

DEFINITION

Gastroenteritis is an inflammatory process (usually infectious) involving the gastrointestinal (GI) tract and resulting in diarrhea and vomiting.

Though often considered a benign process, acute gastroenteritis remains a major cause of pediatric morbidity and mortality around the world, accounting for 1.87 million deaths annually in children < 5 years of age.

IMMEDIATE CONSULTATION REQUIRED IN THE FOLLOWING SITUATIONS

- Moderate to severe dehydration
 - Altered mental status
 - Weak rapid pulse
 - Marked decreased urine output
 - Sunken fontanel
 - Hypotension
 - Delayed capillary refill > 2 seconds
- Unable to tolerate fluids by mouth
- Infant < 6 months of age
- Toxic appearing child: Toxic appearing infants and children may be pale or cyanotic and are often lethargic or inconsolably irritable. In addition, they may have tachypnea and tachycardia with poor capillary refill.
- Hypotonia
- Malnutrition
- Hematemesis
- Absent bowel sounds
- Focal abdominal pain
- Bloody stool
- Seizure activity
- Underlying disease (cardiac)
- Immunocompromised client
- Inability of the child's care to be managed at home

Refer to SRNA CDT Dehydration (Hypovolemia) Pediatric as a follow-up to this CDT.

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CAUSES

Viruses are the most common cause of acute gastroenteritis in children. The two primary mechanisms responsible for acute gastroenteritis are as follows:

1. Damage to the villous brush border of the intestine causing malabsorption of intestinal contents and leading to osmotic diarrhea.
2. Release of toxins that bind to specific enterocyte receptors and cause the release of chloride ions into the intestinal lumen, leading to secretory diarrhea.

Viruses

Norovirus (Norwalk-like virus) has been identified as the chief culprit in acute gastroenteritis in young children. These viruses are responsible for 50% of food-borne outbreaks of gastroenteritis.

The availability of rotovirus vaccines has made rotovirus less of a factor in immunized children.

- Rotavirus vaccine is provided to children in Saskatchewan at 2 and 4 months of age.
- Rotavirus: most common cause in children 6-24 months of age.

Enteric adenovirus: common in children < 2 years of age.

Bacteria

- Salmonella
- Shigella
- *Escherichia coli*
- Campylobacter
- *Clostridium difficile* (*C. difficile*) infection (antibiotics such as penicillins and clindamycin are precipitating factors)

Parasites

- Giardia
- Cryptosporidium

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PREDISPOSING AND RISK FACTORS

- Food and water poisoning
- Adverse outcome of antibiotic therapy (e.g., *C. difficile*)
- Metabolic causes (such as new-onset diabetes mellitus)
- Overfeeding (in newborns)
- Food allergies or intolerance
- Central nervous system related (e.g., increased intracranial pressure)
- Parenteral infection (e.g., otitis media, urinary tract infection [UTI], pharyngitis)
- GI ulcers
- Surgical conditions (e.g., appendicitis)
- Medications or drug use
- Pregnancy (vomiting)
- Eating disorder (vomiting)
- Acute phases of inflammatory bowel disease (ulcerative colitis and Crohn's disease)

HISTORY

The history and physical examination serve two vital functions:

1. Differentiating gastroenteritis from other causes of vomiting and diarrhea in children; and
2. Estimating the degree of dehydration.

Diarrhea: duration of the diarrhea, the frequency, amount of stools, the time since last episode of diarrhea, the quality of the stools.

- Watery stools are more consistent with viral gastroenteritis whereas stools with blood or mucus are indicative of a bacterial pathogen.
- A long duration of diarrhea (> 14 days) is more consistent with a parasite or noninfectious cause of diarrhea.

Vomiting: duration of vomiting, the amount and quality of vomitus (e.g., food contents, blood, bile), and time since last episode of vomiting.

- When symptoms of vomiting predominate, one can consider other diseases such as gastroesophageal reflux disease (GERD), diabetic ketoacidosis, pyloric stenosis, acute abdomen, or UTI.

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Urination: increase or decrease in frequency of urination measured by the number of wet diapers, time since last urination, colour and concentration of urine, and presence of dysuria. Urine output may be difficult to determine with frequent watery stools.

Abdominal Pain: location, quality, radiation, severity, and timing of pain as reported by parents/caregiver and/or child. In general, pain that precedes vomiting and diarrhea is more likely to be due to abdominal pathology other than gastroenteritis.

Signs of Infection: presence of fever, chills, myalgias, rash, rhinorrhea, sore throat, and cough. These may indicate systemic infection or sepsis.

Appearance and Behaviour: weight loss, quality of feeding, amount and frequency of feeding, level of thirst, level of alertness, increased malaise, lethargy or irritability, quality of crying, and presence or absence of tears with crying.

Antibiotics: history of recent antibiotic use increases the likelihood of *C. difficile*.

Travel: history of travel to endemic areas may make prompt consideration of organisms relatively rare in Saskatchewan such as parasitic illnesses or cholera.

PHYSICAL FINDINGS

Dehydration in the pediatric population can develop rapidly and can be lethal if not managed quickly and effectively.

Assessment of Dehydration:

According to the World Health Organization (WHO), a client exhibiting two of the following signs can be considered to have some amount of dehydration.

Consultation with a physician/RN(NP) is needed if this is present:

- Restlessness, irritability
- Sunken eyes
- Thirsty, drinks eagerly
- Skin pinch goes back slowly

According to the WHO, a client exhibiting two of the following signs can be considered

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to have severe dehydration. Consultation regarding medical transport with a physician/RN(NP) is needed in this situation:

- Lethargic or unconscious
- Sunken eyes
- Not able to drink or drinking poorly
- Skin pinch goes back very slowly

General:

- Weight, ill appearance, level of alertness, lethargy, irritability

Head, Eyes, Ears, Nose, Throat (HEENT)

- Presence of tears, dry or moist mucous membranes, and whether the eyes appear sunken

Cardiovascular:

- Heart rate and quality of pulses

Respiratory:

- Rate and quality of respirations (the presence of deep, acidotic breathing suggests severe dehydration)

Abdomen:

- Abdominal tenderness, guarding, and rebound, bowel sounds. Tenderness on exam should prompt consideration of diseases other than gastroenteritis.

Back:

- Flank/costovertebral angle tenderness increases the likelihood of pyelonephritis

Rectal:

- Quality and colour of stool, presence of gross blood or mucus

Extremities:

- Capillary refill time (> 2 sec), warm or cool extremities

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Skin:

- Abdominal rash may indicate typhoid fever (infection with *Salmonella typhi*).
- Jaundice may indicate viral or toxic hepatitis.
- The slow return of abdominal skin pinch suggests decreased skin turgor and dehydration, while a doughy feel may indicate hyponatremia.

DIFFERENTIAL DIAGNOSIS

- Diabetic ketoacidosis
- Gastritis and peptic ulcer disease
- Giardiasis
- Hemolytic uremic syndrome
- Hepatitis
- Inflammatory bowel disease
- Pancreatitis
- Appendicitis
- Foreign body ingestion
- Intussusception
- UTI and pyelonephritis
- Septic shock

COMPLICATIONS

- Complications depend on the cause of the diarrhea and/or vomiting.
- Complications are related to shock from decreased total body water, hypoxemia, and tissue acidosis.
- Death usually occurs with severe complications when severe dehydration is not addressed by prompt rehydration.

INVESTIGATIONS AND DIAGNOSTIC TESTS

- Tests are dependent on suspected cause(s). These may include urinalysis, blood tests, stool for culture and sensitivity, occult blood, and/or ova and parasite.
- Fecal leukocytes and stool culture may be helpful in children presenting with dysentery. Children > 12 months of age with a recent history of antibiotic use should have stool tested for *C. difficile* toxins.

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- Those with a history of prolonged watery diarrhea (> 14 days) or travel to an endemic area should have stool sent for ova and parasites.

MAKING THE DIAGNOSIS

- Definitive diagnosis cannot be made solely on clinical grounds and confirmatory tests are not routinely performed due to the high-cost and the self-limiting nature of the illness.
- Abdominal tenderness with or without guarding should prompt consideration of other causes.
- Abdominal rash may indicate typhoid fever whereas jaundice may indicate viral hepatitis.
- Frequent watery stools are more consistent with viral gastroenteritis.
- Stools with blood or mucus are indicative of a bacterial pathogen.
- Long duration of diarrhea (> 14 days) is more consistent with a parasitic or non-infectious cause of diarrhea.
- When symptoms of vomiting predominate, consider other causes such as GERD, diabetic ketoacidosis, pyloric stenosis, acute abdomen, or UTI.
- Abdominal pain that precedes vomiting and diarrhea is more likely due to abdominal pathology.
- Presence of fever, chills, myalgia, rash, rhinorrhea, sore throat, and cough are indicative of a systemic infection.
- History of recent antibiotic use increases the likelihood of *C. difficile*.
- History of travel to endemic areas prompts consideration of parasitic disease.

MANAGEMENT AND INTERVENTIONS

Goals of Treatment

- Maintain adequate hydration
- Rehydrate
- Prevent complications
- Make the appropriate diagnosis

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Appropriate Consultation

- Consult a physician/RN(NP) as soon as possible for any infant or young child with signs of moderate to severe dehydration. If the child presents with severe signs (e.g., shock), prepare child for transfer to hospital.

Non-Pharmacological Interventions

- Consult a physician/RN(NP) for treatment if child is moderately or severely dehydrated.

Fluid Management

- Oral therapy is always safer than, and as effective as, intravenous therapy.
- Oral replacement therapy is contraindicated in children with protracted vomiting (even with small frequent feedings); severe dehydration with shock; impaired consciousness; paralytic ileus; and monosaccharide malabsorption.
- Oral replacement therapy (e.g., Pedialyte, Gastrolyte) should be given frequently and in small amounts while gradually increasing the volume until the child drinks as desired (e.g., 5 mL every 1-2 minutes can give 150-300 mL/hour).
- Use of a pre-mixed solution (e.g., Pedialyte, Gastrolyte) is safest.
- If a pre-mixed solution is not available the following recipe can be provided: Six level teaspoons of sugar, with half a level teaspoon salt, in one litre of clean (boiled and cooled, if necessary) water.
- Carbonated beverages and sweetened fruit juices **should not** be used for rehydration purposes due to their high carbohydrate and low electrolyte content.
- Parents and caregivers **should not** offer plain water to children with gastroenteritis to avoid hyponatremia and hypoglycemia.
- Continue breastfeeding for fluid requirements if child is able to suck effectively. Supplement with Pedialyte/Gastrolyte.
- When a bottle-fed child is able to return to formula, consult a physician/RN(NP) about changing to a soy-based formula (e.g., Prosobee, Isomil). Switch back to regular formula in 7-10 days. Do not go back to Pedialyte/Gastrolyte unless there is a marked increase in stools while on the soy formula.

Mild - Moderate Dehydration

- Start rehydration with oral replacement solution: 50-100 mL/kg over 4 hours at

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- an approximate rate of 1-2 mL/kg every 5 minutes (this is the fluid deficit volume). Close observation is recommended.
- Reassess at 4 hour intervals by monitoring urine output (e.g., number of wet diapers/hour).
 - From 4-24 hours, give oral replacement therapy as the child desires, ensuring replacement of maintenance requirements and any losses.
 - Give extra oral replacement solution after each emesis (e.g., 2 mL/kg) or diarrheal stool (e.g., 5-10 mL/kg).
 - Give fluid frequently in small amounts.
 - Monitor urine output (output should be at least 1 mL/kg body weight per hour or normal amount of wet diapers for that child).
 - Continue breastfeeding; if child is bottle-fed, early re-feeding of child's normal formula (within 6-12 hours) is recommended.
 - Full, age-appropriate diet should be reinstated after 4 hours if possible.
 - Delay re-feeding only if there is severe, protracted vomiting.

Pharmacological Interventions

- Antispasmodic and antidiarrheal agents should not be used. Explain to the parents or caregiver that it is best to consider the diarrhea as a purging process to rid the intestinal tract of organisms. The most important part of managing diarrhea is the replacement of lost fluids. There is also a very limited role for antiemetic agents.
 - Dimenhydrinate (Gravol) 1.25 mg/kg orally/IM/IV q6h prn
- Antimicrobial agents are usually not indicated, even for bacterial infection. An exception is gastroenteritis caused by *Giardia lamblia* which after a diagnosis is confirmed by a positive stool culture and is usually treated as follows:
 - MetroNIDAZOLE (Flagyl) 15 mg/kg/day orally, divided three times daily for 5 days (maximum dose 750 mg/day)

Client and Caregiver Education

- Parent, caregiver, and child handwashing with soap after toileting, before meals, especially by parent/caregiver after diaper changing.
- Diaper changing areas should be separate from eating areas.

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- Disinfection of diaper changing area: 70% alcohol solution (rotavirus) or bleach. Prepare in a spray bottle.
- Water purification: boil water for 20 minutes or use chlorine tablets or solution.
- Vaccination to prevent viral illnesses - rotavirus vaccination for infants.

Prevention

- Vaccines (rotavirus, typhoid, Dukoral)
- Handwashing
- Ensure meat is fully cooked
- Hygienic food preparation practices

Monitoring and Follow-Up

Gastroenteritis without Dehydration

- Re-evaluate the child with mild symptoms (treated at home) within 24 hours. Be sure to recheck child's weight. Ensure that the parent or caregiver is aware of the signs and symptoms of dehydration and instruct him or her to return immediately if dehydration occurs or worsens or if the child cannot ingest an adequate quantity of fluid. Monitor output by assessing the number of diapers. The frequency should return to pre-diagnosis levels.

Gastroenteritis with Dehydration

- Record vital signs, clinical condition, intake and output, and weight frequently when rehydrating a child with dehydration. Keep the child under observation at the clinic.
- Consult with a physician/RN(NP) for treatment process.

Referral

- Infants or children with mild dehydration, who respond after 4 hours of rehydration, may be sent home on maintenance therapy; if symptoms of dehydration persist and the child continues to have fluid losses, the child should be transferred to hospital.
- The decision to continue home management should be made in consultation with a physician/RN(NP) and depends primarily on the ability of the parents or caregiver to provide adequate care and on other factors such as the distance of their home from the treatment facility.

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- All children with significant dehydration (moderate to severe) should be transferred to hospital.
- Children with significant dehydration can be rehydrated substantially in the nursing station while awaiting transport.
- Consult a physician/RN(NP) for any child with an underlying comorbidity (e.g., diabetes, congenital abnormalities, complex medical history, or when a diagnosis of underlying cause is uncertain).

DOCUMENTATION

- As per employer policy

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