patients with Diarrhea Not Related to Travel**<sup>4,11</sup>

ORS = oral rehydration solution

- Use mild solution of water and soap to clean counters, cutting boards and utensils.
- Protect food from insects and animals.

## Nonpharmacologic Therapy

Rehydration and maintaining electrolyte balance are the cornerstones of therapy for diarrhea.<sup>15</sup> Oral rehydration therapy (ORT) can treat the majority of patients with diarrhea as well as prevent most diarrhea-related complications.<sup>3</sup> Oral rehydration solution (ORS) takes advantage of the sodium/glucose-coupled active absorption mechanism. It is composed of sodium and glucose in the concentration

and osmolality of the luminal fluid. It is recommended by the World Health Organization (WHO) and should be used early, particularly when treating children and the elderly. The WHO formula for ORS is included in Table 3 as are those of the commercially available Gastrolyte<sup>®</sup> and Pedialyte<sup>®</sup>. The use of fruit juices, pop or tea with sugar is unsuitable due to the high carbohydrate concentration of these drinks. Homemade oral rehydration solutions can also be used although this is discouraged because mixing errors often occur. Examples of homemade ORS recipes are described in Table 4.

ORT is contraindicated in the following instances:<sup>17</sup>

- Protracted vomiting despite small frequent feedings

Table 2: Symptoms of Dehydration in Children and Adults<sup>11,12</sup>

| Children   | Adults  |
|--|---|
| <ul style="list-style-type: none"> <li>• Dry mouth, tongue and skin</li> <li>• Few or no tears when crying</li> <li>• Decreased urination (less than 4 wet diapers in 24 h)</li> <li>• Sunken eyes, cheeks or abdomen</li> <li>• Grayish skin</li> <li>• Sunken soft spot (fontanel) in infants</li> <li>• Decreased skin turgor (Figure 2)</li> <li>• Irritability or listlessness</li> </ul> | <ul style="list-style-type: none"> <li>• Increased thirst</li> <li>• Decreased urination</li> <li>• Feeling weak or light-headed</li> <li>• Dry mouth/tongue</li> </ul> |

Figure 2: Decreased Skin Turgor



When pinched and released, the skin flattens slowly.

- Worsening diarrhea and an inability to keep up with losses
- Stupor or coma
- Intestinal ileus

Rapid refeeding with age-appropriate foods should immediately follow rehydration.<sup>15</sup> Withholding food for bowel rest, formula dilution and systematic elimination of lactose are no longer standard recommendations.

## Pharmacologic Therapy

Antidiarrheal medications are indicated for relief of debilitating symptoms that accompany diarrheal illness. Nonprescription agents useful in the management of diarrhea are described in Table 5.

Prescription therapies for diarrhea include:

- Cholestyramine: useful in treatment of bile acid-induced diarrhea<sup>1</sup>
- Codeine: doses necessary for antidiarrheal effect not attainable with nonprescription products (result in acetaminophen overdose)
- Clonidine: effective against diarrhea associated with opioid withdrawal and diabetic autonomic neuropathy<sup>1</sup>
- Diphenoxylate with atropine: less effective than loperamide<sup>21</sup>
- Octreotide: useful in diarrhea due to chemotherapy, short bowel syndrome, neuroendocrine tumors, AIDS-associated diarrhea and other chronic diarrhea not responding to standard treatment<sup>22-24</sup>

## Probiotics

Probiotics are live microorganisms (bacteria and yeast) that exert a beneficial effect by improving the balance of the host's flora.<sup>25,26</sup>

There are few well-designed clinical trials of the use of probiotics to treat or prevent diarrhea. However, *L. rhamnosus* strain GG has been shown to reduce the duration of diarrhea due to rotavirus in children<sup>26</sup> and decrease the incidence of antibiotic-associated diarrhea in children.<sup>27,28</sup>

The standardized brewer's yeast Hansen CBS 5926 may be useful for diarrhea. It can have some activity against *C. difficile* and enterotoxigenic *E. coli*. It

Table 3: **Composition of ORS Preparations**

| Component            | WHO | Gastrolyte® | Pedialyte® |
|----------------------|-----|-------------|------------|
| Sodium (mmol/L)      | 90  | 60          | 45         |
| Potassium (mmol/L)   | 20  | 20          | 20         |
| Chloride (mmol/L)    | 80  | 60          | 35         |
| Bicarbonate (mmol/L) | 30  | 0           | 0          |
| Citrate (mmol/L)     | 0   | 30          | 30         |
| Glucose (g/L)        | 20  | 20          | 25         |

Table 4: **Recipes for Homemade Oral Rehydration Solution**<sup>16</sup>

|           | Ingredients         | Amount           |
|-----------|---------------------|------------------|
| Recipe #1 | Fruit juice         | 240 mL (1 cup)   |
|           | Honey (pasteurized) | 2.5 mL (1/2 tsp) |
|           | Salt                | 0.5 mL (1/8 tsp) |
|           | Baking soda         | 1 mL (1/4 tsp)   |
| Recipe #2 | Purified water      | 1 L (4 cups)     |
|           | Salt                | 5 mL (1 tsp)     |
|           | Sugar               | 40 mL (8 tsp)    |

reduces water and electrolyte influx into the intestines stimulated by *V. cholerae* toxin and can increase the activity of intestinal disaccharidases, saccharidases, maltase and lactase to alleviate symptoms of diarrhea. These results may not be applicable to brewer's yeast in general.<sup>29</sup>

Most probiotics appear relatively safe. There have been isolated reports of serious adverse effects, including one case report of liver abscess due to *L. rhamnosus* in a 74 year old diabetic. Probiotics should be used cautiously in patients who are immunosuppressed or have a badly damaged GI tract.<sup>25</sup>

It is interesting to note that dairy products and many commercially available probiotics may contain organisms that, unlike *L. rhamnosus* strain GG, have not been shown to survive in the human GI tract.<sup>25</sup> Product standardization can also be a problem.

Products may contain microorganisms not listed on the label or contain quantities of microorganisms other than that listed.<sup>30</sup>

### Herbal Remedies

Popular herbal choices for the treatment of diarrhea include german chamomile, carob, marshmallow, slippery elm and bayberry. None are particularly effective even though there are anecdotal reports, especially in folk medicine.

Herbs useful in the management of travelers' diarrhea are discussed in Travelers' Diarrhea, Pharmacologic Therapy.

### Children

In most cases diarrhea in children is self-limiting and non-life-threatening. However, death can result from dehydration brought about by diarrhea.

The treatment of childhood diarrhea focuses on correcting dehydration. ORT is the most effective treatment for children with acute diarrhea. Oral rehydration salts are readily available, effective, safe and economical but are underutilized.<sup>31</sup> Underutilization may be due to the inconvenience of ORT administration in the practice setting and a preference for intravenous versus oral rehydration.

Breastfeeding should be continued during episodes of diarrhea<sup>15</sup> and ORS should be offered. If a child is not being breastfed, all food and drink should be withheld and ORS given as described in Table 6. ORT should start as soon as diarrhea begins and continue until diarrhea is less frequent.

Table 5: **Nonprescription Agents for Diarrhea**<sup>1,18-20</sup>

| Drug                        | Dosage  | Adverse effects  | Drug interactions   | Comments   |
|-----------------------------|---|--|---|--|
| Attapulgite                 | 3-6 yrs: 300 mg initially, then 300 mg after each BM.<br>Max: 2100 mg per day.<br>6-12 yrs: 600-750 mg initially, then 600-75 mg after each BM.<br>Max: 4200 mg per day<br>> 12 yrs and adults:<br>1200-1500 mg initially, then 1200-1500 mg after each BM.<br>Max: 8400 mg per day | Well-tolerated   |   | May be useful for treatment of mild to moderate acute diarrhea.<br>Not to be used for more than 2 days unless directed by a physician.   |
| Bismuth subsalicylate (BSS) | 30 mL q 30 min<br>Max: 8 doses per day  | Black tongue/stools, tinnitus  | Avoid in patients taking anticoagulants or salicylates, probenecid, methotrexate. | Used to treat chronic idiopathic diarrhea with a reduction in stool weight and frequency.  |
| Loperamide                  | Adult: 4 mg stat then 2 mg after each loose BM<br>Max: 16 mg per day  | Abdominal cramps or discomfort, drowsiness, dizziness, dry mouth, skin rash. |   | Contraindicated in children under age 2.<br>Not recommended for children under 12 yrs except on the advise of a physician.<br>Avoid in acute dysentery (i.e., fever and bloody stools). Discontinue if symptoms persist longer than 48 hours. Opiate-like CNS effects have been observed in children under 3 yrs of age.<br>Monitor patients with hepatic dysfunction for signs of CNS toxicity. |
| Psyllium                    | 5 mL (5-6 g) q12h   | Cramping, flatulence   |   | Separate administration of other medications by 2 h. Contraindicated in patients with dysphagia. Allergic reactions have occurred. Esophageal obstruction has occurred when insufficient liquid was administered with the dose.  |

*BM*—*bowel movement*.

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Even if a child refuses ORS by the cup or bottle, the solution is to be given by a medicine dropper or small teaspoon. If vomiting occurs, ORS should be continued with a spoon giving 15 mL every 10 to 15 minutes until vomiting stops, then resuming with the regular amount (Table 6). If vomiting does not stop after four to six hours, the child should receive medical attention.

Early refeeding should begin within six hours of beginning ORS. For infants who are formula-fed, start with small, frequent feedings of the child's usual formula. Should the diarrhea persist for five days, switch to a soy-based formula as lactose intolerance may be suspected.<sup>17</sup>

For older children, early refeeding with age-appropriate, previously tolerated foods is recommended.<sup>15,17</sup> After 24 to 48 hours, the child's normal diet can

resume. It may take 7 to 10 days for stools to become completely formed. Restricting a child to a complex carbohydrate diet (e.g., BRATT diet: bananas, rice, applesauce, tea and toast) is inappropriate.<sup>32</sup>

For dehydrating, persistent diarrhea the use of hypo-osmolar oral rehydration solutions (e.g., Gastrolyte®, Pedialyte®) is beneficial and superior to iso-osmolar ORS.<sup>33</sup> Hypo-osmolar ORS results in a shorter period of diarrhea, less stool output and less need for maintenance therapy.

### Pregnancy

Diarrhea in pregnancy is mainly due to viral or bacterial causes and is usually self-limiting. Maintenance of fluid intake is important. The use of loperamide to treat diarrhea during pregnancy is not associated with an increased risk of major malformations.<sup>34</sup>

### The Elderly

The elderly are particularly susceptible to dehydration due to diarrhea. Nursing homes are similar to child-care settings where pathogens are spread by the oral-fecal route. Prompt rehydration is essential in limiting damage to vital organs.

## Monitoring of Therapy

Table 7 provides a monitoring plan framework that should be individualized.

Table 6: Administration of ORS to Non-breastfed Infants<sup>11</sup>

| Age of child | Amount of ORS to give |
|--------------|-----------------------|
| 0-6 mos      | 30-90 mL every hour   |
| 6-24 mos     | 90-125 mL every hour  |
| > 2 yrs      | 125-250 mL every hour |

Table 7: Monitoring Therapy for Diarrhea

| Symptoms                       | Monitoring   | Endpoints   | Actions   |
|--------------------------------|--|---|---|
| Loose, watery stools           | <b>Patient:</b> regularly as long as symptoms persist.<br><b>Pharmacist:</b> ask for symptom report; call patient within 48 h to see if symptoms have resolved | Resolution of symptoms.<br>Return to usual bowel evacuation pattern | Antidiarrheal medications may be necessary within first 2 days to alleviate symptoms.<br>If symptoms persist beyond 48 h, seek medical attention. |
| Signs of dehydration (Table 2) | <b>Patient:</b> continually  | No signs of dehydration   | If signs of dehydration (Table 2) occur despite ORS, refer to physician.  |
| Fever or blood in stools       | <b>Patient:</b> regularly as long as symptoms persist  | No fever; no blood in stools  | Refer to physician if this occurs.  |

## Travelers' Diarrhea

### Pathophysiology

Travelers' diarrhea is an illness that affects 20 to 50% of two-week travelers from industrialized countries to developing countries like Latin America, Asia and Africa.<sup>35</sup> It is generally self-limiting and even without treatment usually resolves within three to four days. For the most part it is non-life-threatening; however, infants, the elderly, patients with severe chronic diseases (e.g., chronic renal failure, congestive heart failure, insulin dependent diabetes mellitus, inflammatory bowel disease) and immunocompromised hosts may suffer dire consequences. It is known by many names including Montezuma's revenge, GI trots, Turkey trots, turista and Delhi belly. It is defined by three or more loose, unformed stools per day along with at least one symptom of enteric infection such as fever, abdominal cramps, nausea, fecal urgency or dysentery.<sup>36</sup> Caused by bacteria, viruses and parasites, it is primarily spread by the fecal-oral route. Infectious agents responsible for travelers' diarrhea (Table 8) vary depending on the geographical area visited as well as the time of year. Factors associated with an increased likelihood of acquiring travelers' diarrhea include adventurous eating habits, gastric hypo-

chlorhydria, immunodeficiency and a relative lack of gut immunity seen in younger individuals.<sup>16</sup>

### Goals of Therapy

- Educate travelers before they reach their destination in developing countries so as to avoid diarrheal illness
- Educate travelers on effective treatment regimens in case they experience symptoms
- Shorten the period of suffering and minimize interruption of vacation and/or business plans
- Prevent complications such as dehydration

### Patient Assessment

The assessment and management of travelers' diarrhea is illustrated in Figure 3.

### Prevention

The incidence of travelers' diarrhea can be minimized by choosing appropriate foods and avoiding those associated with the illness (Table 9).

Table 8: **Common Causes of Travelers' Diarrhea**<sup>16</sup>

#### Bacterial

Aeromonas spp.—common in Thailand  
*Campylobacter jejuni*—common in Mexico, Thailand, Morocco (dry winter)  
 Enterotoxigenic *Escherichia coli* (ETEC)—common in Latin America, Africa  
 Plesiomonas spp.  
 Salmonella spp.  
 Shigella spp.  
*Vibrio cholerae*—common in India, Ecuador, Bali and Indonesia  
 Yersinia spp.

#### Viral

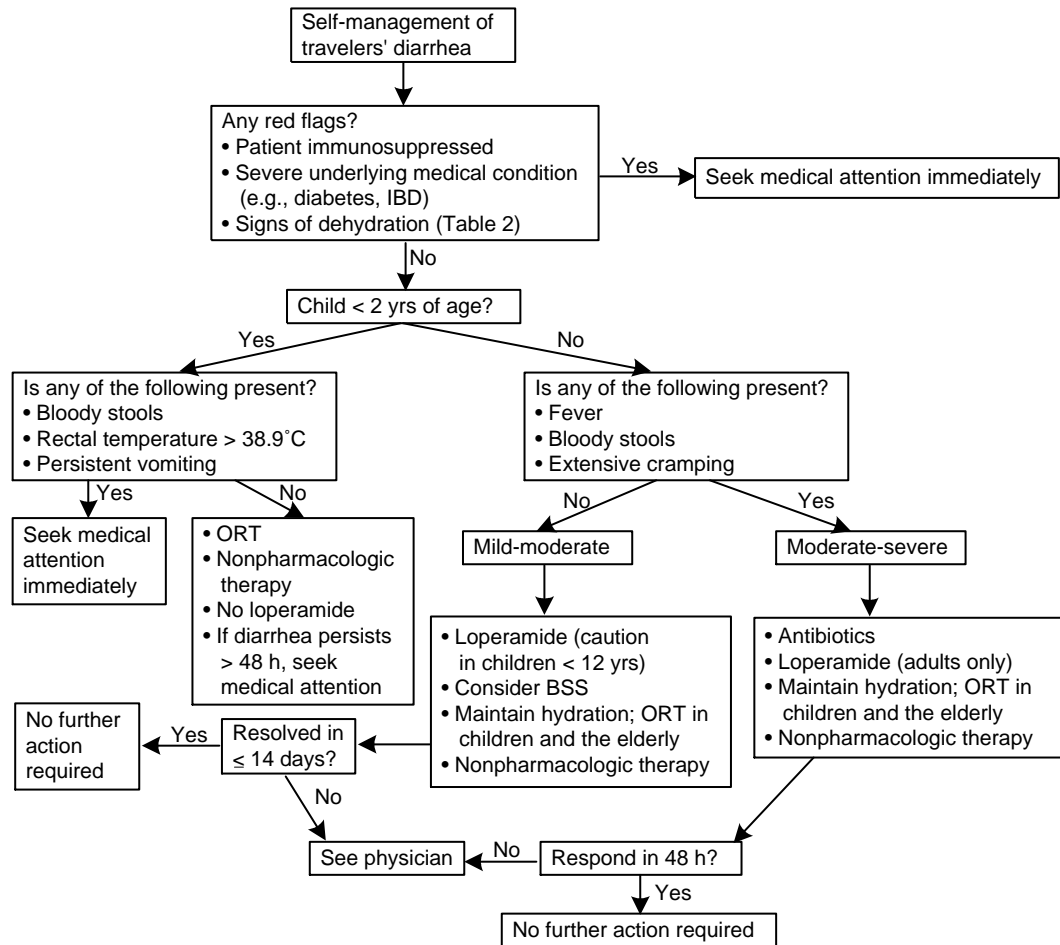
Norwalk virus  
 Rotavirus

#### Parasitic

*Cryptosporidium parvum*—common in Russia  
*Cyclospora cayetanensis*—common in Nepal  
*Entamoeba histolytica*  
*Giardia lamblia*—common in Russia and Nepal

Table 9: **Food and Travelers' Diarrhea**<sup>16,21</sup>

| Safe foods/<br>beverages                 | Unsafe food/<br>beverages   |
|--|---|
| Piping hot food                          | Buffet food at room temperature   |
| Peeled fruit (preferably done by self)   | Fresh soft cheese   |
| Cooked vegetables                        | Food from street vendors  |
| Carbonated beverages (with no ice cubes) | Cold salads   |
| Boiled or bottled water                  | Leafy and/or raw vegetables   |
| Pasteurized milk (if properly stored)    | Uncooked, cold sauces   |
|  | Unpeeled fruit  |
|  | Raspberries/strawberries/watermelon   |
|  | Ice cubes/chips   |
|  | Undercooked hamburger/meat/fish   |
|  | Shellfish   |
|  | Large reef fish from the Caribbean and South Pacific (e.g., snapper, barracuda, grouper, jack, moray eel) |
|  | Custards, mousses, mayonnaise, hollandaise sauce  |

Figure 3: Self-management of Travelers' Diarrhea<sup>16,37</sup>

BSS = bismuth subsalicylate

Other measures that travelers should follow include:

- Follow the adage “Boil it, cook it, peel it or forget it.”
- Use purified water or water from the hot tap to brush teeth.
- Wash hands frequently while traveling, particularly before handling or consuming food (if soap and water are unavailable, consider using commercially available waterless hand sanitizing agents).<sup>16</sup>
- Avoid drinking the water while swimming.
- Avoid drinking local water (although some resort areas have their own filtration system to purify water).

- Drink bottled beverages in their original containers and ensure the cap is sealed.
- Bismuth subsalicylate is 60 to 65% effective as a prophylactic agent<sup>16</sup> (Table 10) and may be used to prevent travelers' diarrhea.

Consider antibiotic prophylaxis in selected cases:

- People who cannot tolerate even a brief illness (e.g., elite athletes, business or political travelers);
- People at high risk of travelers' diarrhea due to achlorhydria, gastrectomy or history of repeated episodes of severe travelers' diarrhea;

Table 10: **Nonprescription Agents for Prevention and Treatment of Travelers' Diarrhea**<sup>16,20,21,38</sup>

| Drug                        | Dosage   | Adverse effects   | Drug interactions  | Comments  |
|-----------------------------|--|---|--|---|
| Bismuth subsalicylate (BSS) | Prevention: 2 × 262 mg tabs or equivalent suspension QID<br>Treatment: 2 × 262 mg tabs or equivalent suspension every 30 min × 8 doses | Black tongue/stools, tinnitus   | Avoid in patients taking anticoagulants or salicylates, probenecid, methotrexate.<br>Can interfere with absorption of doxycycline (which may be used for malaria prevention) | Avoid in patients with history of ASA allergy.<br>Limit prophylaxis to 3 wks.<br>Not for children < 2 yrs.  |
| Loperamide                  | Prevention: Not recommended.<br>Treatment: 4 mg stat then 2 mg after q loose BM<br>Max: 16 mg per day                                  | Abdominal pain or discomfort, drowsiness or dizziness, dry mouth, skin rash |  | Contraindicated in children < 2 yrs.<br>Caution in children < 12 yrs.<br>Drug of choice as antimotility agent for treatment of travelers' diarrhea. |

- Those who are immunosuppressed;
- Those with chronic illness at increased risk of experiencing complications due to travelers' diarrhea (see Pathophysiology).

**Typhoid vaccine** is recommended for travelers who will have significant exposure to contaminated food and water in smaller cities and villages or rural areas off the usual tourist routes. **Cholera vaccine** may be of benefit to health care workers in endemic areas or aid workers in refugee camps, but it is not recommended for most travelers.<sup>16</sup>

Methods for purifying untreated water are discussed in Appendix D: Information for the Traveler.

## Nonpharmacologic Therapy

Travelers are advised to maintain and possibly increase their fluid intake during bouts of diarrhea, though dehydration is not a major concern. Health Canada suggests that children and the elderly use ORS, while healthy adults maintain hydration with canned juices, purified water, carbonated soft drinks or clear salty soups to maintain light-colored urine and relieve thirst.<sup>16</sup>

## Pharmacologic Therapy

Nonprescription agents for the prevention and treatment of travelers' diarrhea are described in Table 10. **Golden seal** (*Hydrastis canadensis*) has been used to treat travelers' diarrhea. The primary active constituent is thought to be **berberine**. There are limited human data to support the efficacy of golden seal or berberine in the treatment of infectious diarrhea. The dose of berberine sulfate used in clinical studies was 400 mg per day given in one to four doses. The adult dose of dried herb is 0.5 to 1 g, three times daily. Safety in children or during breastfeeding has not been established. Golden seal is contraindicated during pregnancy. The use of golden seal extracts appears safe. However, administration of high doses of berberine may result in serious adverse effects (e.g., hypertension, seizures, respiratory failure).<sup>39,40</sup>

Antibiotics useful in treating travelers' diarrhea include the quinolones, azithromycin and cefixime. Trimethoprim/sulfamethoxazole is of limited use due to widespread resistance.<sup>16</sup> Prior to departure, travelers should see a physician for appropriate antibiotics for use in case of diarrhea while traveling.

## Monitoring of Therapy<sup>16,37</sup>

Patients can monitor their condition based on the frequency and severity of symptoms. They can expect a fairly brief illness if they take medication and in some cases even without medication. Monitoring includes reduction of loose, watery stools to  $\leq 1$  per day within two to three days. Medical attention should be sought if the patient develops signs of dehydration, or if a child less than two years of age develops bloody stools, a rectal temperature  $> 38.9^{\circ}\text{C}$  or persistent vomiting. Should symptoms persist longer than 14 days once back from vacation, a physician should be consulted.

### Suggested Readings

#### Diarrhea

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## Diarrhea—Patient Information

Almost everyone has diarrhea at some time in their life. It is especially common in children, who may have diarrhea two or three times a year. Diarrhea is usually caused by an infection or food poisoning but may also be due to drugs, food intolerance, disease, stress or anxiety.

Here are some things you can do to help protect yourself against diarrhea due to infections or food poisoning:

- Wash your hands after going to the toilet or changing a diaper, and before eating or preparing food.
- Do not drink milk or fruit juices that have not been pasteurized (check the label).
- Cook foods thoroughly, especially red meat, poultry (chicken and turkey) and eggs.
- Eat food soon after it is cooked so that germs do not have time to grow on it.
- Rinse fresh fruits and vegetables under running water before you eat them.
- Keep hot foods hot (60°C) and cold foods cold (4°C).
- Keep raw meat and poultry away from cooked food and fresh fruit and vegetables, especially while preparing food.
- Use separate cutting boards for raw meats and other foods.
- If serving leftovers, make sure they are reheated all the way through.
- Use soap and water to clean counters, cutting boards and utensils.

If you do get diarrhea, make sure you get enough fluids. This is especially important in children and older people, and in people with chronic medical conditions. These people should use special mixtures of water and salts (called oral rehydration solutions) to make sure they do not get dehydrated. Talk to your pharmacist to see if you should use these, or if medication would help with your diarrhea.

See a doctor if *any* of the following is true:

- You have a high fever (over 38.5°C or 101°F);
- Your bowel movement has blood in it or looks black;
- Your diarrhea lasts longer than two days;
- You have severe pain in your belly;
- You cannot keep fluids down;
- You have more than six bowel movements in one day;
- You feel dehydrated (very thirsty, weak or light-headed, dry mouth or tongue, not urinating as often as usual).

Children with diarrhea should *also* see a doctor if:

- They are less than six months old, *or*
- They have vomiting that lasts longer than four to six hours, *or*
- They seem dehydrated. Children may be dehydrated if they have a dry mouth or tongue, they have no tears when they cry, they have less than four wet diapers in 24 hours, their eyes or soft spot are sunken, they are irritable or have low energy.

## Travelers' Diarrhea—Patient Information

Travelers to developing countries in areas such as Latin America, Asia and Africa may develop diarrhea during the course of their trip. This is almost always due to contaminated food or water and usually gets better on its own in a few days without causing serious problems.

If you travel to one of these areas you should bring an antidiarrheal and a thermometer. Your pharmacist can help you choose the right antidiarrheal for you. Before you travel talk to your doctor about antibiotics. Many people bring antibiotics with them to take in case they do get diarrhea. A few people need to take medication to prevent diarrhea from happening at all.

Here are some things you can do to prevent diarrhea while traveling:

- Only eat foods and drink fluids that are unlikely to make you sick. These are:
  - piping hot foods
  - fruit you peel yourself
  - cooked vegetables
  - carbonated beverages (with no ice cubes)
  - boiled or bottled water
  - pasteurized milk (properly stored).
- Avoid foods likely to make you sick. These include:
  - buffet foods at room temperature
  - fresh soft cheese
  - food from street vendors
  - cold salads
  - raw vegetables
  - uncooked/cold sauces
  - unpeeled fruit
  - raspberries, strawberries, watermelon
  - ice cubes
  - undercooked meat or fish
  - shellfish
  - large reef fish such as snapper, barracuda, grouper, jack and Moray eel
  - custards, mousses, mayonnaise and hollandaise sauce.
- Remember the saying “Boil it, cook it, peel it or forget it.”
- Wash your hands, especially before you eat.
- Avoid drinking water while swimming
- Do not drink local water.
- Drink bottled beverages from their original containers and make sure the cap is properly sealed.

Talk to your pharmacist about what to do if you have diarrhea while you are away.