

ACUTE GASTROENTERITIS

Introduction

In 1992, the Centers for Disease Control prepared the first national guidelines for managing pediatric diarrhea and published them in MMWR. In 1996, the Subcommittee on Acute Gastroenteritis, of the Provisional Committee on Quality Improvement of the AAP, published a practice parameter for the management of acute gastroenteritis in young children (ages 1mo to 5yo). Subsequently, in 2003 the CDC published an update to their original recommendations, which the AAP endorsed in 2004.

- Statistics in the United States:
 - accounts for > 1.5 million outpatient visits/year
 - accounts for 200,000 hospitalizations/year
 - accounts for 300 deaths/year
 - estimated responsible for 9% of *all* hospitalizations of children <5yo
 - incidence of diarrhea in children <3yo estimated at 1.3-2.3 episodes/child/year
** higher for children in day care

- Statistics Worldwide:
 - diarrheal disease is leading cause of pediatric morbidity and mortality
 - 1.5 (3-5) billion episodes annually in children < 5yo
 - 1.5-2.5 million deaths annually in children <5yo
** these numbers are a significant *improvement!*

- Definitions and Terms:
 - Acute Gastroenteritis (AGE): diarrheal disease of rapid onset, with or without accompanying symptoms, signs, such as nausea, vomiting, fever, or abdominal pain
 - Diarrhea: the frequent passage of unformed liquid stools (3 or more loose, watery stool per day)
 - Dysentery: blood or mucus in stools
 - Excluded from most discussions of AGE:
 - episodes of diarrhea lasting > 10days
 - diarrhea accompanying failure to thrive
 - vomiting with no accompanying diarrhea

- Etiologies:
 - 70-85% of AGE in developed countries are due to viruses
 - Rotavirus accounts for 1/3 of all pediatric AGE hospitalizations in U.S.
 - Most common bacterial causes: Campylobacter, Salmonella, Shigella, E. coli, Yersinia, and C. difficile (iatrogenic)
 - Parasitic agents (e.g. Giardia) cause less than 10% of cases

Early Intervention

Home interventions are an important aspect of early management of acute gastroenteritis. Physicians can triage most patients via phone or office examination.

Reasons for early medical evaluation of children with acute diarrhea:

- young age (<6mo or <8kg)
- h/o prematurity, chronic medical condition, concurrent illness
- temperature >37.9 if <3 mo, or >38.9 in 3-36mo
- visible blood in stool
- high output
- persistent emesis
- caregiver report of signs of dehydration
- change in mental status (including irritability, apathy or lethargy)
- suboptimal response to oral rehydration attempts

Clinical Assessment

A thorough and relevant history must be taken, including onset, frequency, character and quantity of stools, as well as intake. Social history (e.g. caregivers, daycare) and past medical history (e.g. recent infections, medications, and medical problems) are also necessary.

Ideally, amount of acute change in weight is the best way to determine degree of dehydration. However, if a pre-illness weight is not available, clinical signs and symptoms can be utilized to determine degree of dehydration.

TABLE 1. Symptoms associated with dehydration

Symptom	Minimal or no dehydration (<3% loss of body weight)	Mild to moderate dehydration (3%–9% loss of body weight)	Severe dehydration (>9% loss of body weight)
Mental status	Well; alert	Normal, fatigued or restless, irritable	Apathetic, lethargic, unconscious
Thirst	Drinks normally; might refuse liquids	Thirsty; eager to drink	Drinks poorly; unable to drink
Heart rate	Normal	Normal to increased	Tachycardia, with bradycardia in most severe cases
Quality of pulses	Normal	Normal to decreased	Weak, thready, or impalpable
Breathing	Normal	Normal; fast	Deep
Eyes	Normal	Slightly sunken	Deeply sunken
Tears	Present	Decreased	Absent
Mouth and tongue	Moist	Dry	Parched
Skin fold	Instant recoil	Recoil in <2 seconds	Recoil in >2 seconds
Capillary refill	Normal	Prolonged	Prolonged; minimal
Extremities	Warm	Cool	Cold; mottled; cyanotic
Urine output	Normal to decreased	Decreased	Minimal

Sources: Adapted from Duggan C, Santosham M, Glass RI. The management of acute diarrhea in children: oral rehydration, maintenance, and nutritional therapy. *MMWR* 1992;41 (No. RR-16):1–20; and World Health Organization. The treatment of diarrhoea: a manual for physicians and other senior health workers. Geneva, Switzerland: World Health Organization, 1995. Available at http://www.who.int/child-adolescent-health/New_Publications/CHILD_HEALTH/WHO.CDR.95.3.htm.

Laboratory Management

Routine cases of AGE do not require extensive laboratory work-up.

- Stool cultures are indicated in cases of dysentery or where the diagnosis of AGE is unclear.
- Serum electrolytes should be considered in cases of moderate to severe dehydration, when the case is not straightforward, or when IV fluids are required
- Also consider electrolytes if symptoms of hyernatremia (irritability, doughy skin)

Fluid Management

Oral rehydration therapy has repeatedly been proven to be as effective as intravenous fluids in treatment of mild to moderate dehydration both outpatient and inpatient. Methods of delivery include po and ng.

Some studies have demonstrated decreased ER stays and increased parent satisfaction with ORS therapy over IV therapy. There is no difference, however, in duration of illness or hospitalization rates.

Oral rehydration solutions contain glucose plus electrolytes. Many easily available solutions (e.g. Pedialyte) have 45-50 mmol/L of sodium, which is at lower end of that studied. These are best for maintenance fluids, but can be utilized for rehydration in otherwise healthy children.

Rehydration protocols:

- Mild:
 - 50cc/kg of ORS plus replacement over 4 hours**
 - begin with 5cc aliquots q1-2 min with volumes increasing as tolerated
- Moderate:
 - 100cc/kg of ORS plus replacement over 4 hours
 - As for mild, but should be in supervised setting (ER, office)
- Severe:
 - 20cc/kg of isotonic IV fluids over one hour
 - Repeat as necessary
 - Continue replacement for stools

** ongoing losses can be matched at approximately 10cc/kg for each stool

TABLE 3. Composition of commercial oral rehydration solutions (ORS) and commonly consumed beverages

Solution	Carbohydrate (gm/L)	Sodium (mmol/L)	Potassium (mmol/L)	Chloride (mmol/L)	Base* (mmol/L)	Osmolarity (mOsm/L)
ORS						
World Health Organization (WHO) (2002)	13.5	75	20	65	30	245
WHO (1975)	20	90	20	80	30	311
European Society of Paediatric Gastroenterology, Hepatology and Nutrition	16	60	20	60	30	240
Enfalyte ^{®†}	30	50	25	45	34	200
Pedialyte ^{®§}	25	45	20	35	30	250
Rehydralyte ^{®¶}	25	75	20	65	30	305
CeraLyte ^{®**}	40	50-90	20	NA ^{††}	30	220
Commonly used beverages (not appropriate for diarrhea treatment)						
Apple juice ^{§§}	120	0.4	44	45	N/A	730
Coca-Cola ^{®¶¶} Classic	112	1.6	N/A	N/A	13.4	650

* Actual or potential bicarbonate (e.g., lactate, citrate, or acetate).

† Mead-Johnson Laboratories, Princeton, New Jersey. Additional information is available at <http://www.meadjohnson.com/products/cons-infant/enfalyte.html>.

§ Ross Laboratories (Abbott Laboratories), Columbus, Ohio. Data regarding Flavored and Freezer Pop Pedialyte are identical. Additional information is available at <http://www.pedialyte.com>.

¶ Ross Laboratories (Abbott Laboratories), Columbus, Ohio. Additional information is available at http://rpdcon40.ross.com/pn/PediatricProducts.NSF/web_Ross.com_XML_PediatricNutrition/96A5745B1183947385256A80007546E5?OpenDocument.

** Cera Products, L.L.C., Jessup, Maryland. Additional information is available at <http://www.ceralyte.com/index.htm>.

†† Not applicable.

§§ Meeting U.S. Department of Agriculture minimum requirements.

¶¶ Coca-Cola Corporation, Atlanta, Georgia. Figures do not include electrolytes that might be present in local water used for bottling. Base = phosphate.

Dietary, Medical and Other Adjuvant Therapy

- Dietary Therapy
 - All children should be returned to age appropriate diets upon initial rehydration
 - “Resting the gut” is an inappropriate approach; early refeeding has been shown to reduce illness duration, improve nutritional outcomes and decrease changes to intestinal permeability
 - Diluting formula has been shown to prolong symptoms and delay nutritional recovery
 - Lactose-free formulas are largely unnecessary; a meta-analysis concluded that at least 80% of children could tolerate full-strength milk.
 - “BRAT” diet and other restrictive diets are unnecessary and provide suboptimal nutrition
 - Foods high in simple sugars should be avoided due to osmotic load (see: carbonated soft drinks, juice, gelatin desserts, etc)

- Medications
 - Antidiarrheals (e.g. loperamide, opiates, bismuth subsalicylate) are not recommended for use in AGE. Opiates are contraindicated, and the others have limited scientific evidence to outweigh risks)
 - Antiemetics currently anti-emetics are not recommended in the treatment of AGE. Though some clinical studies have demonstrated that ondansetron can decrease vomiting and hospitalization.

- Probiotics
 - Normally, gut flora (saccharolytic bacteria) ferment dietary carbohydrates that have not been absorbed. Diarrhea reduces fecal flora.
 - Probiotics (e.g. *Lactobacillus GG*) alter the composition of gut flora and assist in restoring normal gut function.
 - More studies are supporting the use of probiotics, specifically *Lactobacillus GG*, as an adjuvant therapy in AGE.

References

American Academy of Pediatrics Provisional Committee on Quality Improvement Subcommittee on Acute Gastroenteritis. Practice parameter: the management of acute gastroenteritis in young children. *Pediatrics*. 1996; 97:424-35.

Borowitz SM. Are antiemetics helpful in young children suffering from acute viral gastroenteritis? *Arch Dis Child*. 2005; 90:646-8.

Grunenberg N. Is gradual introduction of feeding better than immediate normal feeding in children with gastroenteritis? *Arch Dis Child*. 2003; 88:455-7.

Guandalini S, et al. Lactobacillus GG administered in oral rehydration solution to children with acute diarrhea: a multicenter european trial. *J Pediatr Gastroenterol Nut*. 2000; 30:54-60.

King CK, Glass R, Bresee JS, Duggan C. Managing acute gastroenteritis among children: oral rehydration, maintenance, and nutritional therapy. *MMWR*. 2003; 52(RR-16):1-16.

Sandhu BK. Rationale for early feeding in childhood gastroenteritis. *J Pediatr Gastroenterol Nut*. 2001; 33:S13-S16.

Szajewska H and Mrukowicz J. Probiotics in the treatment and prevention of acute infectious diarrhea in infants and children: a systematic review of published randomized, double-blind, placebo-controlled trials. *J Pediatr Gastroenterol Nut*. 2001; 33:S17-S25.