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## CHAPTER 12 – GASTROINTESTINAL SYSTEM

*First Nations and Inuit Health Branch (FNIHB) Pediatric Clinical Practice Guidelines for Nurses in Primary Care*  
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### Table of contents

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ASSESSMENT OF THE GASTROINTESTINAL SYSTEM .....	12-1
History of Present Illness and Review of Systems .....	12-1
Physical Examination .....	12-1
COMMON PROBLEMS OF THE GASTROINTESTINAL SYSTEM .....	12-2
Colic .....	12-2
Constipation .....	12-4
Gastroenteritis including Acute Diarrhea and Acute Vomiting .....	12-7
Gastroesophageal Reflux Disease (GERD).....	12-11
Inguinal Hernia .....	12-13
Jaundice.....	12-14
Recurrent Abdominal Pain .....	12-17
Umbilical Hernia .....	12-19
EMERGENCY PROBLEMS OF THE GASTROINTESTINAL SYSTEM.....	12-20
Acute Abdominal Pain .....	12-20
Appendicitis.....	12-22
Bowel Obstruction .....	12-24
Gastrointestinal Bleeding .....	12-25
Intussusception .....	12-25
SOURCES.....	12-27



## ASSESSMENT OF THE GASTROINTESTINAL SYSTEM

See chapter 5 of the the adult clinical guidelines for more information on the history and physical examination of the gastrointestinal system in older children and adolescents.

### HISTORY OF PRESENT ILLNESS AND REVIEW OF SYSTEMS

#### BOWEL HABITS

- Frequency, quantity, colour and consistency of stool
- Presence of blood, mucus
- Pain before, during or after defecation

#### ABDOMINAL PAIN

- Location
- Frequency
- Duration
- Character (for example, crampy or constant, sharp or stabbing)
- Radiation
- Onset (sudden or gradual)
- Progression from onset
- Aggravating and relieving factors
- Associated symptoms

#### VOMITING OR REGURGITATION

- Frequency
- Volume
- Force (for example, projectile)
- Colour
- Hematemesis
- Relationship to food intake

#### OTHER CHARACTERISTICS AND SYMPTOMS

- Fever
- Growth history (see “Growth Measurements” in Chapter 3, “Pediatric Prevention and Health Maintenance”)
- Appetite
- Food and fluid intake since onset of illness
- Usual nutrition and food habits: type of foods eaten, variety of foods in diet, quantity of food eaten, dietary balance, fibre content of diet
- Dysphagia
- Weight loss or weight gain

- Colour (for example, presence of jaundice)
- Skin (for example, pruritus, rash)
- Activity level
- History of previous GI diseases or abdominal surgery
- Medications (for example, iron)
- Allergies, especially known allergies to food (for example, lactose intolerance)

### PHYSICAL EXAMINATION

#### GENERAL APPEARANCE

- Apparent state of health
- Appearance of comfort or distress
- Position of child and presence of guarding (child’s behaviour can also give very good clues as to the severity of any abdominal pain)
- Colour (for example, flushed, pale, jaundiced)
- Nutritional status (obese or emaciated)
- State of hydration (skin turgor, mucous membrane moisture)

#### VITAL SIGNS

- Temperature may be elevated in infection
- Blood pressure usually normal
- Tachycardia or bradycardia may be present
- Respiratory rate
- Obtain weight, height and head circumference when possible and/or applicable

#### INSPECTION

- Size, shape and contour; note any distension or asymmetry (in infancy, abdomen is typically protuberant; in early childhood the abdomen is still protuberant, but flattens when the child is lying down)
- Peristalsis
- Visible masses

#### AUSCULTATION

Auscultation, to listen for bowel sounds, should be done before palpation.

Listen for quality and quantity of bowel sounds. An increase in bowel sounds alone is not significant, because this can occur with anxiety or mild gastroenteritis. However, it may also be a sign of obstruction.

### **Percussion**

- General percussion in all four quadrants for normal tympany
- Delineate span of liver; upper border is in the mid-clavicular line, between the fourth and sixth intercostal spaces
- Determine spleen size
- Shifting dullness to assess for ascites in the abdomen. There will be dullness to percussion on the dependent side when the child is in a side-lying position; the border of the percussion note will change to a new more lateral position several moments after the child assumes a supine recumbent position

### **PALPATION**

Ideally, palpation is performed with the child lying supine, with hands by the sides and relaxed. Be sure your hands are warm. The child's abdomen must be completely exposed. Examine all four quadrants in succession. If there is pain, start with the painless areas, and palpate the painful area last. Palpation should be light at first, with progression to deep palpation by the end of the examination.

### **Light Palpation**

- Assess for tenderness, guarding, superficial masses
- Watch the child's facial expression

### **Deep Palpation**

- Feel for organs (liver, spleen, bladder and kidneys) and masses
- Assess for rebound tenderness (pain that occurs upon suddenly releasing the hand after deep palpation)
- Assess for referred tenderness (pain that is felt in an area distant to the area being palpated), which can be a clue to the location of the underlying disease

### **RECTAL EXAMINATION**

- Anal patency (check this feature only in newborns)
- Skin tags
- Sphincter tone
- Fissures
- Tenderness
- Masses
- Observe for frank blood or melena

## **COMMON PROBLEMS OF THE GASTROINTESTINAL SYSTEM**

### **COLIC<sup>1,2,3</sup>**

Episodes of inconsolable, uncontrollable crying or fussing in an otherwise healthy and well-fed infant less than 3 months old. Episodes last greater than 3 hours per day and greater than 3 days/week and have been present for at least 3 weeks. It typically resolves by 3–4 months and most commonly peaks at 6–8 weeks.

### **CAUSES**

The cause is unknown, although the possibility of a lag in the development of normal peristalsis or a lack of self-soothing mechanisms has been suggested.

### **HISTORY**

- Crying: age of onset, duration of episodes, time of day (usually during the afternoon or evening), frequency of episodes, associated factors like feeding or a recent fall
- Behaviour of infant during crying episodes: often pulls legs up to chest or rigidly stiffens the legs, flexes the elbows, clenches the fists, turns red and passes gas soon after feeding
- Behaviour and activity of infant at other times
- Feeding history: any difficulties, formula or breast, how much, how often, satisfaction with feeding
- Number of wet diapers per day
- Bowel movements: number per day, consistency, colour

**PHYSICAL FINDINGS**

All findings, except possibly behaviour and soothability during a colicky incident, will be normal for colic, but a comprehensive physical assessment, including vital signs, head circumference, height, weight and developmental milestones should be done to ensure there is no physical cause for the crying (*see “Physical Examination of the Newborn” in pediatric chapter 1 for more details*). Attention to the following will help rule out other causes of inconsolable crying:

- Skin: suspicious bruises or marks
- Palpation of long bones: for fractures
- Hair tourniquets (single strand of hair wrapped around an appendage: check all digits and penis)
- Retina: retinal hemorrhage (intracranial hemorrhage)
- Eye: check for foreign bodies

**DIFFERENTIAL DIAGNOSIS**

Colic is a diagnosis of exclusion.

- Normal crying (for all infants, the duration of crying increases until about 6 weeks, then decreases until 4 months (to less than 1 hour/day). It usually happens most during the late afternoon and evening (especially between the ages of 3 and 6 weeks). Different cries exist, likely for different needs (feeding, pain/gas, too hot or cold, change diaper, need for attention/to be held, need to suck, or expression of vigor)
- Child abuse
- Gastrointestinal causes of crying (constipation, anal fissure, gaseous distension, peristalsis problems, gastroesophageal reflux disease, intussusception, cow’s milk protein intolerance)
- Behavioural causes of crying (overstimulation, persistent night awakening)
- Drug reactions (immunizations, drug withdrawal)
- Hematologic causes of crying (sickle cell crisis)
- Injury
- Infection

**COMPLICATIONS**

None.

**DIAGNOSTIC TESTS**

None indicated if child is growing appropriately for their age, achieving developmental milestones, has a normal physical exam and the history does not elicit a cause for further investigation.

**MANAGEMENT**

If no diagnosis is apparent from the history and physical, infants who continue to cry inconsolably during the health care visit should be suspected of having a serious underlying condition.

**Goals of Treatment**

- Rule out serious underlying condition
- Prevent or treat complications
- Parental education and support

**Appropriate Consultation**

Consult a physician if no diagnosis is apparent from the history and physical, and the infant cries inconsolably during the health care visit.

**Nonpharmacologic Interventions**

- Educate the parent or caregiver about colic, including its course and benign nature, and that certain interventions may reduce the crying temporarily, but that it is unlikely to disappear with any intervention
- Provide support to the parent(s) or caregiver(s) by listening, providing reassurance, and encouraging them to get rest and relief help if possible
- Describe how the infant is growing and developing normally
- Educate the parents to never shake the baby

Suggest that the parents or caregivers respond to crying by trying to:

- Answer infant cries quickly, consistently and comprehensively
- Pick the child up and carry them around
- Check the diaper
- Hold the infant skin to skin
- Swaddle the infant
- Use rhythmic rocking movements, like an infant swing, car ride, or rocking chair
- Use a pacifier
- Have a continuous noise, like shushing or a fan
- Feed the infant in an upright position and burp them after 5–10 minutes of feeding; after this time, greater amounts of air are swallowed relative to the amount of milk ingested
- Place the infant across their knees (tummy down) and gently rub the infant’s back
- Distract them by lullabies, the mother’s voice, music or the vacuum
- Reduce external stimuli
- Position the infant in a side or stomach position while observed
- Avoid overfeeding (this decreases intestinal spasm)

There is some evidence that removing cow’s milk from the infant’s diet may reduce symptoms of colic in a small percentage of infants. This can be done by eliminating maternal consumption of dairy products if the infant is breastfeeding or feeding hypoallergenic formula (casein hydrolysates formula, for example, Alimentum or Nutramigen). Soy formulas should be avoided as soy protein is an important allergen in infants. Low-lactose or fibre-enriched formulas are not an effective treatment for colic. Monthly cow’s milk challenges are made to ensure that the effect is due to diet modification, not to natural resolution. Usually this is only tried if the infant has other symptoms of allergy.<sup>4</sup>

### **Pharmacologic Interventions**

Medications such as simethicone (for example, Ovol) and gripe water are of no proven benefit.<sup>5</sup>

### **Monitoring and Follow-Up**

Follow-up with infant and parent or caregiver in 2 to 3 days and then in 1 to 2 weeks to ensure interventions to provide support to the infant have been adopted.

### **Referral**

Determine need to medevac the infant in consultation with a physician. This may occur only if the infant is suspected to have a serious underlying condition causing the inconsolable crying.

## **CONSTIPATION**

Infrequent passage of hard, often dry stool. In 99% of cases, the cause of the constipation is never proven definitively. The condition is common in children, and often (in 60% of cases) occurs during the first year of life.

Constipation is a symptom, not a diagnosis. In all cases, the underlying cause must be sought, as many of the causes are correctable.

### **CAUSES**

#### **Dietary**

- Introduction of cow’s milk
- Inadequate fluid intake
- Under-nutrition
- Diet high in carbohydrates or protein (or both)
- Low-fibre diet

#### **Organic**

- Diseases causing abnormally dry stool
- Diabetes insipidus or diabetes mellitus
- Fanconi’s syndrome
- Idiopathic hypercalcemia

#### **Gastrointestinal Anomalies**

- Hirschsprung’s disease (congenital megacolon)
- Anorectal stenotic lesion, stricture or fissure
- Masses (intrinsic or extrinsic)
- Anterior anal displacement

#### **Central Nervous System Lesions**

- Hypotonia (benign congenital hypotonia)
- Hypertonia (cerebral palsy)

**OTHER CAUSES**

- Hypothyroidism
- Prune-belly syndrome
- Coercive toilet training
- Medications (for example, narcotic analgesics, iron)
- Lack of exercise
- Stress

**HISTORY**

- Change in frequency of bowel movements (in children older than infancy, a period of more than 3 days without a bowel movement is one of the best indicators of this condition)
- Consistency of stool (usually hard; in severe constipation, stools may be very thick)
- Pain on defecation
- Blood on stool
- Straining while passing stool
- Intermittent, crampy abdominal pain
- Constipation present since birth (in this situation, consider Hirschsprung’s disease)
- Dietary history, specifically low fibre content (the best sources of fiber are whole wheat bread and flour, bran, whole grain cereals, vegetables and some fruits)
- Family history of constipation
- Drugs that are constipating (for example, iron)
- Concurrent bladder incontinence or abnormal anal tone (neurologic)
- Medical conditions that may cause constipation (*see “Causes”*)
- Hypothyroidism (dry skin, lethargy, slow growth of hair and nails)

**PHYSICAL FINDINGS**

- Assess height and weight, plot on growth chart; determine if child is following adequate growth curve (*see “Growth Measurement” in pediatric chapter 3*).

**Abdominal Examination**

- Assess for tenderness and masses
- Fecal masses can usually be felt along the descending colon or in the suprapubic area

**Rectal Examination**

- Rectum for size, dilation and presence of stool
- Tone of external sphincter
- Reflex contraction of anus on gentle scratching of the perianal skin with a sharp object (anal wink reflex)
- Anal placement should be midline and midway between posterior fornix and coccyx
- Evidence of precipitating event (for example, anal fissure)

**DIFFERENTIAL DIAGNOSIS**

*See “Causes”*

In infancy, the possibility of Hirschsprung’s disease causes the greatest concern. This diagnosis is most likely in a baby who has been severely constipated from birth and in whom passage of meconium was delayed (that is, > 24 hours after birth).

**COMPLICATIONS**

- Overflow incontinence (encopresis) with fecal soiling (may be incorrectly characterized as diarrhea)
- Impaction with chronic dilatation
- Urinary tract infection with or without vesicoureteral reflux
- Intestinal obstruction

Constipation also seems to be related to enuresis.

**DIAGNOSTIC TESTS**

- Stool for blood
- Check urine (culture and sensitivity) to exclude UTI, which can be a complication of chronic constipation

**MANAGEMENT****Goals of Treatment**

- Rule out gastrointestinal emergency
- Relieve symptoms
- Establish regular bowel function
- Determine if there is any underlying cause
- Prevent or treat complications
- Encourage wise use of laxatives, to prevent dependence on these drugs

**Consultation**

- Consult a physician if constipation is not resolving despite interventions (*see “Referral” for other cases where one should consult*)

**Nonpharmacologic Interventions**

Interventions depend on age and severity of constipation.

- Give extra daily feeding of 2–4 oz. (60–125 mL) of water in addition to usual formula or breast milk
- Infants (> 6 months), toddlers and older children: prune juice, apple juice or pear juice may be effective; as solid foods are introduced, gradually increase fruits and vegetables as proportion of the diet. Prunes may also be effective
- Increase dietary fibre, if low
- Increase fluid intake, particularly water

**Client Education**

- Explain pathophysiology to family (and child, if old enough): draw a diagram of GI system and explain how stool is formed and the mechanism of constipation
- Encourage high-fibre, high-bulk diet. Most children eat a diet very low in fibre. A commitment on the part of the whole family is usually required to change this aspect of the diet. A good rationale for promoting a high-fibre diet for all family members is that high fibre intake may reduce the risk of cancer in later life and also evens out timing of carbohydrate absorption
- Stress importance of follow-up
- Educate about proper toilet training for toddlers: regular attempts just after meals, proper position (hips flexed, feet flat); do not coerce the child to toilet train

**Pharmacologic Interventions**

Medication is used only if organic pathology has been ruled out.

Infants (if distressed):

infant glycerin suppository; give one suppository and repeat as necessary

Older children:

magnesium hydroxide (Milk of Magnesia), 6.5–15 mL PO hs (2–6 years) or 15–30 mL PO hs (6–12 years)

or

lactulose 1 ml/kg (up to adult dose) once PO daily<sup>6</sup>

Limit the use of these agents to 3 or 4 days at most for acute constipation, unless complications such as encopresis are present where they may be used for longer with physician consultation.

**Monitoring and Follow-Up**

If you treat the child for acute functional constipation (no physical or physiological cause), reassess in 2 or 3 days to see if the condition has resolved.

**Referral**

The following factors may alert you to the need for referral to a physician for evaluation:

- History: failure to pass meconium in the first 24 hours of life in an infant now presenting with difficulty passing stool
- Rectal examination: rectum empty, despite stool in colon (as revealed by abdominal exam)
- Abnormal size and location of anus (ectopic or imperforate)
- Abnormal findings on neurologic examination
- Evidence of sexual abuse
- Chronic constipation without organic cause

The following factors may indicate the need for emergency medevac:

- Clinical indications of intestinal obstruction (for example, vomiting, abdominal pain, decrease in bowel sounds)
- Clinical indications of Hirschsprung’s disease (for example, delayed passage of meconium at birth, fever, pain, distension, bloody diarrhea)
- Clinical indications of acute surgical abdomen



## GASTROENTERITIS INCLUDING ACUTE DIARRHEA AND ACUTE VOMITING<sup>7,8</sup>

Inflammatory process (usually infectious) involving the gastrointestinal (GI) tract and resulting in diarrhea and vomiting. It is very common, especially among infants. The danger of dehydration from diarrhea is much greater in children than adults because of their high body water content and large surface area for weight. Significant diarrhea and vomiting must be taken seriously in small children (see “Dehydration in Children” in pediatric chapter 4).

### CAUSES

Infectious gastroenteritis can be caused by bacteria, viruses and parasites. These organisms can be categorized according to the mechanism by which they produce diarrhea (secretory, cytotoxic, osmotic or dysenteric mechanism).

#### Viruses

- Rotavirus: most common cause in children 6–24 months of age
- Norwalk virus: affects older children
- Enteric adenovirus: common in children < 2 years old

#### Bacteria

- *Salmonella*
- *Shigella*
- *Escherichia coli*
- *Campylobacter*
- *Clostridium difficile* infection (adverse outcome of antibiotic therapy)

#### Parasites

- *Giardia*

#### Other Causes of Vomiting and/or Diarrhea<sup>9</sup>

- Food and water poisoning
- Side effect of antibiotic therapy (for example, amoxicillin)
- Adverse outcome of antibiotic therapy (for example, *C. difficile*)
- Metabolic causes (such as new-onset diabetes mellitus)
- Hirschsprung’s disease (congenital megacolon)
- Overfeeding (in newborns)
- Food allergies or intolerance

- CNS related (such as increased intracranial pressure)
- Parenteral infection (for example otitis media, UTI, pharyngitis)
- GI ulcers
- Pyloric stenosis
- Surgical conditions (such as appendicitis)
- Medications or drug use
- Pregnancy
- Eating disorder

### HISTORY

- Onset, duration and timing (for example, relationship to meals, at night) of symptoms of pain, diarrhea and vomiting
- Vomiting: frequency, colour (bilious is often indicative of an obstruction), amount, force of vomiting (projectile)
- Stool pattern: frequency, quantity (number of diapers), consistency (formed or watery), colour, presence of blood or mucus
- Presence of fever
- Associated dizziness
- Thirst
- Oral intake from all sources
- Voiding: frequency and duration, number of wet diapers and their degree of saturation, time of last wet diaper
- Alertness and activity level
- Alterations in mental state (for example, irritability, lethargy)
- Diet history, focusing on water source and intake of poultry, milk and fish
- Family history: other family members or close contacts with similar symptoms
- Exposure to infected contacts at daycare centre
- Recent exposure to animals
- Past medical history, including other recent illness, recent antibiotic use (which may lead to infection with *C. difficile*) or other medication use, GI surgery
- Recent travel to an area where diarrheal illness is endemic

### PHYSICAL FINDINGS

#### General

- Mental status (for example, alert, irritable, lethargic)

**Vital Signs**

Temperature elevated in infectious gastroenteritis (see “Temperature Measurement in Children” in Chapter 1, “Pediatric Health Assessment”)

- Heart rate
- Respiration rate
- Blood pressure
- Colour: observe for dehydration with pale, mottled skin, skin turgor and weight loss
- Capillary refill (normal < 3 seconds)

**Hydration Status**

See Table 1, “Clinical Features of Dehydration”

- Weight (with child unclothed). Weight loss is a significant sign of dehydration in infants
- Mucous membranes: check for dryness
- Fontanel sunken in dehydration
- Skin turgor decreased in dehydration; skin may be doughy; when pinched, skin may remain in a tent shape for several seconds before slowly resuming its normal shape
- Mental state (for example, irritability, listlessness)

**Table 1 – Clinical Features of Dehydration**

Feature	Mild Dehydration (< 5%)	Moderate Dehydration (5% to 10%)	Severe Dehydration (> 10%)
Heart rate	Normal	Slightly increased	Rapid, weak
Systolic blood pressure	Normal	Normal to orthostatic, > 10 mm Hg change	Hypotension
Urine output	Decreased	Moderately decreased	Markedly decreased, anuria
Mucous membranes	Slightly dry	Very dry	Parched
Anterior fontanel	Normal	Normal to sunken	Sunken
Tears	Present	Decreased, eyes sunken	Absent, eyes sunken
Skin*	Normal turgor	Decreased turgor	Tenting
Skin perfusion	Normal capillary refill (< 2 seconds)	Capillary refill slowed (2–4 seconds); skin cool to touch	Capillary refill markedly delayed (> 4 seconds); skin cool, mottled, gray
Mental status	Alert	Irritable	Lethargic

\*Skin condition is less useful in diagnosis of dehydration in children > 2 years of age.

**Abdominal Examination**

See “Examination of the Abdomen”

- Mild, diffuse, generalized tenderness is frequent

**Other Physical Examination Considerations**

Assess for:

- Evidence of other infections
- Abnormal neurologic symptoms
- Papilledema or retinal hemorrhage
- Nystagmus
- Skin changes in the perianal area

**DIFFERENTIAL DIAGNOSIS**

See “Causes”

- Viral gastroenteritis: 80% of cases in children < 2 years old
- Bacterial gastroenteritis: 20% of cases in children < 2 years old
- Indigestion
- Food or water contamination
- Infections outside the GI tract can also cause diarrhea and vomiting, especially in younger children. Otitis media, pneumonia and urinary tract infections are among the most frequent non-GI infections associated with diarrhea and vomiting

## COMPLICATIONS

Complications depend on the cause of the diarrhea and/or vomiting.

## DIAGNOSTIC TESTS

Test is dependent on suspected cause(s). These may include urinalysis, blood tests, stool for culture and sensitivity, occult blood, and/or ova and parasite.

## MANAGEMENT

### Goals of Treatment

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

### Appropriate Consultation

Consult a physician in the following situations:

- Any infant or child presenting with fever, abdominal pain and vomiting
- Any infant or child who shows signs of dehydration on initial presentation
- Any infant or child who does not improve on oral hydration therapy
- Any infant or child who has blood-tinged diarrhea<sup>10</sup>

## Nonpharmacologic Interventions

Management depends on the suspected diagnosis. For all children with acute vomiting and/or diarrhea, adequate hydration is the priority.

To help with educating parents, *see the Canadian Paediatric Society's "Dehydration and Diarrhea in Children: Prevention and Treatment"*<sup>11</sup> (<http://www.caringforkids.cps.ca/whensick/dehydration&diarrhea.htm>).

*See "Dehydration in Children" in Chapter 4, "Fluid Management".*

- Fluid therapy is based on assessment of degree of dehydration
- Therapy should include the following elements: rehydration, maintenance of fluids and replacement of ongoing losses
- To determine degree of dehydration, *see Table 1, "Clinical Features of Dehydration"*
- To start fluid resuscitation, *see Table 2, "Fluid Resuscitation" in Chapter 4, "Fluid Management"*
- To calculate fluid deficit, *see "Calculating Fluid Deficit" in Chapter 4, "Fluid Management"*
- To calculate hourly maintenance requirements, *see "Hourly Maintenance Fluid Requirements" table and "Conditions Modifying Daily Fluid Requirements" table in Chapter 4, "Fluid Management"*

## MILD DIARRHEA WITHOUT DEHYDRATION OR FEVER

- Breastfeeding and age appropriate diet should continue at home, with fluid intake dictated by thirst
- High-osmolality fluids (for example, undiluted juices or soda pop) and plain water should be avoided
- Document number of wet diapers

### Fluid Resuscitation<sup>12</sup>

Oral replacement solution (for example, Pedialyte) can be used for rehydration. It should be given in small, frequent doses (to minimize vomiting) with a syringe or spoon. It should not be given for more than 24 hours without restarting an age-appropriate diet. The following table can be used in children without fever. Fluid calculations for moderate and severe dehydration should be reviewed with a physician.

**Table 2 – Fluid Resuscitation<sup>13</sup>**

<b>Mild Dehydration (&lt; 5%)</b>	<b>Moderate Dehydration (5% to 10%)</b>	<b>Severe Dehydration (&gt; 10%)</b>
Start rehydration with oral replacement solution: 50 mL/kg over 4 hours at an approximate rate of 1 mL/kg every 5 minutes <sup>14</sup> (this is the fluid deficit volume). Close observation is recommended	Start rehydration with oral replacement solution; 100 mL/kg over 4 hours at an approximate rate of 2 mL/kg every 5 minutes <sup>14</sup> (this is the fluid deficit volume) Close observation is recommended	<b>Medical emergency</b> Normal saline or Ringer's lactate 20–40 mL/kg/hour intravenous <sup>13</sup> (a minimum of 5–20 minutes for 20 mL/kg boluses) <sup>16</sup> ; Repeat boluses may be given up to a maximum total fluid amount of 40–80 mL/kg during the first hour <sup>16</sup> ; reassess the patient, particularly cardiac and respiratory function, after each bolus <sup>17</sup>
Reassess at 4-hour intervals		
From 4 to 24 hours, give oral replacement therapy as the child desires, ensuring replacement of maintenance requirements (see “Hourly Maintenance Fluid Requirements” table in the pediatric chapter, “Fluid Management”) and any losses	From 4 to 24 hours give oral replacement therapy as the child desires, ensuring replacement of maintenance requirements (see “Hourly Maintenance Fluid Requirements” table in the pediatric chapter, “Fluid Management”) and any losses	If unable to start an intravenous line in three attempts (or within 60–90 seconds), establish intraosseous access. For intraosseous infusion, see “Intraosseous Access” in the chapter, “Pediatric Procedures;” this technique can save the child's life and is not technically difficult; when line is in place, use as you would a regular intravenous line
Give extra oral replacement solution after each emesis (for example, 2 mL/kg) or diarrheal stool (for example, 5–10 mL/kg) <sup>15</sup>	Give extra oral replacement solution after each emesis (for example, 2 mL/kg) or diarrheal stool (for example, 5–10 mL/kg) <sup>15</sup>	Monitor blood pressure
Give fluid frequently, in small amounts	Give fluid frequently, in small amounts	Reassess child, particularly cardiac and respiratory function, and repeat bolus if signs of shock persist (for example, tachycardia, decreased systolic blood pressure, poor perfusion, skin grey and mottled)
Monitor urine output (output should be at least 1 mL/kg body weight per hour)	Monitor urine output (output should be at least 1 mL/kg body weight per hour)	Start oral replacement therapy when child is stable at 100 mL/kg over 4 hours <sup>15</sup>
Continue breastfeeding; if child is bottle-fed, early refeeding of child's normal formula (within 6–12 hours) is recommended	Continue breastfeeding; if child is bottle-fed, early refeeding of child's normal formula (within 6–12 hours) is recommended	Replace ongoing losses with oral replacement solution (for emesis 2 mL/kg or diarrheal stool 5–10 mL/kg)
Full, age-appropriate diet should be reinstated after 4 hours, if possible	Full, age-appropriate diet should be reinstated after 4 hours, if possible	Monitor urine output (output should be at least 1 mL/kg body weight per hour)
Delay refeeding only if there is severe, protracted vomiting	Delay refeeding only if there is severe, protracted vomiting	Full, age-appropriate diet should be reinstated after rehydration, if possible

**Feeding Guidelines**

- Full, age-appropriate diet, including breastfeeding and formula feeding should be reinstated as soon as possible. There is evidence that diarrhea lasts longer if starvation occurs
- The BRAT diet (that is, bananas, rice, applesauce, toast) is no longer recommended as it does not provide adequate protein and caloric intake<sup>18</sup>

If the reintroduction of formula or breastfeeding exacerbates diarrhea and the diarrhea is blood tinged,<sup>10</sup> consider the possibility of lactose intolerance (see “Lactose Intolerance” in Chapter 17, “Hematology, Endocrinology, Metabolism and Immunology”). If this symptom occurs with the introduction of formula and lasts for more than 12–48 hours, depending on age of the baby, consult a physician about switching to a lactose-free formula (for example, Similac LF, Enfalac LF).

### Pharmacologic Interventions

Antispasmodic and antidiarrheal agents should not be used. It should be explained to the parents or caregiver that it is best to consider the diarrhea as a purging process, to rid the intestinal tract of organisms, and that the most important part of managing diarrhea is the replacement of lost fluids. There is also a very limited role for antiemetic agents.

Specific antimicrobial agents are usually not indicated, even for bacterial infection. An exception is gastroenteritis caused by *Giardia lamblia*, which is usually treated as follows (after diagnosis is confirmed by a positive stool culture):

metronidazole (Flagyl), 15 mg/kg/day, divided tid for 5 days (maximum 250 mg/dose)<sup>19,20</sup>

### 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, and keep child under observation at the clinic.

### 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 medevaced
- The decision to continue home management should be made in consultation with a physician 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
- All children with significant dehydration (moderate to severe) should be evacuated to hospital
- Children with significant dehydration can be rehydrated substantially in the nursing station while awaiting transport

## GASTROESOPHAGEAL REFLUX DISEASE (GERD)<sup>21</sup>

Physiologic conditions or pathologic disease causes retrograde movement of gastric contents into the esophagus, which results in injury to the esophagus and extra-intestinal disease. This causes GI, respiratory and/or neurobehavioural manifestations.

The prevalence is unknown. In children, the peak age at onset is 1–4 months of age. Children with neurologic injury are more likely to have GERD.

### CAUSES

Disturbance of the normal functioning of the esophagus and related structures results in a defective anti-reflux barrier.

#### Gastric Dysfunction

- Delay in gastric emptying causing increased pressure in stomach (for example, large volume of feeding, particularly in infants)
- Fundus does not relax without an increase in pressure while accepting food (for example, high abdominal pressure because of obesity or tight clothes exacerbates reflux)

#### Increased Relaxation of Lower Esophageal Sphincter

- Transient relaxation of lower esophageal sphincter (LES) is a major cause of reflux

#### Esophageal Dysfunction

- Impairment of esophageal clearance of refluxate due to inflammation, position and/or mucosal damage

#### Aggravating Factors

- Supine position
- Certain foods and medications (*see* “Management”)

## HISTORY AND PHYSICAL FINDINGS

### Infants

#### Gastrointestinal Manifestations

- Failure to thrive
- Malnutrition
- Esophagitis
- Feeding problems
- Irritability
- Hematemesis
- Anemia

**Respiratory Manifestations**

- Apnea (obstructive)
- Chronic cough
- Wheeze (GERD is a trigger for reactive airways disease or asthma<sup>22</sup>)
- Pneumonia (chronic or recurrent)
- Cyanotic spells
- Others (for example, stridor, hiccups, hoarseness)

Reflux with respiratory manifestations is more likely to be observed in association with certain disorders in both infants and children (for example, esophageal atresia, cystic fibrosis, bronchopulmonary dysplasia and tracheo-esophageal fistula).

**Children and Adolescents****Gastrointestinal Manifestations (Esophagitis)**

- Chest pain (heartburn)
- Dysphagia (difficulty swallowing)
- Halitosis (due to refluxate in mouth)
- Odynophagia (painful swallowing)
- Water brash (flow of sour saliva into mouth)
- Hematemesis
- Iron deficiency anemia

**Respiratory Manifestations**

- Recurrent or chronic pneumonia
- Recurrent wheeze (GERD is a trigger for reactive airways disease or asthma<sup>22</sup>)
- Chronic cough
- Others (for example, stridor, hoarseness)

**DIFFERENTIAL DIAGNOSIS**

- Infection as a cause of vomiting (for example, gastroenteritis)
- Neurologic problem (for example, hydrocephalus, brain tumor)
- Metabolic problem (for example phenylketonuria, galactosemia)
- Food intolerance (for example, milk allergy, celiac disease)
- Anatomic malformations (for example, pyloric stenosis, esophageal atresia, intussusception)

**COMPLICATIONS**

- Esophagitis
- Esophageal stricture
- Esophageal adenocarcinoma
- Failure to thrive
- Recurrent aspiration pneumonia
- Apnea, near-miss sudden infant death syndrome (SIDS)
- Anemia

**DIAGNOSTIC TESTS**

- Hemoglobin level (if there is a concern about anemia)
- Chest x-ray (if available), to rule out aspiration or recurrent pneumonia

**MANAGEMENT****Goals of Treatment**

- Eliminate detrimental effects of reflux (GI, respiratory and neurobehavioural manifestations)

**Appropriate Consultation**

Consult a physician in the following circumstances:

- You think that diagnostic tests are necessary to confirm the diagnosis, or you think that medications are needed
- Conservative (nonpharmacologic) measures fail to control reflux
- There is evidence of complications (for example, failure to thrive, chronic cough, recurrent respiratory infections)

**Nonpharmacologic Interventions****Client Education**

Discuss diagnosis with parents or caregiver and explain difference between physiologic conditions and pathologic disease that cause reflux.

**Positioning**

- Place child in upright or prone (if supervised) positions
- Do not prop bottle when feeding child
- Avoid supine or semi-seated position
- Elevation of head of bed onto 6 inch (15 cm) blocks may be useful



**Feeding**

- Thicken infant foods (add 1 tbsp [15 mL] dry rice cereal for each ounce of formula)
- Encourage fasting for a few hours before child goes to sleep
- Avoid large meals (that is, promote smaller, but more frequent feedings)
- Diet for weight loss may be considered in an older child, if he or she is overweight or obese
- Avoid foods that decrease LES pressure or increase gastric acidity (for example, carbonated drinks, fatty foods, citrus fruits, tomatoes)
- Avoid tight-fitting clothes
- Avoid exposure to tobacco smoke

**Pharmacologic Interventions (for Older Children and Adolescents)**

Medications for an infant or young child must be ordered by a physician. The medications presented here are for older children and adolescents (12 years).

**Acid-Reducing Agents**

Used more often in older children who have pain associated with esophagitis:

Aluminum-magnesium hydroxides suspension (for example, Alumag), 0.5–1 mL/kg PO 3–6 times per day. This should only be given for short-term use.

Proton pump inhibitors (for example, omeprazole [Losec]) are frequently used as well and must be ordered by a physician.

**Prokinetic Agents**

Prokinetic agents (for example, domperidone [Motilium]) may be used in severe cases where complications arise or are expected. It must be ordered by a physician.

**Monitoring and Follow-Up**

Reassess monthly while the child is symptomatic. Watch carefully for signs of complications (for example, failure to thrive, recurrent pneumonia, asthma, erosive esophagitis or anemia). Monitor growth and development, hemoglobin level and lung sounds.

**Referral**

Refer any infant with suspected GERD to a physician in the following situations:

- Simple measures fail to relieve the problem
- There are symptoms of complications (for example, failure to thrive, recurrent pneumonia)

Surgery may be necessary in severe cases.

Indications for surgery:

- Failure of medical management
- Severe or intractable detrimental effects (for example, failure to thrive, recurrent pneumonia, peptic stricture)
- Neurologically impaired children with or without gastrostomy tube

**Prognosis**

- Most infants with regurgitation have resolution of symptoms by 2 years of age

Children more resistant to complete resolution have good response to medical therapy but experience relapse when medications are discontinued.

**INGUINAL HERNIA**

Protrusion of part of the abdominal contents into the inguinal canal.

This type of hernia is common in children, affecting more boys than girls and occurring on the right side more often than the left.

**CAUSES**

- Embryologic failure of closure of the processus vaginalis

**HISTORY**

- Nonsymptomatic hernias may be suddenly observed by caregiver
- Presence of swelling with no involvement of GI function
- Mass may be present in the groin at birth or may appear anytime after birth
- May only appear when the child coughs or cries

If the hernia becomes incarcerated:

- Pain may occur
- Mass becomes impossible to reduce
- Infarction of the bowel can occur, causing intestinal obstruction (*see “Bowel Obstruction”*)

**PHYSICAL FINDINGS**

- Vital signs usually normal, unless bowel infarction has occurred
- Mass visible in the inguinal area, especially when the baby is crying
- Impulse on coughing or sneezing may be felt
- If the mass is not visible, feel the inguinal canal by invaginating the upper part of the scrotum or labia with a finger
- During transillumination of scrotum (by shining a flashlight behind the scrotum), hernial contents will not be transilluminated because they contain viscera
- If a mass can gently be pushed back inside the abdomen wall it is termed “reducible”
- Reducing a hernia will require that the child is in a supine position (this may be difficult in a crying, anxious child)
- If the hernia proves difficult to reduce, do not force abdominal contents back, because this can internalize or incarcerate the hernia, and the child remains at risk for all the complications of hernias (*see “Complications”*)

**DIFFERENTIAL DIAGNOSIS**

- Hydrocele (a hydrocele transilluminates, but is not reducible, as a hernia is)
- Undescended testis (cryptorchism)
- Seminoma, teratoma
- Lymphadenopathy
- Scrotal trauma

**COMPLICATIONS**

- Incarceration of hernia (*see Bowel Obstruction*)
- Strangulation of hernia (*see Bowel Obstruction*)
- Bowel obstruction (*see Bowel Obstruction*)
- Testicular infarction
- Testicular torsion (*see Testicular Torsion in chapter 6 adult*)

Cryptorchism may be associated with inguinal hernia.

**DIAGNOSTIC TESTS**

- Ultrasound can be used to differentiate a hernia from a condition of testicular origin

**MANAGEMENT****Goals of Treatment**

- Confirm diagnosis
- Observe until surgery
- Prevent complications

**Appropriate Consultation**

Consult a physician early and prepare to medevac if the hernia is not reducible and there are signs of complications (for example, pain, symptoms of bowel obstruction). If the hernia is not incarcerated (and is reducible), this is not an emergency situation.

**Nonpharmacologic Interventions**

Reassure the parents or caregiver.

**Client Education**

Teach the parents or caregiver the following:

- Observe for signs and symptoms of complications (for example, incarceration, strangulation, bowel obstruction)
- To bring the child in for immediate assessment if pain develops

Emphasize the need to have the child assessed immediately if the child’s status changes.

**Pharmacologic Interventions**

- None

**Monitoring and Follow-Up**

Assess the size and reducibility of the hernia every 3 months while awaiting surgical consultation and surgery.

**Referral**

Refer all asymptomatic children electively to a physician for assessment. A surgical referral will be necessary. Because of the risk of incarceration, surgery is recommended for all infantile inguinal hernias.

**JAUNDICE**<sup>23,24,25,26,27</sup>

High levels of bilirubin in a child’s blood due to abnormal metabolism or excretion showing up as a yellowish discoloration in their skin and sclera. This is seen most often in the newborn, so neonatal jaundice will be the focus here.



**CAUSES**

- Conjugated hyperbilirubinemia
- Unconjugated hyperbilirubinemia

The two most common causes of jaundice in a newborn are physiologic jaundice and breastfeeding jaundice; both are a type of unconjugated hyperbilirubinemia, and they are the only two that do not have a pathologic cause.

**Risk Factors**

Risk factors for severe hyperbilirubinemia<sup>28</sup>:

- Jaundice present when less than 24 hours old
- Jaundice present when discharged from hospital
- Gestational age < 38 wks
- Sibling who had severe hyperbilirubinemia in past
- Visible bruising
- Cephalhematoma
- Male sex
- Maternal age > 25 years
- Dehydration
- Exclusive and partial breastfeeding

**HISTORY**

- Gestational age at birth and birth history
- Length of symptoms
- Age in hours when jaundice first noticed; where it started (physiologic and breastfeeding jaundice starts in the face and progresses to trunk and then extremities)
- Vomiting
- Fever
- Anorexia
- Diet – breast or formula fed, amount, frequency, how the baby tolerates feedings
- Failure to thrive
- Stool — pattern and colour (meconium, white stools)
- Urine — colour, frequency
- Fatigue/lethargy
- Abdominal pain or fullness
- Pruritus
- Irritability
- Family history of jaundice (in siblings)
- Course of pregnancy, including maternal infection, illness, drug use, medications taken

**PHYSICAL FINDINGS**

- Weight, height; may show failure to thrive
- Yellow skin (press down on skin to blanch it to better determine colour), look at palms of hands to determine extent
- Yellow conjunctiva/sclera and mucous membranes
- Abdominal exam — enlargement of spleen and liver
- Ocular anomalies
- Rashes or visible bruising
- Hearing deficits
- Unusual facial features
- Cardiac anomalies
- Mucous membranes dry
- Perform a complete physical exam, including neurological exam

**DIFFERENTIAL DIAGNOSIS****Unconjugated Hyperbilirubinemia**

- Physiological jaundice\* (occurs normally after birth. If full-term, jaundice peaks between 2nd and 4th days of life. In premature infants, jaundice peaks between 5th and 7th days)
- Breastfeeding jaundice\* (occurs in the first week of life)
- Breastmilk jaundice (peaks by the 4th week of life and can last as long as 12 weeks)
- High intestinal obstruction (for example, pyloric stenosis, duodenal atresia)
- Hematologic problems (for example, blood group incompatibility between mother and infant, hemolytic anemia, infants of diabetic mothers)

\* not pathologic

**Conjugated Hyperbilirubinemia (always pathologic)**

- Inflammation of the hepatocytes due to infection (for example, hepatitis B, rubella, sepsis)
- Metabolic diseases or inborn errors of metabolism (for example, glucose-6 phosphate dehydrogenase)
- Genetic conditions (for example, cystic fibrosis)
- Extrahepatic biliary atresia (for example, viral infections such as herpes simplex)

## COMPLICATIONS

- Acute bilirubin encephalopathy (lethargy, hypotonia and poor suck, which may progress to hypertonia with a high-pitched cry and fever, and eventually to seizures and coma)
- Chronic bilirubin encephalopathy (happens after acute encephalopathy with cerebral palsy, developmental delay, hearing deficit, oculomotor disturbances, dental dysplasia and mental deficiency)

## DIAGNOSTIC TESTS

Total serum bilirubin should be done within 72 hours of birth. It is usually done in the hospital. Other tests if a child is jaundiced should be discussed with a physician. They may include:

- Total serum bilirubin from a capillary or venous blood sample
- Blood glucose
- Direct antiglobulin test (direct Coomb’s test) if the mother was not tested in pregnancy or mother has blood group O when child has early jaundice
- Infant and maternal ABO and Rh determination (mother’s should be done during the pregnancy)
- CBC with peripheral smear and reticulocyte count
- Total conjugated bilirubin

Other tests are done according to suspected cause.

## MANAGEMENT

Management depends on the cause of jaundice.

### Goals of Treatment

- Prevent complications
- Identify or rule out serious causes of jaundice
- Refer child with a serious cause to a physician
- Treat appropriately

### Appropriate Consultation

Consult a physician in the following situations:

- Jaundice is present
- Pathologic jaundice is suspected
- The newborn is having difficulty feeding, or experiencing a change in behaviour, apneic spell(s), fever or hypothermia
- One or more risk factors for severe hyperbilirubinemia are present (*see “Risk Factors”*)

## Nonpharmacologic Interventions

In the case of jaundice that is not pathologic, provide support and education to the mother or caregiver:

- Encourage the mother to breastfeed every 2–3 hours and on hunger cues from the infant
- Provide breastfeeding support and encourage continued breastfeeding
- Routine supplementation of breastfed infants with water or dextrose water is not recommended
- If the infant is breastfeeding and there is inadequate intake, > 12% weight loss from birth weight, or the infant appears dehydrated, supplement with formula
- Place the newborn, with only a diaper on, in a sunny window if the child is feeding well and is not at increased risk for severe hyperbilirubinemia (*see “Risk Factors”*)

## Pharmacologic Interventions

Medication use is limited in newborn nonpathologic jaundice. However, it may be used in a hospital setting for pathologic jaundice.

## Monitoring and Follow-Up

- Routine newborn surveillance should include assessment of breastfeeding, weight and jaundice every 24 hours until feeding is established (usually on the 3rd or 4th day of life) and the jaundice is improving
- All jaundiced infants, especially high-risk infants and those who are exclusively breastfed, should continue to be closely monitored until feeding and weight gain are established and the total serum bilirubin concentration starts to fall

## Referral

Medevac in consultation with a physician if the newborn has severe jaundice or is at increased risk of developing severe hyperbilirubinemia, as they will need phototherapy, possibly surgery if the cause is biliary atresia and/or an exchange transfusion.

Medevac if there are signs of acute bilirubin encephalopathy or if the infant is having difficulty feeding, or experiencing a change in behaviour, apneic spell(s), fever or hypothermia.

## RECURRENT ABDOMINAL PAIN<sup>29,30,31,32,33</sup>

Pain that has at least three different episodes over a 3-month period and continues after this period. The pain interferes with a patient's normal activities such as school. It occurs most often in school-aged children.

### CAUSES

There are many potential causes of recurrent abdominal pain, and for the majority of children no physical cause of the symptoms is found. However, one needs to ensure that organic causes are recognized and treated. For children under 2 years of age, recurrent abdominal pain is often associated with an organic cause. Some common causes of recurrent abdominal pain are:

**Functional:**<sup>34</sup> (pain at least once per week for 2 months)

- Isolated paroxysmal (often triggered by new situations, difficulty at school or relationship problems)
- Associated with functional dyspepsia (ulcer-like or dysmotility-like symptoms)
- Associated with altered bowel pattern
- Abdominal migraine (acute onset, incapacitating, midline, non-colicky abdominal pain)

### Organic:

- Gastrointestinal conditions (for example, chronic constipation, inflammatory bowel disease, peptic ulcer disease)
- Urogenital conditions (for example, dysmenorrhea, UTI, pelvic inflammatory disease)
- Musculoskeletal pain
- Neurologic conditions (for example, spinal cord tumor)
- Metabolic conditions (for example, diabetic ketoacidosis, hypoglycemia)
- Hematologic conditions (for example, Henoch-Schonlein purpura)
- Lactose intolerance
- Drugs (for example, antibiotics, anticonvulsants, iron supplements)

### Psychogenic:

- School phobia
- Depression
- Acute reactive anxiety
- Conversion reaction

### HISTORY

#### *Characteristics of Pain*

Use the following mnemonic to characterize the pain:

- O for **onset**
- P for **progression**
- Q for **quality**
- R for **radiation**
- S for **site and severity**
- T for **timing** (time of day, related to any activity or food, and course of pain)
- A for **aggravating** and **alleviating** factors and **associated** symptoms

#### *Review of Systems and Medical History*

- Bowel movements
- Fever
- Nausea, vomiting
- Respiratory system
- Urinary system
- Musculoskeletal system
- Diet
- Sexual history, including menstrual history (in female adolescents)
- Trauma history (to abdominal area)
- Abdominal surgeries
- Excessive exercise
- Medications
- Weight loss, anorexia
- How condition is interfering with life and activities of daily living (for example, school, play, friends)
- Family history of peptic ulcer disease, celiac disease or inflammatory bowel disease

**PHYSICAL FINDINGS****Vital Signs**

- Temperature
- Heart rate
- Blood pressure
- Respiratory rate
- Weight, height

**General Observations**

- Colour
- Sweating
- Facial expression
- Activity level when observed and not

**Abdominal Examination****Inspection**

- Abdominal distension (may be caused by organomegaly, infection, obstruction or ascites)
- Guarding with or without decrease in activity level
- Involuntary guarding
- Masses, pulsation, hernia

**Auscultation**

- Bowel sounds: high-pitched, rushing (may indicate obstruction) or absent (may indicate ileus)

**Percussion**

- Tympany may be increased with severe distension or perforation
- Enlargement of liver or spleen
- Tenderness of costovertebral angle

**Palpation**

- Tenderness (generalized or localized; ensure patient is distracted if psychogenic pain is suspected)
- Muscle guarding (voluntary or involuntary)
- Localized rigidity may indicate peritoneal irritation
- Masses, pulsation, hernia
- Referred pain (pain felt in an area different from that palpated) may indicate site of lesion
- Rebound tenderness (pain on sudden release of palpation pressure) may indicate peritoneal irritation; cough or jumping also may elicit rebound tenderness
- Enlargement of liver or spleen

**Rectal Examination**

- Inspection of perirectal area for skin tags, rash, erythema, fecal soiling or fissures
- Feel for hard stool if indicated

**Pelvic Examination**

- Bimanual pelvic exam (optional depending on suspected cause) to feel uterus and adnexa for tenderness or masses in sexually active adolescent females

**Other Systems Examination**

Abdominal pain in children is frequently a referred pain, so the heart, lungs, musculoskeletal and other systems should always be examined.

**DIFFERENTIAL DIAGNOSES**

It is a diagnosis of exclusion. Rule out acute conditions such as appendicitis and bowel obstruction and other organic conditions. (*See “Causes” for functional, physical and psychogenic causes.*)

**COMPLICATIONS**

Complications are rare and depend on cause.

**DIAGNOSTIC TESTS**

Tests are dependent on suspected cause. Tests to help clarify a diagnosis for a physical cause of recurrent abdominal pain include urinalysis, occult blood in stool, CBC, pregnancy test, ESR, stool testing for ova and parasites and sexually transmitted infection testing.

**MANAGEMENT**

Specific management is based on the most likely cause of the recurrent abdominal pain.

**Goals of Treatment**

- Identify or rule out urgent causes of pain
- Treat treatable conditions
- Return to normal function

Provide reassurance and education for conditions that are not serious.

**Appropriate Consultation**

Consult with a physician if the cause is unclear or the patient is unstable.

**Nonpharmacologic Interventions**

Educate the parents and/or child. Points to discuss include:

- Even though no serious disease was found on examination, the child’s pain is real
- A thorough exam was done and the child is not currently in physical danger
- Recurrent abdominal pain is common in children and it has many causes
- The child may have many reoccurrences, but will need to learn to cope with the symptoms and do their usual daily activities (similar to adults with a headache)
- The family’s lifestyle should return to normal, including the child attending school and their usual activities
- Permit the child to rest during severe pain (ensuring no secondary gains like television watching)
- Potentially discover triggers by keeping a calendar of the pain, including time, length, events or foods before and after. Use clinical judgment by considering if it is likely to make the family focus on the pain more or make the pain worse before using this technique
- Signs of emergent abdominal pain include fever, vomiting, pallor and a rigid abdomen. If any of these happen, the child should return for assessment
- Relaxation techniques older children can use when pain is present
- Fibre in the diet should be increased
- If a lactose intolerance is suspected, try a lactose-free diet for 1 week to see if symptoms improve

**Pharmacologic Interventions**

Use of medications is usually not indicated unless there is a physical cause. If used, they should be directed at the trigger for the pain. All medication use for recurrent abdominal pain should be discussed with a physician.

If lactose intolerance is suspected a trial of lactase enzyme replacement (Lactaid) may be warranted.

**Monitoring and Follow-Up**

Regular follow-up should happen for support, to assess for other problems and to review the treatment plan. Initial follow-up should be in 2 weeks.

**Referral**

If the pain persists and continues to interfere with school, peers, family members and activities, referral to a physician or specialist is indicated. This may include a mental health specialist if stress or family dynamics are the suspected cause.

**UMBILICAL HERNIA**

Protrusion of abdominal contents through the diastasis recti, causing an out-pouching of the umbilicus. Very common in First Nations children.

**CAUSE**

- Weakness of the diastasis recti muscles of the abdomen

**HISTORY AND PHYSICAL FINDINGS**

- Enlargement and protrusion of the umbilicus
- Pain suggests incarceration or strangulation

**COMPLICATIONS**

Complications are very rare.

- Incarceration or strangulation of hernia
- Bowel obstruction

**DIAGNOSTIC TESTS**

- None

**MANAGEMENT**

In spite of the size of umbilical hernias, they almost never become incarcerated, and surgery is not required. They usually disappear by the time the child reaches 2 or 3 years of age.

- All that is necessary is to reassure the parents or caregiver
- Instruct caregiver to bring the child in for immediate assessment if any sign of incarceration or strangulation of hernia (for example, pain, uncontrollable crying and/or unable to reduce hernia)
- If the hernia persists beyond 3 years of age or pain is present, a physician should be consulted
- Strapping and taping are not of clinical value

## EMERGENCY PROBLEMS OF THE GASTROINTESTINAL SYSTEM

### ACUTE ABDOMINAL PAIN<sup>29,35</sup>

Abdominal pain is a common symptom in children with more and less serious causes. In very young children it may be difficult to verify that the pain is abdominal, as the child cannot describe the pain. In younger children, abdominal pain may be a nonspecific symptom of disease in almost any system. In older children, the symptoms become more specific, but can still be caused by a wide variety of more and less serious conditions.

Abdominal pain can be acute, chronic or recurrent (see “*Recurrent Abdominal Pain*”). Pain that requires surgical intervention is almost always acute.

#### CAUSES

##### *Infants*

- Infant colic
- Food allergy (for example, cow’s milk protein allergy)
- Incarcerated hernia
- Surgical conditions (intussusception [in children aged 3 months to 2 years], volvulus)

##### *School-aged Children*

- Parenteral infection (for example, pneumonia, tonsillitis)
- Hydronephrosis
- Pyelonephritis
- Appendicitis (especially in children 3 years old)
- Urinary tract infection
- Primary peritonitis
- Gastroenteritis
- Peptic ulcers
- Hepatitis
- Pancreatitis
- Hematologic and vascular disorders (for example, rheumatic fever, Henoch-Schonlein purpura)
- Diabetes mellitus

##### *Adolescents*

- Appendicitis
- Gynecologic problems (Mittelschmerz [pain at the midpoint of menstrual cycle, presumably related to ovulation], dysmenorrhea, pelvic inflammatory disease)
- Parenteral infection (for example, tonsillitis, pneumonia)
- Pyelonephritis
- Urinary tract infection
- Functional cause
- Gastroenteritis
- Gall bladder disease

#### HISTORY

##### *Characteristics of Pain*

Use the following mnemonic to characterize the pain:

- O for **onset**
- P for **progression**
- Q for **quality**
- R for **radiation**
- S for **site and severity**
- T for **timing**
- A for **aggravating** and **alleviating** factors and **associated** symptoms

##### *Review of Systems and Medical History*

- Bowel movements
- Fever
- Nausea, vomiting
- Respiratory system
- Urinary system
- Diet
- Sexual history (in female adolescents)
- Trauma
- Medications
- Weight loss



**PHYSICAL FINDINGS****Vital Signs**

- Temperature
- Heart rate
- Blood pressure
- Respiratory rate
- Weight

**General Observations**

- Colour
- Sweating
- Distress
- Facial expression

**Abdominal Examination****Inspection**

- Abdominal distension (may be caused by organomegaly, infection, obstruction or ascites)
- Peristaltic waves may or may not be present in obstruction (for example, pyloric stenosis in small infants)
- Guarding with or without decrease in activity level
- Involuntary guarding
- Masses, pulsation, hernia

**Auscultation**

- Bowel sounds: high-pitched, rushing (may indicate obstruction) or absent (may indicate ileus)

**Percussion**

- Tympany may be increased with severe distension or perforation
- Enlargement of liver or spleen
- Tenderness of costovertebral angle

**Palpation**

- Tenderness (generalized or localized)
- Muscle guarding (voluntary or involuntary)
- Localized rigidity may indicate peritoneal irritation
- Masses, pulsation, hernia
- Referred pain (pain felt in an area different from that palpated) may indicate site of lesion
- Rebound tenderness (pain on sudden release of palpation pressure) may indicate peritoneal irritation; cough or jumping also may elicit rebound tenderness
- Obturator sign (pain on internal rotation of flexed right knee and hip). If there is pain in right abdomen it may indicate irritation of the obturator muscle or peritoneum due to an inflamed appendix
- Psoas sign (pain on raising straight right leg against resistance just above knee while supine) may indicate abscess or irritation of the muscle by an inflamed appendix
- Murphy's sign (increased pain in right upper quadrant when child is breathing in and examiner is applying pressure toward liver in right upper quadrant)
- Enlargement of liver or spleen

**Rectal Examination**

- Indicated if you suspect a surgical problem (for example, appendicitis)
- Feel for hard stool

**Pelvic Examination**

- Bimanual pelvic exam (optional depending on suspected cause), to feel uterus and adnexa for tenderness or masses in sexually active adolescent females

**Other Systems Examination**

Abdominal pain in children is frequently a referred pain, so the heart, lungs and other systems should always be examined.

**DIFFERENTIAL DIAGNOSIS**

See “Causes.”

The lists of causes given above are by no means comprehensive, but most of the urgent conditions are listed. Once urgent conditions have been ruled out, the child can often be treated symptomatically until a physician is able to assess the client.

## DIAGNOSTIC TESTS

- Hemoglobin
- White blood cell (WBC) count
- Urinalysis (for blood, protein, nitrates and WBCs)
- Urine for culture and sensitivity
- Pregnancy test for all reproductive-age females
- Chest x-ray (upright), to rule out pneumonia
- Blood cultures should be drawn if fever is present
- Serum chemistry profile if indicated
- Stool testing if travel history or diarrhea
- Abdominal and/or pelvic ultrasound if indicated

## MANAGEMENT

Specific management is based on the most likely cause of the abdominal pain.

### Goals of Treatment

- Identify or rule out urgent causes of pain
- Refer child with an urgent cause to a centre where surgery is available
- Treat treatable conditions
- Provide pain relief and reassurance for conditions that are not serious

### Appropriate Consultation

Consult a physician in the following circumstances:

- The diagnosis is unclear
- The presentation looks at all serious (for example, surgical abdomen)
- Before administering any analgesia

### Adjuvant Therapy

- If, after consultation, the physician agrees, start IV therapy with normal saline
- Give enough fluid for maintenance (*see “Hourly Maintenance Fluid Requirements” table in the pediatric chapter, “Fluid Management”*) or more, according to state of hydration and physician order

### Nonpharmacologic Interventions

- Give nothing by mouth until the diagnosis is clear
- Insert nasogastric tube if, upon consultation, a physician supports its use. It may be useful if there is vomiting, bleeding or suspected bowel obstruction
- Record output and assess need for Foley catheter

### Pharmacologic Interventions

Unless the diagnosis is clear, do not administer any analgesia until you have consulted a physician.

Although classic surgical teaching has been that medication for pain may confuse the diagnosis of abdominal pain in the emergency setting, this is not supported by the literature. Opioid analgesics can increase client comfort and do not mask clinical findings or delay diagnosis.<sup>36</sup>

### Monitoring and Follow-Up

Monitor pain, ABCs (airway, breathing and circulation), vital signs and any associated fluid losses closely. Serial examinations over a few hours may clarify the diagnosis.

### Referral

Medevac for evaluation if the diagnosis is uncertain and the child’s condition warrants urgent evaluation.

Keep child under observation if you are unsure of the diagnosis. For any child with acute abdominal pain who has been sent home, the parents or caregiver should be warned that it is difficult to diagnose appendicitis early in the course of this condition and that if the pain increases in severity or becomes constant or fixed in one spot, they should bring the child back to the clinic.

## APPENDICITIS<sup>37</sup>

Inflammation of appendix.

This condition is rare in children < 3 years old. It can be very difficult to diagnose, especially in younger children. Therefore, the index of suspicion should be high.

### CAUSES

Obstruction of the opening of the appendix.



## HISTORY

The following outlines the classic pattern of acute appendicitis. However, in younger children, this history is less likely. If the child is older and has a retrocecal or retroperitoneal appendix, the presentation may be confusing, with pain radiating to the back or bladder, or the presence of bowel irritation.

- Vague, diffuse periumbilical or epigastric pain
- Worsening pain that becomes more localized (right lower quadrant)
- Anorexia (decreased appetite)
- Nausea
- Vomiting may or may not occur
- Low-grade fever may be present
- Urinary frequency, dysuria and diarrhea may develop if tip of appendix irritates the bladder or bowel
- In adolescent girls, date of most recent normal menstrual period and any recent menstrual irregularity should be noted

## PHYSICAL FINDINGS

Presentation is variable, depending on whether the child presents early or late in the evolution of the disease process.

- Temperature mildly elevated
- Tachycardia (although heart rate may be normal in early stages)
- Variable level of distress

### **Abdominal Examination**

- Bowel sounds variable: hyperactive to normal in early stages, reduced to absent in later stages
- Localized tenderness in right lower quadrant
- Muscle guarding in right lower quadrant
- Rebound tenderness may be present
- Obturator sign (pain on internal rotation of flexed right knee and hip). If there is pain in right abdomen it may indicate irritation of the obturator muscle or peritoneum due to an inflamed appendix
- Psoas sign (pain on raising straight right leg against resistance just above knee while supine) may indicate abscess or irritation of the psoas muscle or peritoneum by an inflamed appendix

Another test for peritoneal irritation is to have the child jump off the examining table. If the child can do this without pain, he or she probably does not have appendicitis.

### **Rectal Examination**

- Tenderness may be present in right lower quadrant if appendix is near the rectum

## DIFFERENTIAL DIAGNOSIS (<10 YEARS)

Appendicitis is known as the “great mimic.” The actual signs and symptoms depend on the location of the appendix within the abdomen. Calculating a risk score for appendicitis may be helpful; however, note that the scores rely on blood work that may not be available at the time of assessment. (*See Point-of-Care Guides Diagnosis of Appendicitis: Part I. History and Physical Examination at <http://www.aafp.org/afp/2008/0315/p828.html> and *Diagnosis of Appendicitis: Part II. Laboratory and Imaging Tests at <http://www.aafp.org/afp/2008/0415/p1153.html> for details.*)*

- Gastroenteritis
- Crohn’s disease
- Cecal or Meckel’s diverticulitis
- Pyelonephritis
- Biliary colic
- Pneumonia
- Gall bladder disease (rare but possible)

## COMPLICATIONS

- Abscess
- Localized peritonitis
- Perforation (in the first 24–48 hours)
- Generalized peritonitis
- Sepsis

## DIAGNOSTIC TESTS

- WBC count (if available)
- Urinalysis to rule out a urinary tract infection
- Blood cultures if fever is present and diagnosis uncertain
- Ultrasound (if available)

## MANAGEMENT

### **Goals of Treatment**

- Maintain hydration
- Prevent complications

### **Appropriate Consultation**

Consult a physician as soon as possible.

**Adjuvant Therapy**

- Start IV therapy with normal saline
- Give enough fluid for maintenance (*see “Hourly Maintenance Fluid Requirements” table in the chapter “Fluid Management”*) or more, according to state of hydration and physician order

**Nonpharmacologic Interventions**

- Bed rest
- Nothing by mouth
- Insert a nasogastric tube if, upon consultation, a physician supports its use

**Pharmacologic Interventions**

Although classic surgical teaching has been that medication for pain may confuse the diagnosis of abdominal pain in the emergency setting, this is not supported by the literature. Opioid analgesics can increase client comfort and do not mask clinical findings or delay diagnosis.<sup>36</sup> Nonetheless, do not administer analgesia until you have consulted a physician.

If the diagnosis is clear, the physician may recommend that broad-spectrum antibiotics be started before transport to hospital.

For example, for suspected nonperforated appendix:  
cefazolin (Ancef) plus metronidazole (Flagyl)<sup>20</sup>

For suspected perforated appendix:

ampicillin (Ampicin) plus gentamicin (Garamycin)  
plus metronidazole (Flagyl)

**Monitoring and Follow-Up**

Monitor vital signs and general condition frequently.

**Referral**

Medevac as soon as possible; surgical consultation is required.

**BOWEL OBSTRUCTION**

Blockage of small or large bowel. Most common in newborns. Less common in older children unless they have a specific risk factor.

**CAUSES****Newborns**

- Atresia: duodenal (often associated with Down’s syndrome), jejunal or ileal
- Imperforate anus
- Malrotation
- Duplication of bowel
- Volvulus

**Infants**

- Atresia: duodenal (often associated with Down’s syndrome), jejunal or ileal
- Imperforate anus
- Malrotation
- Duplication of bowel
- Volvulus
- Pyloric stenosis
- Post-surgical adhesions
- Intussusception (most common in children aged 3 months to 2 years)
- Foreign body ingestion

**Older Children**

- Post-surgical adhesions
- Intussusception (unusual, but possible)
- Malrotation
- Duplication of bowel
- Tumor

**HISTORY**

- Vomiting (often with sudden onset; may be stained with bile if obstruction is below ligament of Treitz; may be projectile if obstruction is high in the GI tract; may be stained with feces if obstruction is very low in the GI tract)
- Diarrhea (bloody or colour of red currant jelly [indicates intussusception])
- Abdominal pain is severe and initially crampy
- Bowel movements decreased or absent
- Abdominal distension
- History of GI surgery
- History of similar pain

**PHYSICAL FINDINGS****General Observations**

- Colour
- Hydration
- Facial expression

**Vital Signs**

- Temperature normal or mildly elevated
- Tachycardia
- Blood pressure normal, unless child is in shock
- Capillary refill normal, unless child is in shock
- Check weight if child is well enough

**Abdominal Examination**

- Abdominal distension (present unless the obstruction is located very high in the GI tract)
- Peristaltic waves
- Bowel sounds
- Diffuse tenderness
- Shifting dullness can help to distinguish distension caused by ascites from obstruction (*see “Palpation” in the section “Assessment of the Gastrointestinal System”*)

**DIFFERENTIAL DIAGNOSIS**

(*See “Causes”, in this section.*)

- Appendicitis

**COMPLICATIONS**

- Perforation
- Peritonitis
- Strangulation of bowel segment
- Sepsis
- Hypotension, shock
- Death

**DIAGNOSTIC TESTS**

- Examination of stool for occult blood

**MANAGEMENT****Goals of Treatment**

Treatment is directed to cause and is thus usually surgical.

- Relieve distension
- Maintain hydration
- Prevent complications

**Appropriate Consultation**

Consult a physician and prepare to medevac.

**Adjuvant Therapy**

- Start a large-bore IV (size is age-dependent) with normal saline
- Give enough fluid for maintenance (*see “Hourly Maintenance Fluid Requirements” table in the chapter “Fluid Management”*) or more, according to state of hydration and physician order
- If there is evidence of hypovolemia or shock, give a bolus of IV fluid (20 mL/kg) over 20 minutes; repeat boluses may be given up to a total fluid amount of 40–80 mL/kg during the first hour<sup>16</sup>

*See “Shock” in the chapter “General Emergencies and Major Trauma”.*

**Nonpharmacologic Interventions**

- Bed rest
- Nothing by mouth
- Insert a nasogastric tube if, upon consultation, a physician supports its use. It may be attached to low suction or to straight drainage
- Insert urinary catheter; measure hourly urinary output

**Pharmacologic Interventions**

Analgesia may be necessary or prudent before transfer. Discuss with a physician first.

Morphine, dosage depending on age and weight of child

Antiemetics (for example, dimenhydrinate [Gravol]) may be necessary or prudent before transfer. Discuss use with a physician first.

**Monitoring and Follow-Up**

Monitor ABCs, vital signs, intake and output, abdominal findings and general condition frequently while awaiting transfer.

**Referral**

Medevac as soon as possible.

## GASTROINTESTINAL BLEEDING<sup>38</sup>

Life-threatening GI bleeding is uncommon in the pediatric population, however it is seen. The incidence of upper gastrointestinal bleeding in the pediatric population is much lower than that in adults.

(See “Gastrointestinal Bleeding (Upper and Lower)” in the chapter, “Gastrointestinal System” in the adult clinical practice guidelines for detailed information on the clinical presentation of gastrointestinal bleeding.)

## INTUSSUSCEPTION<sup>39</sup>

Telescoping of one section of bowel into another. In children, the most common form of intussusception is prolapse of the terminal ileum into the colon. It is most common in males 3–12 months of age.

### CAUSE

- Unknown in most cases
- Processes that can cause a mechanical lead point (for example, foreign body, intestinal polyp)

### HISTORY

- Previously well
- Recent diarrhea
- Usually starts with crampy abdominal pain, which is manifested as regular, intermittent episodes of colic during which the baby draws his or her feet up to the knee-chest position
- Vomiting
- Stools (“currant jelly” stool almost pathognomonic when present; first stools after pain onset may be normal)
- Other signs of obstruction, including abdominal distension, may be present
- Lethargy (may become extreme, very similar to coma)
- Previous history of intussusception

### PHYSICAL FINDINGS

- Vital signs usually normal in the early stages
- Pallor

### Abdominal Examination

- Careful palpation may reveal an empty feeling in the right lower quadrant and a sausage-shaped mass in the area of the transverse colon
- May be pain over area of intussusception

### Rectal Examination

- May reveal bloody or currant jelly stool
- May reveal presence of a mass

### DIFFERENTIAL DIAGNOSIS<sup>40</sup>

- Blunt abdominal trauma
- Appendicitis
- Hernia
- Gastroenteritis
- Testicular torsion
- Any process that may cause acute abdominal pain or GI bleeding
- Tumor
- Hirschsprung’s disease (congenital megacolon)
- Meckel’s diverticulum

In children who are extremely lethargic, a clinical history, physical examination and high index of suspicion are needed to rule out conditions such as meningitis, various metabolic conditions, enterocolitis caused by coxsackievirus and trauma.

### COMPLICATIONS

- Bowel necrosis
- GI bleeding
- Bowel perforation
- Sepsis
- Shock

### DIAGNOSTIC TESTS

- None

### MANAGEMENT

#### Goals of Treatment

- Identify the condition early (keep a high index of suspicion)
- Maintain hydration
- Prevent complications

#### Appropriate Consultation

Consult a physician and prepare to medevac.

**Adjuvant Therapy**

- Start IV therapy with normal saline
- Give enough fluid for maintenance (see “Hourly Maintenance Fluid Requirements” table in the pediatric chapter, “Fluid Management”) or more, according to state of hydration and physician order
- If there is evidence of hypovolemia or shock, give a bolus of IV fluid (20 mL/kg) over 20 minutes; repeat boluses may be given up to a total fluid amount of 40–80 mL/kg during the first hour<sup>16</sup>

See “Shock” in the chapter “General Emergencies and Major Trauma.”

**Nonpharmacologic Interventions**

- Nothing by mouth
- Insert nasogastric tube if, upon consultation, a physician supports its use

**Pharmacologic Interventions**

- None

**Monitoring and Follow-Up**

Monitor ABCs, vital signs, intake and output, and abdominal findings frequently while awaiting transfer.

**Referral**

- Once this diagnosis is suspected, the child must be transferred to a centre where pediatric surgery and radiology can be carried out
- Medevac as soon as possible

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