



NCC Pediatrics Continuity Clinic Curriculum: Constipation



Goals & Objectives: *To understand the differential diagnosis & management of constipation in the pediatric patient:*

- Name 8 diagnoses in the differential diagnosis of constipation.
- Identify at least 5 “red flags” in the history of a patient presenting with constipation.
- List the medications (oral and rectal) used in constipation and their indications.
- Write out the behavioral and dietary management of constipation.

Pre-Meeting Preparation:

Please read/review the following enclosures:

- “Constipation” (*PIR, AUG2020*)
- Patient Resources: Parent Handout; Stool Diary; Management Plan

Conference Agenda:

- *Review Constipation Quiz*
- *Complete Constipation Cases*
- **“Hands-on” Activity:** *Using a finger inserted into a balled fist, simulate the DRE findings of the following conditions: Hirschsprung’s, neurologic dysfunction, functional constipation, and normal anal tone.*

Post-Conference: *Board Review Q&A*

Extra-Credit:

- [Childhood Defecation Disorders](#) (*IFFGD, 2006*)—parent-friendly review
- [Constipation](#) (*PIR, 2015*)
- [Prevalence, Symptoms, & Outcome of Constipation in Infants & Toddlers](#) (*JPeds, 2005*)
- [Evaluation & Treatment of Constipation: Recs from NASPGHN](#) (*CPG, 2014*)
- [Evaluation and Treatment of Constipation in Infants and Children](#) (*American Family Physician, 2014, alternate review article*)
- **Constipation Action Plan**

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Constipation and Encopresis in Childhood

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Educational Gap

A recent study in *Pediatrics* concluded that 25% of children with functional constipation continued to experience symptoms at adult age, suggesting that referral to specialized clinics at an early stage for children who are unresponsive to first-line treatment may help improve outcomes. (1)

Objectives After completing the article, the reader should be able to:

1. Know that constipation is a common problem in childhood with a diverse clinical presentation.
2. Understand that functional constipation is a symptom-based diagnosis that does not require extensive testing.
3. Recognize that most children who present with fecal incontinence or encopresis have associated constipation.
4. Describe the treatment of constipation and encopresis, which should include a medical-behavioral approach that focuses on maintaining soft and regular bowel movements and improving toileting behavior.

INTRODUCTION

What do the following children have in common?

- A 12-month-old girl with hard pellet-like stools.
- A 3-year-old girl with frequent complaints of dysuria and hard stools.
- An 8-year-old boy with a weekly stool that is large enough to clog a toilet.
- A 12-year-old boy with daily loose stools in his underpants.

Answer: They share a familiar diagnosis: functional constipation.

Constipation is a common pediatric problem and parental concern. In general, a complaint of constipation accounts for 5% of general pediatric office visits and 25% of all referrals to pediatric gastroenterologists. The estimated worldwide prevalence is 0.7% to 29.6%. (2) Constipation rarely signifies a serious disease, but it has an unfavorable impact on patient quality of life, parental satisfaction, and health-care costs. Children with constipation often complain of abdominal pain, decreased appetite, and painful stooling, which can be distressing to both the child and the parents. Common transient problems with defecation, if unrecognized and untreated, can develop into disruption of toilet training and

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interference with achieving and maintaining bowel continence. The chronic nature of constipation and common misconceptions about the symptoms and pathophysiology of constipation can lead to frustrating experiences for patients and families. Multiple office visits, emergency department visits, and unnecessary diagnostic testing contribute to the rising cost of health-care.

DEFINITION

Defining constipation remains a challenge because stooling patterns are highly variable in childhood. Generally, infants have an average of three to four stools per day and a toddler may have two to three stools per day. (3) By the age of 4 years, children have a pattern and frequency of bowel movements that are similar to those of adults. (4) A consistent, reliable method for diagnosis allows for better understanding of and communication about the disorder. Constipation can be roughly defined as infrequent passage of hard, uncomfortable stools that are distressing to the child.

Encopresis is the repeated passage of feces into inappropriate places (usually the underpants). Some have suggested replacing the term fecal incontinence with the term encopresis in the literature to clarify that most children treated for this problem have either current or intermittent constipation. However, we continue to reference the term encopresis along with fecal incontinence due to the prevalence of this term in the literature. Fecal incontinence/encopresis is often the result of liquid/soft stool leaking around a large mass of stool in the rectum, which clinicians should describe as constipation with overflow.

Encopresis differs from delayed bowel training in that children with encopresis pass liquid/soft stool in their underpants unknowingly because of constipation with overflow and difficulty feeling the indication to stool. Children with encopresis also generally do not have accidents of formed stool whereas children with delayed bowel training simply refuse to use the toilet and have regular bowel movements in their diapers or underpants. Children with encopresis often also use the toilet to pass formed or semifformed stool.

Children with delayed bowel training may refuse to use the toilet because of fear, anxiety, oppositional behavior, skill deficits, or lack of interest or motivation. Bowel continence is expected to occur by the age of 4 years. Encopresis is not a developmental variation after the age of 4 to 5 years.

PATHOGENESIS

Causes for the development of constipation include inadequate hydration, low-fiber diet, slow intestinal transit, minimal

activity level or inactivity, and behavioral factors. Because some or all components may play a role in the development of constipation and encopresis, these conditions should be conceptualized in the biopsychosocial framework. Constipation can manifest at any age and most commonly presents during a period of transition in the child's life. In infancy, constipation may present when the breastfed infant is transitioned to formula or whole milk or when transitioning from pureed to solid foods. In toddlers, constipation may arise when toilet training begins. In childhood, constipation is more likely when a child enters school and is using a toilet away from home.

Normal Anatomy and Physiology

The internal anal sphincter, external anal sphincter, puborectalis muscle, and rectum must work together for a productive bowel movement. The internal anal sphincter and the rectum are composed of circular smooth muscle. The external anal sphincter and puborectalis muscle are made up of skeletal muscle. When the rectum is empty and collapsed, the internal and external anal sphincters are tonically contracted, maintaining continence. The puborectalis muscle forms a sling around the rectum, pulling the rectum forward when it is contracted and increasing the angle acuity between the rectum and the anus.

When a bolus of stool reaches the rectum, distension of the rectal wall signals the urge to defecate. The internal anal sphincter reflexively relaxes and the external anal sphincter contracts. There are two options at this time: 1) squatting or sitting on the toilet, relaxing the puborectalis muscle, straightening the anorectal angle, relaxing the external anal sphincter, and increasing intra-abdominal pressure to evacuate stool or 2) maintaining and increasing contraction of the external anal sphincter and gluteal muscles to force stool back into the rectum. When the stool is pushed back into the rectum, the sensation or urge to have a bowel movement disappears.

Constipation and Withholding

When children do not recognize or respond to the urge to defecate, stool is retained in the rectum, the urge to defecate subsides, and the rectal wall stretches to accommodate the fecal load. Repeated withholding or avoidance of defecation leads to larger stool load in the rectum, causing further stretching and potential thinning of the rectal wall. The retained stool becomes larger, harder, drier, and more difficult to pass the next time the urge arises.

Prolonged and repetitive stool withholding and avoidance of defecation leads to large amounts of retained stool in the rectum. The large fecal mass becomes impacted and

extremely difficult to evacuate. Peristaltic movement of the colon pushes semiformal and liquid stool lower in the colon, resulting in leakage around the large mass of stool into the child's underpants. This is especially true if the impacted fecal mass is putting downward pressure on the anosphincteric complex, distending a normally tonically contracted outflow barrier and making voluntary closure of the external anal sphincter more difficult. Therefore, a common complication of unrecognized and untreated or undertreated chronic constipation is encopresis or fecal incontinence.

If chronic constipation and encopresis are untreated, they can lead to other significant clinical issues, such as enuresis, frequent urinary tract infections, rectal prolapse, or pelvic dyssynergia. The hard fecal mass in the rectum puts pressure on the urethra and bladder, causing incomplete evacuation of the bladder. Incomplete bladder evacuation can predispose children to urinary stasis and sensations of urgency followed by hesitancy. Chronic fecal soiling exposes the urethra to bacterial pathogens that can ascend into the bladder, causing infection. In addition, the enlarged dilated rectum may result in decreased tone and contractility. Thus, increasing intra-abdominal pressure (necessary for defecation) may ultimately result in rectal prolapse during a defecation attempt. Finally, chronic constipation and encopresis can contribute to the development of pelvic dyssynergia, or pelvic floor dysfunction, in which pelvic floor muscles contract instead of relax with attempted defecation, continuing the cycle of incomplete rectal evacuation.

There are many reasons why a child may start to withhold stool or avoid defecation. Stool withholding may be an intentional behavior to avoid unpleasant sensations or associations with defecation. It may be a response to a painful bowel movement that is caused by a stool that was larger or harder than normal, an anal fissure, or a perianal infection. The child may not want to use the toilet at school due to limited time, lack of privacy, or concern about restroom cleanliness, choosing instead to withhold stool until arriving home. A child may not want to interrupt an enjoyable activity to have a bowel movement. Finally, stool withholding may be a learned avoidance behavior that is less intentional or even unconscious due to repeated painful bowel movements.

Early recognition of stool withholding can prevent chronic constipation and long-term defecation problems. Certain behaviors, such as extending and crossing legs, clenching gluteal muscles and the external anal sphincter, and avoiding the squatting position, are compatible with active stool withholding. These behaviors can be confusing for parents who may interpret them as strenuous efforts to have a bowel movement.

DIFFERENTIAL DIAGNOSIS

Some of the multiple causes for constipation (Table 1) are reviewed in this article. Most of the diagnoses discussed are exceedingly rare. Functional constipation is most common in childhood.

Functional

Infant dyschezia describes healthy infants younger than 6 months of age who strain excessively with bowel movements. They appear to be in significant discomfort, often crying or screaming, turning red in the face, and bringing their knees up to their abdomens, before eventually passing soft stools. Symptoms abate following the stool passage. Infants of this age have not yet coordinated increasing intra-abdominal pressure with relaxation of pelvic floor muscles to have a bowel movement. Infant dyschezia often spontaneously resolves around 6 months of age.

Functional constipation and functional fecal retention are synonymous and the terms are often used interchangeably. Functional constipation refers to hard or infrequent

TABLE 1. Differential Diagnosis of Constipation and Defecation Disorders

FUNCTIONAL	NEUROLOGIC
<ul style="list-style-type: none"> • Infant dyschezia • Functional constipation • Nonretentive fecal soiling 	<ul style="list-style-type: none"> • Hirschsprung disease • Neuronal dysplasia • Anal achalasia • Disorders of the spinal cord
Obstructive	Endocrine/Metabolic
<ul style="list-style-type: none"> • Anal stenosis • Anterior displacement of the anus • Small left colon syndrome • Meconium ileus • Colonic stricture 	<ul style="list-style-type: none"> • Hypothyroidism • Celiac disease • Diabetes • Cystic fibrosis
Medications	Dietary/Allergy
<ul style="list-style-type: none"> • Opioid narcotics • Anticholinergic agents • Tricyclic antidepressants 	<ul style="list-style-type: none"> • Cow milk protein allergy • Low-fiber diet • Decreased fluid intake for age
Other	
<ul style="list-style-type: none"> • Sexual abuse • Chronic intestinal pseudo-obstruction 	

stools in the absence of any other disorders, including neurologic, obstructive, endocrine, or metabolic, and is discussed in more detail throughout this review.

Neurologic

Hirschsprung disease (HD) is a congenital form of constipation in which the infant or child cannot evacuate stool due to a lack of ganglion cells in the myenteric and submucosal plexus of the intestinal wall. Without ganglion cells and nerve fibers to innervate the intestinal musculature, the affected colonic segment remains in a chronic contracted state.

HD should be considered in any newborn who has delayed passage of meconium (ie, beyond 48 hours after birth). Age at presentation may depend on the length of the affected intestine. Infants with long-segment HD develop signs of distal intestinal obstruction, which may include abdominal distention, vomiting, irritability, lethargy, and failure to pass meconium or stool. Enterocolitis with or without bowel perforation must be considered if the infants develop fever, bloody diarrhea, and continued abdominal distention. One of the most serious and possibly fatal complications of Hirschsprung enterocolitis is progression to toxic megacolon and overwhelming sepsis.

Infants with shorter segments of HD may not be diagnosed until childhood. They may experience intermittent abdominal distention and severe constipation that is refractory to standard treatment. They may also have poor growth or failure to thrive due to decreased caloric intake. Only rarely do children who have HD experience encopresis or inadvertent leakage of stool.

Anal achalasia is the failure of the internal anal sphincter to relax despite the presence of ganglion cells on biopsy. It is unclear if anal achalasia is a variant or mild form of HD.

Neuronal dysplasia and hypoganglionosis are rare disorders involving inadequate or inappropriate numbers of ganglion cells. These conditions are infrequent and incompletely understood. They can be associated with neurofibromatosis, multiple endocrine neoplasia type IIb, or Chagas disease.

Obstructive

Anal stenosis presents with painful and difficult defecation in infancy. This is due to the presence of a tight anal opening or ring.

Anterior displacement of the anus is a congenital variation in the placement of the anus. External anal inspection can reassure the clinician that anterior displacement is not present. Theoretically, the anogenital index can be calculated after careful examination and measurement of the perineum

by dividing the distance (in centimeters) from the vagina or scrotum to the anus by the distance (in centimeters) from the vagina or scrotum to the coccyx. The normal anogenital index in females is 0.30 ± 0.09 and in males is 0.56 ± 0.2 . Affected children have difficulty with defecation because they are not able to straighten the anorectal canal completely due to malposition of the anal sphincter complex in relation to the anus.

Meconium ileus causes delayed passage of meconium in children with cystic fibrosis. It is one of the earliest signs of cystic fibrosis and is almost always associated with pancreatic insufficiency. The meconium in infants with cystic fibrosis is much thicker than the meconium in unaffected children, which is attributed to an altered ratio of albumin and water concentrations. The viscous meconium and increased mucus production can lead to partial or total bowel obstruction. This is often recognized at birth or within the first few days of birth.

Strictures can occur anywhere in the intestinal tract. If they occur more distally, children often have symptoms of distal obstruction, including lower abdominal pain, abdominal distention, and infrequent or total lack of bowel movements. Strictures can be congenital or acquired due to necrotizing enterocolitis in infants or inflammatory bowel disease in children and adolescents.

Small left colon syndrome is a rare diagnosis that is most closely associated with infants born to women who have diabetes. Infants with signs of distal intestinal obstruction and a small left colon noted on barium enema should be screened for HD and cystic fibrosis because a small-caliber left colon is a common finding on barium enema due to the aganglionic segment in HD or as a result of meconium ileus in cystic fibrosis.

Other

Hypothyroidism may slow the motility of the gastrointestinal tract, leading to constipation. Other symptoms of hypothyroidism include fatigue; weight gain; shortness of breath; and changes in the skin, hair, or nails. This constellation of findings can help direct appropriate testing.

Celiac disease is an autoimmune sensitivity to gluten and gluten-containing products in genetically susceptible individuals. The clinical presentation of this disease is so variable that the "atypical" or nonclassic presentation of celiac disease is becoming more commonplace. Children may present with diarrhea, constipation, bloating, abdominal pain, poor weight gain, short stature, skin rash, or iron deficiency anemia. Evaluation for celiac disease should be considered in children who have constipation that does not respond to laxative therapy.

Chronic intestinal pseudo-obstruction manifests as severe altered motility of the intestinal tract. This rare disorder can be congenital or acquired. Children with this disorder experience recurrent signs and symptoms of bowel obstruction, such as vomiting, abdominal pain and distention, and constipation or diarrhea without an anatomic obstruction.

CLINICAL ASPECTS

Diagnosis of constipation relies foremost on an appropriate definition, including the symptom-based Rome III criteria for functional constipation. (5) Rome III defines functional constipation as two or more of the following (fulfilled at least weekly for 2 months) in a child older than 4 years who does not have irritable bowel syndrome:

1. Two or fewer defecations in the toilet per week.
2. At least one episode of fecal incontinence per week.
3. History of retentive posturing or excessive volitional stool retention.
4. History of painful or hard bowel movements.
5. Presence of a large fecal mass in the rectum.
6. History of large-diameter stools that may obstruct the toilet.

Similar age-appropriate criteria are also available for children younger than 4 years. A variety of supplemental tests should be applied only in the presence of warning signs or symptoms or with failure of constipation to respond to typical therapy. Test results should be interpreted in the context of the patient's history and physical examination findings, which are sufficient for diagnosis in most cases.

The clinical history should include a description of stool frequency and quality, associated symptoms such as abdominal pain and rectal bleeding, growth pattern, continence and toilet training, presence or absence of withholding behavior, and symptom onset and duration. Delayed passage of meconium should raise suspicion for HD. Thin, ribbonlike stools also may suggest HD compared to the large bulky stools that often are found with functional constipation. Fecal incontinence should be directly assessed in terms of frequency and quality because it may be concurrent with constipation due to leakage of liquid stool around a firm rectal stool mass. Symptoms of overflow incontinence typically are small-volume liquid stools, often passed in the afternoon or during activities and sometimes unrecognized or ignored by the child. Specific questions, including family history, should be directed toward exclusion of diagnoses other than functional constipation.

Standardized measures such as the modified Bristol stool form scale (6) or Amsterdam infant stool scale (7) allow for

a common language and description of stools. These measures can be used in combination with age-appropriate questions that engage the patient and caregiver in an effort to overcome barriers of symptom anxiety, embarrassment, or denial (eg, Does it take you a long time to push poop out of your body? Does the poop hurt your bottom when it comes out?). Physically exemplifying withholding behavior during the interview sometimes provides a moment of clarity for caregivers who thought such behavior indicated an attempt at defecation.

Physical examination should explore both the severity of constipation and potential causes. Ideally, a growth curve contains data spanning the onset of constipation to determine current parameters as well as past growth velocity. Observation of the patient should not be underestimated in its ability to elicit information; interaction between the patient and caregiver, willingness of the patient to engage in toileting discussion, and ability to sit and climb on or off the examination table can provide important diagnostic clues and sometimes direct treatment strategies. Abdominal distension, tenderness to palpation, and presence of fecal mass as well as perianal examination for skin tags, fissures, and anal appearance and location are important for all new patients in whom constipation is suspected. External anal inspection can assess for anal atresia and displacement and may identify anal fissures, skin tags, or external hemorrhoids. It may also be useful to assess sphincter tone visually or identify fecal material around the anus or in the underwear. In addition, examining the back for sacral dimples or spinal deformities and assessing lower extremity motor tone, strength, and deep-tendon reflexes can indicate whether additional assessment for neurologic pathology is indicated.

Digital rectal examination (DRE) is important in specific circumstances but is not always necessary to diagnose functional constipation. Palpation of a firm or large rectal stool mass on rectal examination often confirms clinical suspicions, abnormalities in sphincteric tone may indicate anal stenosis, and an empty rectal vault with expulsion of stool on finger withdrawal is a classic but infrequently seen finding in HD. Performing a DRE should be left to the discretion of the clinician. DRE may provoke anxiety or fear in children who have had past experiences with painful stool passage. It is important to avoid reinforcing this negative association when possible and limiting frightening or painful interventions, which can aid in building a therapeutic alliance between the patient and caregiver.

Laboratory evaluation is not warranted for constipation unless warning signs are present (Table 2) or other aspects of the history or physical examination suggest systemic

TABLE 2. “Red Flag” Symptoms

- Delayed passage of meconium
- Failure to thrive
- Bloody stools
- Severe abdominal distention
- Perianal fistula
- Absent anal wink
- Sacral dimple

disease. Constipation rarely is the sole presenting symptom of hypothyroidism, electrolyte abnormalities, lead toxicity, or celiac disease, and routine screening for these diseases is not recommended. Routine allergy testing is also not recommended in evaluation of constipation, and cow milk protein restriction in young children for a limited time to assess the clinical response remains controversial.

History and physical examination generally precludes the need for radiography to diagnose functional constipation. Although the presence or absence of a fecal mass and determination of stool burden are important to direct therapy, abdominal radiography is usually not necessary. An abdominal radiograph may help parents visualize the amount of retained stool, allowing for a better understanding of constipation (with or without overflow) and the proposed treatment plan. A single abdominal radiograph is an inexpensive, low-risk test, but even when using standardized scales to determine stool burden, it is not clearly reliable, sensitive, or specific.

The indications for barium enema are extremely limited. Barium or other contrast enema is suggested but not required when constipation is accompanied by “red flag” symptoms (Table 2). It provides information about the caliber of the rectum and colon and may be useful if obstruction in the colon is suspected. It does not require any specific preparation and does not subject the patient to risk aside from radiation exposure. Gastrografin enemas in the setting of suspected meconium ileus may be diagnostic as well as therapeutic.

Further diagnostic tests when the clinician suspects HD depend on patient characteristics (age, health status) and test availability. Full-thickness rectal biopsy remains the gold standard for diagnosis and is performed under anesthesia, but rectal suction biopsy can be performed at the bedside without adjunct medication and is recommended in lieu of surgical biopsy as initial evaluation. Although rectal suction biopsy traditionally is performed in infants, it may also be

sufficient in older children and teenagers. Aganglionosis or hypertrophied nerves on rectal biopsy hematoxylin and eosin staining can indicate HD. Although the presence or absence of these findings is typically sufficient for determining or ruling out the diagnosis of HD, supplementary analysis may demonstrate aganglionic intestine with altered acetylcholinesterase morphology or absent calretinin expression. Anorectal manometry uses a small rectal balloon and anorectal pressure sensors to determine the presence or absence of the rectoanal inhibitory reflex (relaxation of the internal anal sphincter in response to rectal distension). Although not used as an isolated test to diagnose HD, clear demonstration of the rectoanal inhibitory reflex is sufficient to remove HD from diagnostic consideration.

Anorectal manometry may also have a role in determining rectal sensation threshold and the presence of anorectal dyssynergia, potentially directing therapy, including the addition of physiotherapy or biofeedback. High-resolution anorectal manometry with increased number of pressure sensors and enhanced computer analysis may better delineate anorectal sensory and motor function, but this test is not widely available in pediatrics.

Spinal imaging, including magnetic resonance imaging, should be considered in the child with constipation and other neurologic signs or symptoms, including lower motor dysfunction, lower urinary tract symptoms, and lumbosacral spinal abnormalities. The neurologic examination may yield normal results in constipated children with spinal cord abnormalities, but routine spinal imaging of constipated children is not recommended.

MANAGEMENT

Constipation and fecal incontinence are clinical issues that require a thorough understanding of physiology, biology, behavior, and psychology for effective management. Therefore, a combined treatment approach is recommended. Although no objective clinical trials and data support a single treatment approach to constipation and fecal incontinence, we discuss a general management protocol. The management protocol can be divided into four major treatment components: 1) education about constipation and encopresis, 2) disimpaction or cleanout of stool, 3) maintenance laxative therapy and establishing regular bowel movements, and 4) behavior modifications to improve daily toileting behaviors.

Education

Education and reassurance comprise the first component in the management of functional constipation and encopresis

or fecal incontinence and should continue throughout all stages of management. Education includes talking with the parents and the child about constipation and its influence on lower gastrointestinal tract functioning and overflow and fecal incontinence. Developmentally appropriate discussion of the anatomy and physiology of the lower gastrointestinal tract and defecation is important and visual diagrams can aid in this education. Many parents of children presenting with encopresis incorrectly assume that the child is soiling on purpose. Parents need to be educated that fecal incontinence is often involuntary and the result of overflow from constipation, deconditioning, or altered function of the rectum and pelvic floor as well as learned withholding behaviors in some children. Counseling can be provided to parents to help them establish a positive and supportive attitude toward their child during treatment. Counseling can help remove blame from the child and encourage the parents and child to join the clinician in addressing the symptoms. Clinicians should recognize and empathize with families about the stress and frustration surrounding constipation and fecal incontinence.

Disimpaction or Cleanout

The second component in the management of functional constipation is removal of the fecal impaction. Such removal decompresses the rectum, allows for the normal passage of stool, and prevents liquid stool from leaking around the fecal mass. If the fecal impaction is not removed, a child with functional constipation cannot achieve a normal stooling pattern, and fecal soiling may be exacerbated, which is highly frustrating to parents and children.

Among the approaches to disimpaction are high-dose oral laxatives, enemas, manual disimpaction, or admission to the hospital for nasogastric administration of a bowel cleansing agent. High-dose oral laxatives and enemas are equally efficacious, but the preferred method for evacuation of fecal impaction is via the oral route. Minimizing attention to the anus and rectum via oral laxatives can be important because these children have a history of unpleasant and painful experiences associated with defecation. Current recommendations (Table 3) suggest the use of polyethylene glycol solution (PEG 3350) at doses of 1 to 1.5 g/kg per day for 3 consecutive days (up to 6 consecutive days if necessary) to achieve disimpaction. If PEG 3350 is unavailable, once-daily sodium phosphate, saline, or mineral oil enemas for 3 consecutive days are acceptable. Suppositories may be used in combination with high-dose oral laxatives to help promote evacuation of the fecal impaction. Manual disimpaction is rarely necessary and generally not advised except in cases of severe impaction and obstipation. If manual

TABLE 3. Medical Therapy for Disimpaction

◦ Oral (preferred)
■ Polyethylene glycol solution 1–1.5 g/kg/day x 3–6 consecutive days
■ Magnesium citrate 4 mL/kg/day x 2 consecutive days
◦ Rectal
■ Normal saline enema 10 mL/kg x 3 consecutive days
■ Sodium phosphate enema x 3 consecutive days
· 2–4 years: one-half contents of a 2.25-oz pediatric enema
· 5–11 years: 2.25-oz pediatric enema
· >12 years: 4.5-oz enema
■ Mineral oil enema x 3 consecutive days
· 2–11 years: one-half contents of a 4.5-oz bottle
· >12 years: 4.5-oz bottle
◦ Nasogastric (requires hospital admission)
■ Polyethylene glycol solution 25–40 mL/kg/hr until rectal effluent is clear (24–48 hr)

disimpaction is required, general anesthesia should be used to decrease the trauma associated with this procedure.

Maintenance Therapy

The third component in the management of functional constipation is maintenance laxative therapy to ensure regular passage of soft, appropriate-sized stools. Such maintenance can eliminate painful defecation and prevent the recurrence of fecal impaction. This component of treatment may last many months to years and requires ongoing close follow-up evaluation. Having families use a bowel symptom tracking form or calendar to monitor the child's response to treatment may be helpful. Clinicians should emphasize the need for close monitoring and long-term treatment with parents because nonadherence to prescribed medications or discontinuing medications too early can result in the development of hard stools and relapses of withholding, leading to fecal impaction. The most common medication used for maintenance therapy is PEG 3350 due to its ease of use, titratability, low adverse effect profile, and efficacy.

When full evacuation of the rectum consistently occurs with stooling for 1 to 2 months without any development of hard stools or withholding behaviors, the laxative medication may gradually be reduced. Early recognition of relapse by both parents and clinicians is vital to long-term treatment of functional constipation. Increasing therapy and aggressively treating a relapse can avoid prolongation of the maintenance phase.

Laxatives used for maintenance therapy should be individualized for each patient. Dosing guidelines and recommendations are suggestions for starting therapy (Table 4). In practice, laxative doses should be titrated to achieve at least one soft bowel movement every day. Understanding the mechanism of action of each laxative can aid clinicians in customizing maintenance therapy because combination therapy can be useful and necessary.

Osmotic laxatives increase the osmotic load within the lumen of the intestine, allowing for fluid retention. The retained fluid is incorporated into the stool and distends the colon, promoting peristalsis. Children may experience bloating, but these laxatives are generally safe; the most common adverse effect is diarrhea. Examples of osmotic laxatives include PEG 3350, lactulose, and magnesium products such as magnesium hydroxide and magnesium citrate.

Stimulant laxatives such as bisacodyl or senna irritate smooth muscle of the colon and stimulate the myenteric plexus to produce peristaltic activity within the colon. Children may experience abdominal cramping with the peristaltic activity. The abdominal cramping is self-limited and can be reduced by decreasing the dose. Although stimulant laxatives are safe, no studies have assessed dependency with chronic daily use. Stimulant laxatives can generally be reserved for intermittent use and rescue therapy.

Stool softeners decrease the surface tension of the stool, which allows integration of more water into the stool, thereby softening it. Docusate has a modest stool softening effect. It is generally safe, with minimal adverse effects.

Mineral oil may ease the passage of stool by lubricating the intestine and decreasing water absorption. A common complaint with use of mineral oil is leaking of the oil from the rectum, which can be unpleasant. Palatability of mineral oil is also a challenge for many children. Oral mineral oil is contraindicated in children younger than age 1 year or with known or suspected aspiration.

Dietary modification is frequently considered for treatment, but increasing fluid or fiber intake has unclear efficacy in constipated children. Maintaining adequate hydration is important for a variety of physiologic functions and, in most cases, is a safe recommendation. However, solely increasing fluid intake should not be expected to alter stooling frequency or consistency. Fiber is often chosen as first-line therapy in constipated adults, but recent reviews of evidence cast some doubt on its effectiveness. Dietary fiber intake may be reduced in constipated children compared to those without constipation, but increasing fiber does not clearly improve symptoms and is not recommended as therapy based on current evidence. Fiber also may be tolerated less well than other therapies for constipation in children. Although complications related to fiber therapy are unusual, use of fiber as monotherapy may delay implementation of effective treatment and prolong patient symptoms. Growing evidence supports probiotic and prebiotic use as treatment in adult constipation. These agents may reduce whole-gut transit time, increase stool frequency, and reduce constipation-associated symptoms. However, evidence in pediatrics demonstrates mixed efficacy and their use is associated with additional patient expense, possibly to the exclusion of other effective therapies.

Behavior Modification

The fourth treatment component is behavior modification to improve daily toileting habits and routines. This component should be started at the time of bowel disimpaction or cleanout and continue throughout maintenance treatment.

TABLE 4. Maintenance Therapy for Chronic Constipation

◦ Osmotic laxatives
■ Polyethylene glycol 1 g/kg/day
■ Lactulose 1–3 mL/kg/day divided into 2 doses
■ Magnesium hydroxide
• <2 years: 0.5 mL/kg/dose
• 2–5 years: 5–15 mL/day once before bedtime or in divided doses
• 6–11 years: 15–30 mL/day once before bedtime or in divided doses
• ≥12 years: 30–60 mL/day once before bedtime or in divided doses
◦ Stool Softeners/Lubricants
■ Docusate 5 mg/kg/day (up to 400 mg/day)
■ Mineral oil 1–3 mL/kg/day divided into 2 doses
◦ Stimulant Laxatives (can be used for rescue therapy)
■ Senna
• 1 month–2 years: 2.2–4.4 mg/day at bedtime or in 2 divided doses
• 2–6 years: 4.4–6.6 mg/day at bedtime or in 2 divided doses
• 6–12 years: 8.8–13.2 mg/day at bedtime or in 2 divided doses
• >12 years: 17.6–26.4 mg/day at bedtime or in 2 divided doses
■ Bisacodyl
• 3–12 years: 5–10 mg/day
• >12 years: 5–15 mg/day

Research regarding specific behavioral treatments for encopresis is disjointed and difficult to synthesize based on recent reviews. However, the use of operant procedures (incentive/reward programs and positive reinforcement) for goals related to toileting and cleanliness have empiric support. Incentive/reward systems can be used to target various goals related to successful toileting. The targets of intervention may vary with individual children. Rewarding the patient for cooperation with the components of the treatment regimen and NOT just for proper elimination in the toilet is important. Children must achieve important goals or behavioral skills on the way to successful toileting, such as gaining confidence and compliance with toilet sitting, responding appropriately and honestly to soiling accidents, and learning effective pushing techniques to produce complete and emptying bowel movements.

An important part of the standard medical-behavioral treatment of encopresis is improving toilet sitting behavior. However, stool withholding and toileting refusal behaviors may interfere with progress toward toilet sitting goals and sometimes must be addressed before implementing a toilet sitting plan. Stool withholding and toileting refusal are believed to be related to the history of difficult-to-pass or even painful bowel movements and are often conceptualized as an anxiety or phobia about passing bowel movements, especially into the toilet. The initial focus of stool withholding management should be to ensure soft and easy-to-pass bowel movements so that the child can gain comfort in passing a bowel movement on a daily basis. In early stages of treatment, bowel movements in a pull-up or diaper may need to be reinforced for the child to gain confidence and voluntarily relax the pelvic floor to achieve a bowel movement. Toilet refusal behavior should also be treated with interventions that gradually desensitize children toward toileting. Desensitization to the toilet may include rewarded trips to the bathroom to look at the toilet, stand by the toilet, sit on a closed lid fully clothed, and eventually sit on the toilet with open lid and pants down. Once the child is having bowel movements comfortably in the diaper or a pull-up and able to sit on the toilet without significant anxiety, parents can use a shaping procedure to encourage bowel movements closer to the toilet and eventually into the toilet. Reward systems or incentives are used to encourage children to take a next step toward successful toileting behavior.

Once the child is comfortable and compliant with sitting on the toilet, the overall goal is to improve daily toileting habits and routines. Empiric evidence suggests that operant procedures or reward systems should be an active part of

a toilet sitting schedule. Scheduled toilet sits can occur 20 to 30 minutes after meals to take advantage of the gastrocolic reflex. In addition, pairing toilet sitting with meals is easier to build into the family routine and can create a behavioral stimulus condition for bowel movement success. The time on the toilet should be unrushed and positive. It may include special activities that are only available while on the toilet (special books, toys, or handheld electronics). Parents can also be counseled to provide modeling and coaching during toilet sitting, which includes the parents showing the child when they sit on the toilet and that they are pushing to help get bowel movements out in the toilet. Toilet sits should generally last 5 minutes, but some children need to gradually work their way up to longer sits if there is initial resistance. Scheduled, rewarded toilet sits should include small stepstools to assist the children in getting on the toilet and to use as leverage for their feet. We recommend a wider stepstool or potty stool to allow the child to spread out the feet and knees for better posture to allow successful defecation and for them to feel more comfortable and balanced on the toilet. Once children are having more productive bowel movements in the toilet and soiling has stopped for a 1 month, the number of daily toilet sits can be reduced. Often parents can observe which toilet sits during the day are most productive and begin focusing on those sits. As treatment progresses, children can start to earn incentives/rewards for independently going to the toilet when they feel the urge to have a bowel movement rather than strictly relying on the schedule and parental prompt.

Involving the preschool, kindergarten, or school in scheduled and rewarded toilet sitting is important. Children who are apprehensive about completing toilet sits at school benefit from a more private restroom so that they can take their time and be comfortable with toileting. It also is helpful to allow an "anytime bathroom pass" for children when they start school so that they do not withhold stool when they need to have a bowel movement.

Due to the biopsychosocial nature of functional constipation and fecal incontinence, multidisciplinary or even interdisciplinary care is becoming more common and is highly recommended when available. The combination of medical therapy, behavioral modification, and supportive counseling has the greatest success in the treatment of constipation and encopresis. When multidisciplinary or interdisciplinary care is not readily available, clinicians can still effectively treat this condition with a basic understanding of behavior modification techniques, such as the use of incentives/rewards and gradual setting of goal related to effective toileting.

PROGNOSIS

The overall prognosis for functional constipation has not been completely established. However, a general message for families is that the treatment of constipation and encopresis often requires many months of medication and behavior modification. In addition, relapse of symptoms is very common. According to a recent systematic review, approximately 60% of children with functional constipation are symptom-free between 6 and 12 months after beginning treatment regardless of laxative use, with the remaining 40% of children still experiencing symptoms. (8) In addition, a study in *Pediatrics* concluded that 25% of children with functional constipation continue to experience symptoms into adulthood. (9) Older school-age children and adolescents who have ongoing constipation and encopresis are even more difficult to treat. All these points highlight the need for aggressive treatment as early as possible as well as close follow-up evaluation and adjustments to the treatment plan. Nonetheless, most children with constipation and encopresis can be managed effectively by the general pediatrician. Indications for referral to a pediatric gastroenterologist include medical red flags, trouble with disimpaction, trouble establishing maintenance therapy, and lack of improvement after 6 months of therapy. Referral to a pediatric behavioral specialist should be considered if significant conditions are interfering with treatment, such as attention-deficit/hyperactivity disorder, oppositional behaviors, anxiety or mood disorders, family

conflict or parent-child conflict, or problems with adherence to recommendations.

Summary

The following summary statements are based primarily on consensus and expert opinion due to the lack of relevant clinical studies. A recent comprehensive review of the literature by Tabbers et al, in the *Journal of Pediatric Gastroenterology and Nutrition*, identified no moderate- or high-quality evidence regarding therapeutic interventions for the evaluation and treatment of functional constipation in infants and children.

- The presentation of constipation varies, but constipation should be identified according to an appropriate definition, which includes the symptom-based Rome III criteria.
- Constipation is prevalent in children and infrequently a result of underlying intestinal or systemic disease.
- Based on limited evidence as well as consensus, history and physical examination are sufficient to provide a diagnosis of functional constipation; digital rectal examination, laboratory tests, and abdominal radiography are generally not necessary.
- Treatment of constipation requires four components: education, disimpaction, maintenance therapy, and behavioral modification.

References for this article are at <http://pedsinreview.aappublications.org/content/36/9/392.full>.

Constipation and Your Child



Bowel patterns vary from child to child just as they do in adults. What's normal for your child may be different from what's normal for another child. Most children have bowel movements 1 or 2 times a day. Other children may go 2 to 3 days or longer before passing a normal stool.

If your child doesn't have daily bowel movements, you may worry that she is constipated. But if she is healthy and has normal stools without discomfort or pain, this may be her normal bowel pattern.

Children with constipation have stools that are hard, dry, and difficult or painful to pass. These stools may occur daily or may be less frequent. Although constipation can cause discomfort and pain, it's usually temporary and can be treated.

Constipation is a common problem in children. It's one of the main reasons children are referred to a specialist called a *pediatric gastroenterologist*. Read more to learn about constipation and its causes, symptoms, and treatments, as well as ways to prevent it.

What causes constipation?

Constipation frequently occurs for a variety of reasons.

- **Diet.** Changes in diet, or not enough fiber or fluid in your child's diet, can cause constipation. (See "Getting enough fiber in your diet.")
- **Illness.** If your child is sick and loses his appetite, a change in his diet can throw off his system and cause him to be constipated. Constipation may be a side effect of some medicines. Constipation may result from certain medical conditions (such as hypothyroidism or low thyroid).
- **Withholding.** Your child may withhold his stool for different reasons. He may withhold to avoid pain from passing a hard stool—it can be even more painful if your child has a bad diaper rash. Or he may be dealing with issues about independence and control—this is common between the ages of 2 and 5 years. Your child also may withhold because he simply doesn't want to take a break from play. Your older child may withhold when he's away from home, at camp or school, because he's embarrassed or uncomfortable using a public toilet.
- **Other changes.** In general, any changes in your child's routine (such as traveling, hot weather, or stressful situations) may affect his overall health and how his bowels function.

If constipation isn't treated, it may get worse. The longer the stool stays inside the lower intestinal track, the larger, firmer, and drier it becomes. Then it becomes more difficult and painful to pass the stool. Your child may hold back his stool because of the pain. This creates a vicious cycle.

What are the symptoms of constipation?

Symptoms of constipation may include the following:

- Many days without normal bowel movements
- Hard stools that are difficult or painful to pass
- Abdominal pain (stomachaches, cramping, nausea)
- Rectal bleeding from tears called *fissures*

What is encopresis?

If your child withholds her stools, she may produce such large stools that her rectum stretches. She may no longer feel the urge to pass a stool until it is too big to be passed without the help of an enema, laxative, or other treatment. Sometimes only liquid can pass around the stool and leaks out onto your child's underwear. The liquid stool may look like diarrhea, confusing both parent and pediatrician, but it's not. This problem is called *encopresis*.

- Soiling (See "What is encopresis?")
- Poor appetite
- Cranky behavior

You also may notice your child crossing her legs, making faces, stretching, clenching her buttocks, or twisting her body on the floor. It may look like your child is trying to push the stool out but instead she's really trying to hold it in.

How is constipation treated?

Constipation is treated in different ways. Your pediatrician will recommend a treatment based on your child's age and how serious the problem is. If your child's case is severe, he may need a special medical test, such as an x-ray. In most cases, no tests are needed.

Treatment of babies. Constipation is rarely a problem in younger infants. It may become a problem when your baby starts solid foods. Your pediatrician may suggest adding more water or juice to your child's diet.

Treatment of older children. When a child or teen is constipated, it may be because his diet doesn't include enough high-fiber foods and water. Your pediatrician may suggest adding more high-fiber foods to your child's diet, and encourage him to drink more water. These changes in your child's diet will help get rid of abdominal pain from constipation.

Severe cases. If your child has a severe case of constipation, your pediatrician may prescribe medicine to soften or remove the stool. *Never give your child laxatives or enemas unless your pediatrician says it's OK; laxatives can be dangerous to children if not used properly.* After the stool is removed, your pediatrician may suggest ways you can help your child develop good bowel habits to prevent stools from backing up again.

How can constipation be prevented?

Because each child's bowel patterns are different, become familiar with your child's normal bowel patterns. Make note of the usual size and consistency of her stools. This will help you and your pediatrician determine when constipation occurs and how severe the problem is. If your child doesn't have normal bowel movements every few days, or is uncomfortable when stools are passed, she may need help in developing proper bowel habits.

Getting enough fiber in your diet

The American Academy of Pediatrics recommends that children between the ages of 2 and 19 years eat a daily amount of fiber that equals their age plus 5 grams of fiber. For example, 7 grams of fiber is recommended if your child is 2 years old (2 plus 5 grams).

The following are some high-fiber foods:

Food	Grams of Fiber
Fruits	
Apple with skin (medium)	3.5
Pear with skin	4.6
Peach with skin	2.1
Raspberries (1 cup)	5.1
Vegetables Cooked	
Broccoli (1 stalk)	5.0
Carrots (1 cup)	4.6
Cauliflower (1 cup)	2.1
Beans Cooked	
Kidney beans (½ cup)	7.4
Lima beans (½ cup)	2.6
Navy beans (½ cup)	3.1
Whole Grains Cooked	
Whole-wheat cereal (1 cup flakes)	3.0
Whole-wheat bread (1 slice)	1.7

You can...

- Encourage your child to drink plenty of water and eat more high-fiber foods.
- Help your child set up a regular toilet routine.
- Encourage your child to be physically active. Exercise along with a balanced diet provides the foundation for a healthy, active life.

Remember

If you are concerned about your child's bowel movements, talk with your pediatrician. A simple change in diet and exercise may be the answer. If not, your pediatrician can suggest a plan that works best for your child.

The information contained in this publication should not be used as a substitute for the medical care and advice of your pediatrician. There may be variations in treatment that your pediatrician may recommend based on individual facts and circumstances.

From your doctor



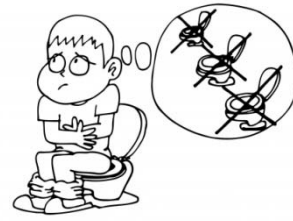
Name:
Weeks of:

Day/date	Toilet sitting			Stools outside of sitting time	Medication	Comments
	AM	Mid-day	PM			

Instructions:

- Write your child's name and the time period in the upper right corner.
- Write the day of the week and date in the first column.
- When your child has a bowel movement in the toilet place an "X" in the appropriate column (ie, during toilet sitting or outside of sitting time).
- When your child sits on the toilet, but doesn't have a bowel movement, place an "O" in the appropriate column.
- When your child takes his or her maintenance laxative, place a checkmark in the "Medication" column.
- Write any additional information in the "Comments" column (eg, need for rescue medication, episodes of wetting, soiling, or abdominal pain).
- Keep this diary and bring it with you to the next appointment.

Constipation Management



I. Cleanout Phase

Give your child the following:

- ___ Miralax: Give ___ capful mixed in 8oz of liquid ___ times/day for ___ days.
- ___ Pediatric Fleet Enema: Give ___ enema ___ times/day for ___ days.
- ___ Dulcolax Tablets: Give ___ tablet ___ times/day for ___ days.
- ___ Dulcolax Suppository: Insert 1 suppository into rectum ___ for ___ days.
- ___ Magnesium Citrate: Drink ___ oz ___ times/day for ___ days.
- ___ Fleets PhosphoSoda: Drink ___ oz or ___ cc ___ times/day followed by 8 oz of water for ___ days.

II. Maintenance Phase

After the cleanout phase is complete, give your child the following:

- ___ Miralax: Give ___ capful mixed in 8 oz of liquid ___ times/day.
- ___ Milk of Magnesia: Give ___ tablespoons ___ teaspoons ___ times/day.
- ___ Lactulose: Give ___ tablespoons ___ teaspoons ___ times/day.
- ___ Mineral Oil: Give ___ tablespoons ___ teaspoons ___ times/day.
- ___ Dulcolax Tablets: Give ___ tablet ___ times per week

III. Daily Behaviors

1. Make sure your child drinks plenty of water every day
2. Have your child sit on the toilet and try to have a bowel movement for 10 minutes each day approximately 30 minutes after breakfast and dinner. Give your child a foot stool to put his feet on if his feet do not touch the floor. Toilet time is not a punishment and should be a calm pleasant relaxed event. **This is a very important part of your child's care!**
- 3 Increase your child's intake of fresh fruits and vegetables.
4. Turn off the TV & computer, and have your child participate in some form of exercise for at least 30 minutes a day.

Constipation takes a long time to develop—and can take many months to correct. Please be patient with your child!

Constipation Quiz

1. **Define Constipation:**

- A) Failure to evacuate the lower colon completely.
- B) A delay or difficulty in defecation for ≥ 2 weeks
- C) Type 1 & 2 on the [Bristol Stool Chart](#)
- D) < 2 stools/wk & h/o of large diameter stools
- E) All of the Above

2. Please complete the following **laxative classification table:**

	Bulk-producers	Stool softeners	Lubricants	Osmotics	Stimulants
<i>Mechanism</i>					
Examples					

3. What is the goal of **maintenance therapy**? How long should it be continued?

Constipation Cases

Case 1:

Dee is a 6 year old male who presents with fecal soiling on a daily basis, which began in late October. He claims he "can't tell when" he is about to soil. His parents Mr. and Ms. Stewart report multiple bouts daily of fecal urgency where he rushes to the toilet, only to pass small amounts of diarrheal stool. His toilet sitting behavior is peculiar in that he sits far back on the toilet seat with his knees extended and his toes pointed, straining at defecation. Once or twice weekly he will pass a very large caliber formed stool, which has on occasion plugged the plumbing. This pattern was not thought to be a problem by his parents as it began shortly after they began potty training him at two years old so that he could enter preschool earlier than rest of the neighborhood children.

Who was D. Stewart?

What additional history would you like to know?

The dietary history finds that he eats the school breakfast and lunch, and will often not touch his vegetables at supper. Closer questioning indicates Dee does not pick fruit or vegetables from the salad bar at school, and the school typically offers only sweet buns or a burrito for breakfast. Physical examination finds a midline mass in the lower abdomen, with a rectal examination that shows a normally placed anus with an intact anal wink and a perineum coated with stool. The anus is shortened with the internal anal sphincter dilated by a massive amount of formed stool. You are unable to accurately assess the diameter of the rectum as the stool appears to fill the pelvic bowl. The stool tests negative for occult blood.

What diagnosis does this history/physical suggest?

What is the pathogenesis of this diagnosis? Draw a picture.

What are the key features of behavioral management for this patient?

How would you disimpact this patient?

What maintenance therapy would you provide?

What dietary recommendations would you make for this patient and family?

Case 2: Ms. Queen calls you about her daughter Louise. She is a one month old female and Ms. Queen is concerned because Louise hasn't stooled in 3 days. Previously, she had stooled four to five times a day. She was a term delivery with no issues and stooled within the first 48 hours of life.

Who was Queen Louise?:

Connection to peds GI?

What other history questions would be important at this time?

Louise is exclusively breastfed. She is urinating well, continues to eat well, and seems happy and playful. Her weight was over birthweight at her 2 week well child and there were no concerns during that visit. Her abdomen seems a little fuller to Ms. Queen, but Louise does not seem bothered.

Are you concerned?

What is your advice for this mom? Should she be seen immediately? Tomorrow?

Louise is now 5 months old. Ms. Queen brings her in for a visit because every time she tries to start solid foods, Louise goes from stooling every 3-4 days (which has been her norm) to “never”. Ms. Queen reports the first time she tried solids (about 3 weeks ago) Louise went 7 days without stooling and was very uncomfortable and fussy. Ms. Queen finally gave her a glycerin suppository and stopped the solids for a little bit. A week or so later, she tried again with similar results. This time she had gotten some advice to try some clear juice, so she tried pear juice for 2 days with no success. Again, she had to give a suppository on the 7th day which produced a fairly explosive stool. She is growing well and is otherwise developmentally normal.

Are you concerned? Is there other history you would like to obtain?

What would be important on exam? What findings might increase your concern?

Constipation Board Review

1. A 16-year-old girl presents with a complaint of constipation. She passes two to three small, pellet-like stools per week and claims that she has not experienced a "normal bowel movement" in 2 months. She usually skips breakfast and buys lunch at school. Both parents are employed, but the family tries to eat dinner together, usually at 8 pm during the week. Physical examination demonstrates a well-developed, well-nourished adolescent who has no unusual findings. Rectal examination reveals normal anal sphincter tone and an empty rectal vault.

Of the following, the MOST appropriate treatment of this patient's constipation includes

- A. lactulose
- B. methylcellulose
- C. milk of magnesia
- D. mineral oil
- E. polyethylene glycol

2. You are evaluating a 2-day-old term infant because of abdominal distention. He fed normally the first day after birth, but has had progressively increasing vomiting, which now is bilious. Physical examination demonstrates upslanted palpebral fissures, a prominent tongue, and mild hypotonia. Upon passage of a nasogastric tube, you aspirate 80 mL of green-yellow material from his stomach. Abdominal radiographs, including a left lateral decubitus film, reveal dilated loops of bowel and air-fluid levels but no evidence of pneumatosis.

Of the following, the condition that BEST explains this baby's clinical findings is

- A. duodenal atresia
- B. Hirschsprung disease
- C. meconium ileus
- D. necrotizing enterocolitis
- E. neonatal intussusception

3. A 5-year-old child presents to your office with a history of recurrent rectal prolapse that occurs at the time of bowel movements. Both the mother and child are very concerned when the rectal tissue protrudes from the anus, but the prolapse typically resolves without treatment.

Of the following, the MOST common cause of rectal prolapse in children is

- A. celiac disease
- B. cystic fibrosis
- C. *Enterobius vermicularis* infestation (pinworms)
- D. functional constipation
- E. rectal polyps

4. A 3-year-old child presents with a history of intermittent painless rectal bleeding. Approximately once or twice a week, she passes a formed stool that contains up to "a teaspoon" of blood. Physical examination demonstrates no fissures or hemorrhoids. Hematocrit measurement and results of coagulation studies are normal. The bleeding persists despite stool softeners.

Of the following, the test that is MOST likely to establish a diagnosis is

- A. colonoscopy
- B. computed tomography scan of the abdomen
- C. Meckel scan (radionuclide technetium scan)
- D. magnetic resonance angiography
- E. stool culture