Bowel function and Constipation in children

Normal movement of food/feces through the gastrointestinal tract depends on peristalsis – coordinated, sequential nerve and neurochemical regulation of muscular activity in the gut wall.

- distention with food, stool, or gas triggers contraction of muscles in that segment of the gut along with receptive relaxation of segments below,
  - e.g., rectal distention results in relaxation of the internal rectal sphincter and, absent voluntary contraction of the external sphincter, results in stool expulsion,
- in some segments of the gut, distention can cause complementary nerve-stimulated activity in more distant segments,
  - e.g., gastric distention stimulates contraction of the cecum resulting in movement of stool in the colon, and
  - e.g., distention of the cecum by retained stool can slow gastric emptying, causing nausea, early satiety, and contributing to gastro-esophageal reflux.
- meals, sufficient in size to distend the stomach, stimulate intestinal motility and stool passage.

Development – bowel function changes with development, in terms of involuntary and voluntary neurologic control, as well as cognitive control.

- meconium should be passed promptly and completely within about 2 days of birth
- infants may vary in frequency of bowel movements and associated discomfort, but should
  - be eating comfortably and gaining weight,
  - not be persistently distended,
  - calm down after passing a stool,
  - not require routine assistance (positioning, rectal stimulation, suppositories, enemas).
- some breast fed infants may have difficulty passing stools, even though they are liquid, and may be helped by anal stimulation or suppositories. This generally resolves with maturation of neurologic control of the gut or the introduction of solids, providing more substance to the stool.
- iron in formula is <u>not</u> a common cause of constipation, but the use of prune juice is often sufficient to resolve constipation in formula fed infants.
- dietary changes – some infants may develop thick, difficult-to-pass stools with changes in diet, particularly with the initial introduction of rice cereal.
- in 16-24 month-old children, the external (voluntary) anal sphincter begins to contract in response to relaxation of the internal sphincter. This may lead to conscious awareness of an impending bowel movement and allows for the cognitive control required for toilet training.
- toilet training – at whatever age, the first step is learning how to hold the stool and then learning how to let it go. If stool is held too long, it becomes larger and harder, making it too easy to hold and may result in constipation.
- entering pre-school, kindergarten, first grade – any event that may lead a child to be reluctant to have a bowel movement when ready (shy about asking to leave the room, embarrassed that it might take too long, afraid of a public restroom, etc.) might start a pattern leading to constipation.

Mechanisms of constipation

- if bowel movements have been painful, difficult to pass, or anxiety-provoking, chronic contraction of the external sphincter may result, to avoid repeating the pain, etc.
- the external sphincter is relatively weak and often unable to maintain contraction, resulting in “accidents”
- if stools has been retained for long, the intestine becomes distended and the stool becomes large and firm; liquid stool may seep around the hard stool and “leak” out with inadvertent relaxation of the external sphincter, causing soiling.
- because filling of the rectal vault and reflex relaxation of the external sphincter are the messages that let our brains know that we need to plan for a bowel movement, when the vault is

chronically full because of constipation kids may not know they need to have a bowel movement until it is forcing its way out, resulting in urgency/

- the longer a child is constipated and the further the stool is "backed up" the more the colon distends and the poorer its neurologic and muscular function, leading to a vicious cycle that may result in toxic megacolon.

Diet

- Liquid – inadequate liquid intake may contribute to constipation. Increasing water may be helpful, but can be difficult to do, particularly in a young child. Avoid using sweetened beverages, especially sodas, to increase fluid intake.

- Fiber – increasing fiber in the diet may reduce constipation. The best sources include: whole grains, fruits, and vegetables. Avoiding highly processed and carbohydrate-rich foods that lack fiber may increase appetite and motivation to eat foods that the child may not prefer.

- Stimulants – some foods may provide stimulation to the intestines to move more quickly. Prunes are the most common of these, but children may vary in which foods work best for them.

- Constipators – many foods seem to contribute to constipation, at least in some children. Bananas and cheese are the most common. Again, this can vary among children.

Habits

- Meals – as mentioned above, regular meals are helpful in keeping the bowels moving and timing opportunities to use the toilet to follow meals can enhance the ease of passing bowel movements.

- Snacks – snacks, particularly "grazing" (eating small amounts of food, usually low in fiber, through the day), can limit the amount of food eaten at meal times and result in a poor gastro-colic reflex, resulting in poor gut motility and constipation.

- Toileting – not having a relaxed opportunities to use the toilet after meals, or having reasons to hold bowel movements when they urge arises, can lead to constipation. When constipated, kids may always have the sensation of a full rectum (the feeling that lets us know about the need to have a bowel movement), and thus may not recognize that they need to pass stool.

- Exercise – kids who get plenty of exercise seem less likely to get constipated. Assuring exercise on a daily basis has other benefits in terms of fitness and weight control.

Signs & Symptoms associated with other problems (indications for GI consultation)

- Delayed or prolonged passage of meconium > 2 days after birth *(Hirschsprung disease, cystic fibrosis)*
- Weight loss, short stature or low weight for length or height *(malabsorption, celiac disease)*
- Hematochezia, with blood mixed into stool, or melena *(food allergy/intolerance, inflammatory bowel disease)*
- Persistent vomiting, especially if bilious (bright yellow or green) *(intestinal obstruction, volvulus, malrotation)*
- Persistent abdominal distention *(malabsorption, malnutrition, obstruction, obstipation)*
- Consistent pain in RUQ, subxiphoid/epigastrium, RLQ *(obstruction, obstipation)*
- Nocturnal symptoms of pain, vomiting or urgency awakening from deep sleep *(obstruction, obstipation, CNS cause)*

- Fever, oral or genital ulceration, eye inflammation, rash *(inflammatory bowel disease)*
- Clubbing or arthritis *(malabsorption, cystic fibrosis)*
- Anemia; elevated ESR, CRP, WBC band count, AST; or low albumin *(malabsorption, inflammatory bowel disease)*
- Positive celiac disease serology or hypothyroidism
- Perianal disease: skin tag or fissure off of the sagittal (6, 12 o'clock) plane
- Sacrococcygeal abnormalities, including sacral dimple or sinus, hair patch or pigmentation above the gluteal cleft *(spinal dysraphism/spina bifida occulta)*
- Abnormal lower extremity neurologic exam, including gait or weight bearing or gross motor delay *(tethered cord)*
- Absent anal wink or cremasteric response *(tethered cord, spinal dysraphism, spinal tumor or injury)*
- Failure to respond to or worsening with the Bowel Management Program.
- anal stenosis?
- milk allergy?

Bowel Management Program

Eligibility – if the answers to the first 4 questions are "No" AND the patient has 3 of the 8 signs/symptoms listed, trial of the Bowel Management Program may be indicated.

Questions:

1. Is your child losing weight?
2. Is your child vomiting daily?
3. Is there rectal bleeding with blood mixed into the stool (not just on the outside)?
4. Does the abdominal pain routinely wake your child from deep sleep?

Signs & Symptoms of stool retention disorders (must have 3 of the following):

- Hard or pebble-like or fragmented stools
- Difficulty passing stools, long time in bathroom or incomplete elimination.
- Leaking/soiling/accidents of stool
- Sharp, cramping abdominal pain near the belly button or lower left or right side, usually occurring during waking hours, often 10-30 minutes after eating or with exercise; intermittent.
- Abdominal pain associated with urgency and/or relief with bowel movements.
- Fills up fast (early satiety), sense of bloating, prefers to snack rather than have full meal.
- Nausea
- School absence > 7 days.

Bowel Management Program (BMP) instruction sheets for parents are available for the following ages:

BMP 3-4 years	BMP 3-4 years in Spanish (Español)
BMP 5-8 years	BMP 5-8 years in Spanish (Español)
BMP 9-12 years	BMP 9-12 years in Spanish (Español)
BMP 13-17 years	BMP 13-17 years in Spanish (Español)

The Bowel Management Program relies primarily on PEG 3350 (Miralax or Glycolax) and senna, but there are number of other laxatives available.

Laxatives[1]

Polyethylene Glycol 3350 or PEG (Miralax/Glycolax)

PEG Dosage for cleanout phase = 1 –1.5 mg/kg/day [2]

PEG Dosage for maintenance phase = 0.5 gram/kg/day divided in 2-3 doses

PEG : H2O ratio is 17 g (1 heaping tbsp) : 8 oz (240cc) liquid or 1 tsp : 2.5 oz liquid

Do not count the PEG fluid volume in the child's total daily maintenance fluid volume.

Age range:	PEG grams mean (range):	Approx. volume:[3]
6 - 12 mos	3.75 (2.5 - 5)	_ - 1 teaspoon
13 mos – 3 years	6 (4 – 7.4)	1 – 2 teaspoon
4 – 7 years	11.7 (7 – 16)	_ - 1 capful
8 – 15 years	16 (16 – 24)	1 –1.5 capful

Other osmotic agents

- Lactulose (1-3 mL/kg/day in divided doses, available as 70% solution)
- Sorbitol (1-3 mL/kg/day in divided doses, available as 70% solution)
- Barley malt extract (2-10 mL/240 mL of milk or juice daily)
- Magnesium hydroxide (1-3 mL/kg/day of 400mg/5mL solution)
- Magnesium citrate (<6 years – 1-3 mL/kg/day; 6-12 yrs. – 100-150 mL/day; >12 yrs. – 150-300 mL/day; in single or divided doses)
- Osmotic enema – Phosphate (avoid use under 2 years of age, ≥2 years – 6 mL/kg up to 135 mL)

Fiber

- Psyllium (Metamucil and others) (1/2-1 rounded tsp. or packets in 4 oz of water 1-3 times per day)

Stimulants

- Senna (ExLax, Senokot) (2-6 years – 2.5-7.5 mL/day; 6-12 years – 5-15 mL/day; as syrup 8.8 mg/5mL; also available as granules and tablets)
- Bisacodyl (Colace) (≥2 years – 0.5-1 suppository or 1-3 tablets per dose; 5 mg tablets, 10 mg suppositories)

Lubricant

- Mineral oil (not recommended in those <1 year; 1-3 mL/kg/day for maintenance use)

[1] *Clinical Practice Guideline – Evaluation and Treatment of Constipation in Infants and Children: Recommendations of the North American Society for Pediatric Gastroenterology, Hepatology and Nutrition. Journal of Pediatric Gastroenterology and Nutrition. 2006; 43:e1-e13.*

[2] *Youssef NN et al. Dose response of PEG 3350 for the treatment of childhood fecal impaction. J Pediatr 2002; 141: 410-4*

[3] *Dupont C, et al. A dose determination study of polyethylene glycol 4000 in constipated children: factors influencing the maintenance state. J Pediatr Gastroenterol Nutr 2006; 42:178-85*