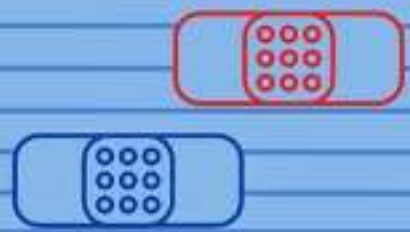
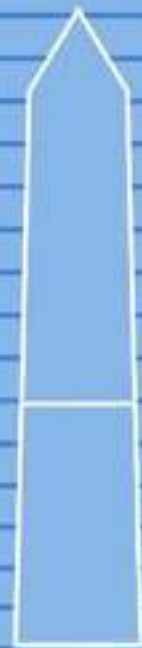


Future ^{OF} Pediatrics

Pediatric Health Network
Children's National.



Beyond the Basics: Decision Trees & Teaming Up with GI for Happy Tummies

Vahe Badalyan, MD, MPH, MBA
Medical Director, Celiac Program
Gastroenterology



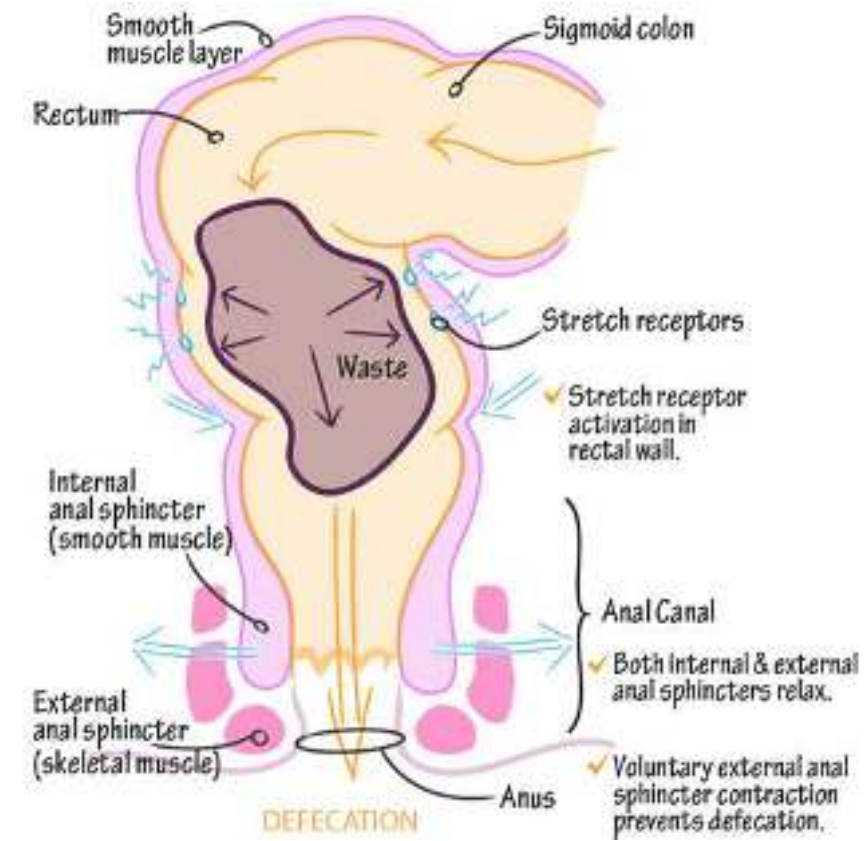
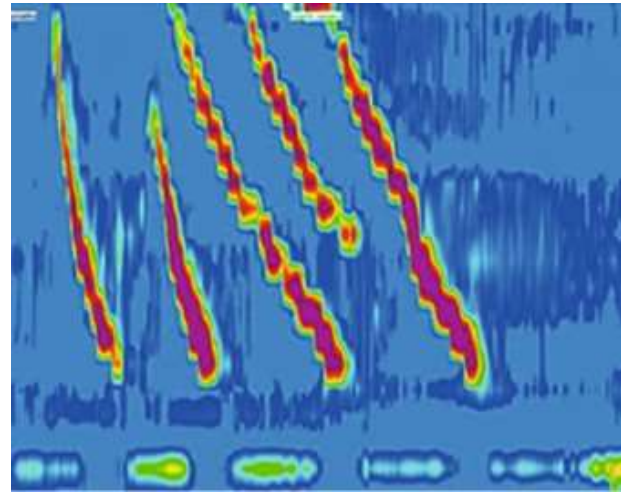
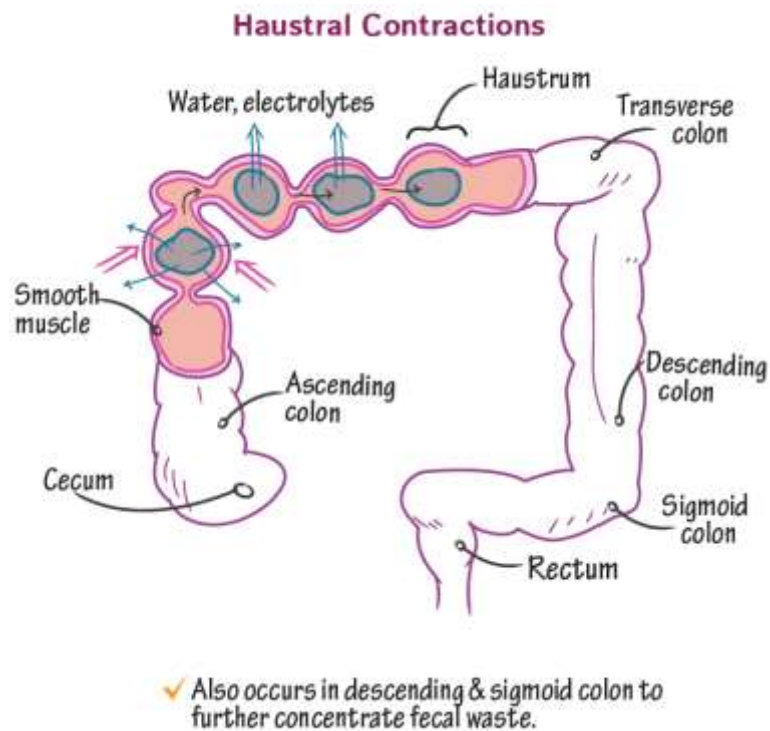
Learning objectives

- Refresher on mechanisms of defecation and constipation
- Refresher on assessment and diagnosis
- Refresher on treatment and referral

Disclosures

- None

- Motility of the large intestine
 - 95% of motor events are segmental (mixing) pressure waves that facilitate the absorption of water and electrolytes
 - remaining 5% are propagating pressure waves (peristalsis)



<https://ditki.com/course/physiology>

Nat Rev Gastroenterol Hepatol 16, 559–579 (2019)

J Acad Nutr Diet. 2017 Feb;117(2):251-264.

- Physiology of defecation extrinsic innervation (sympathetic and parasympathetic)
- intrinsic innervation from the enteric nervous system
- key factors: GI transit, stool volume and/or consistency, and dietary intake
- coordination of neural, muscular, hormonal and cognitive systems

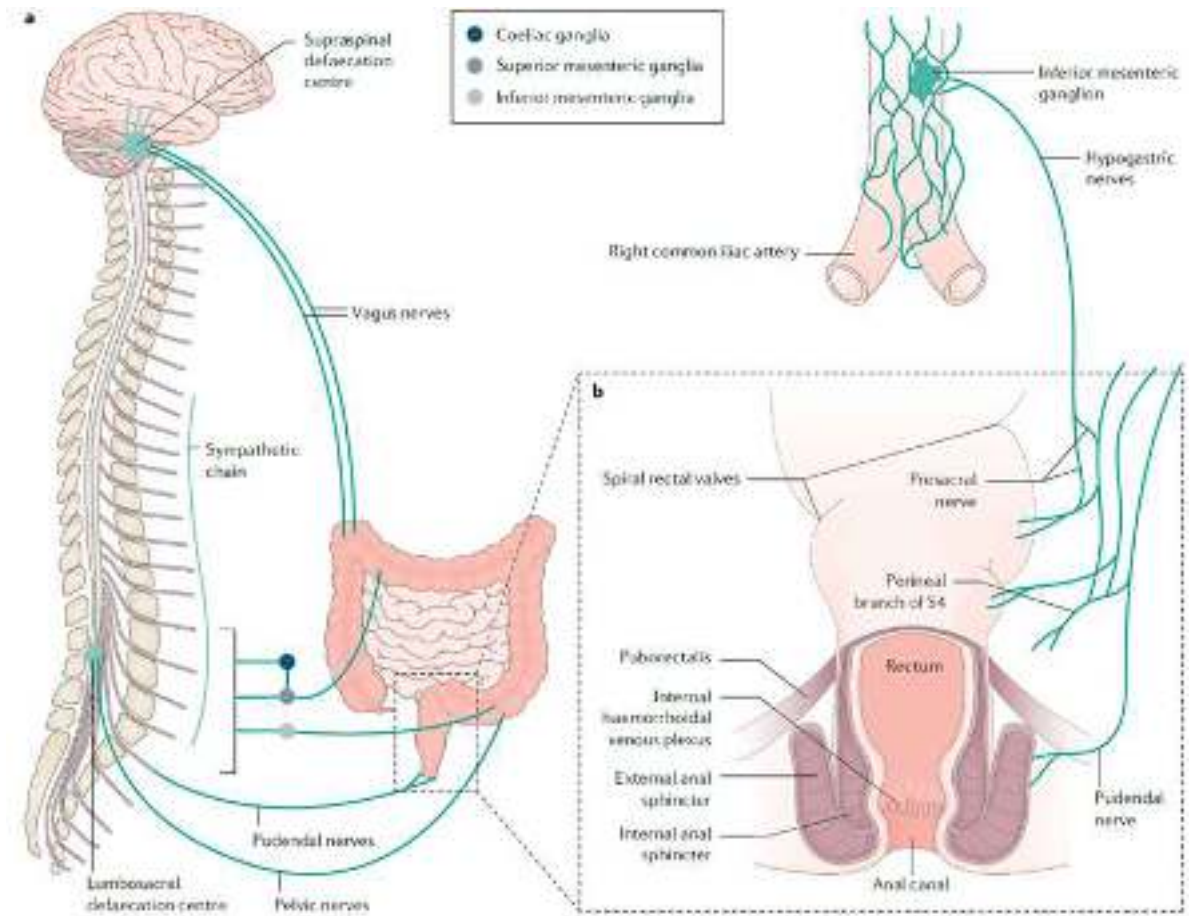
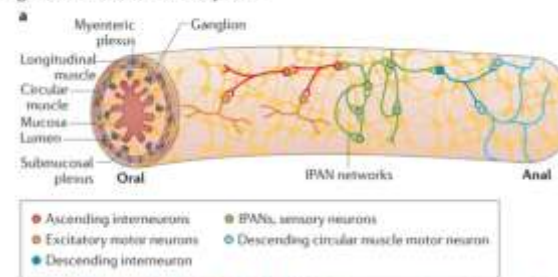


Figure 1: The enteric nervous system.



Orchestra Concert at Strathmore



Definitions

- **Constipation:** infrequent, and painful bowel movements, fecal incontinence, stool withholding behavior, and occasional passage of large diameter stools
- **Intractable Constipation:** constipation not responding to optimal conventional treatment for at least 3 months
- **Fecal Impaction:** a hard mass in the lower abdomen ; or a dilated rectum filled with a large amount of stool ; or excessive stool on x-ray

Fecal incontinence

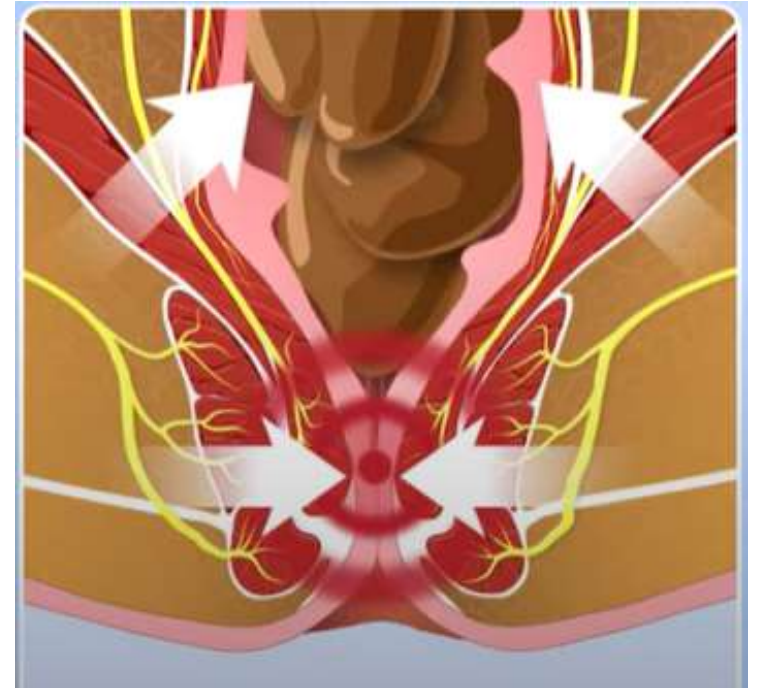
Involuntary passage of stool into the underwear; unintentional seepage of small amounts of liquid stools (generally referred to as “soiling” or “leakage”) in an older (> 4 y/o) or toilet trained child

2 types:

- Retentive (constipated children with fecal impaction)
- Nonretentive (children with psychological problems)

Dyssynergic Defecation

- Functional disorder characterized by failure of relaxation or paradoxical contraction of the anal canal and/or a failure to increase intrarectal pressure



Rome IV criteria for diagnosing functional constipation



Infants and toddlers¹

Must have ≥ 2 of the following criteria for ≥ 1 month:

- ≤ 2 defaecations per week
- History of painful or hard bowel movements
- History of excessive stool retention
- History of large diameter stools
- Presence of a large faecal mass in the rectum
- ≥ 1 episode of faecal incontinence per week^a
- History of large diameter stools that can obstruct the toilet^a

Children and adolescents²

Must have ≥ 2 the following criteria for ≥ 1 month:

- ≤ 2 defaecations in the toilet per week
- History of painful or hard bowel movements
- History of retentive posturing or excessive volitional stool retention
- History of large diameter stools that can obstruct the toilet
- Presence of a large faecal mass in the rectum
- ≥ 1 episode of faecal incontinence per week

Practice Guideline

➤ [J Pediatr Gastroenterol Nutr. 2014 Feb;58\(2\):258-74.](#)

doi: [10.1097/MPG.0000000000000266.](#)

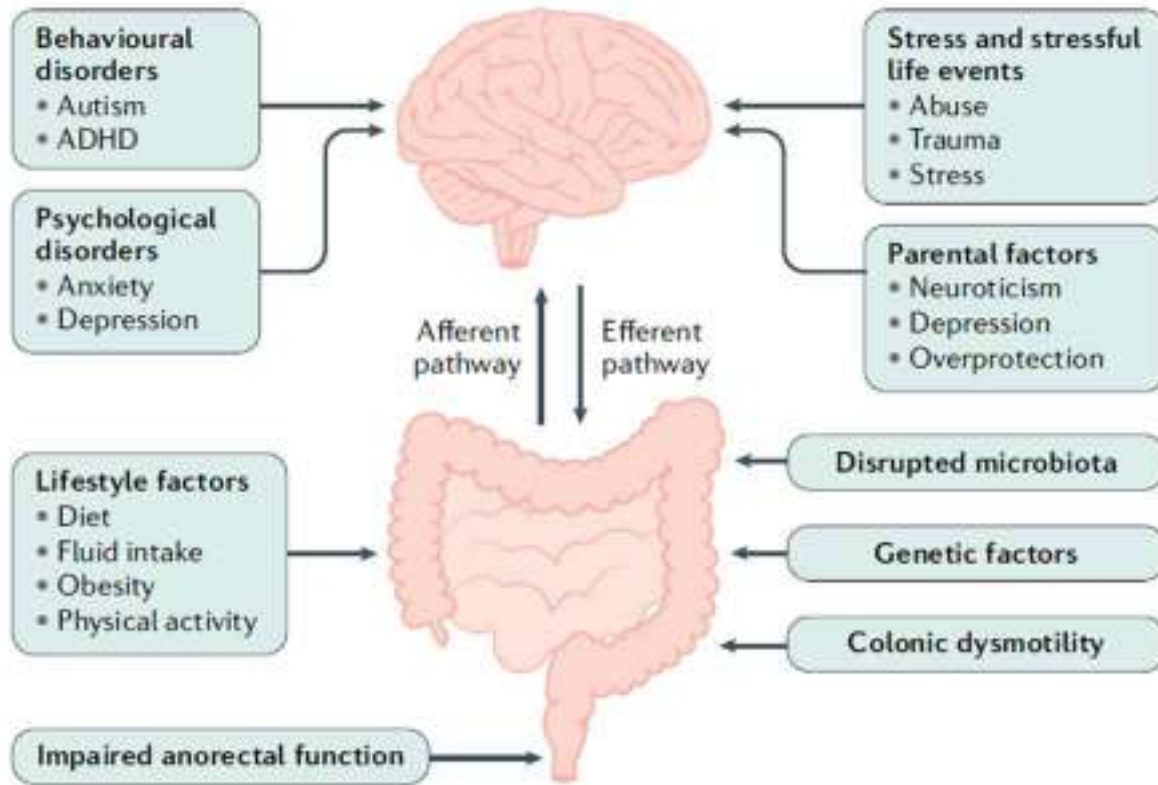
Evaluation and treatment of functional constipation in infants and children: evidence-based recommendations from ESPGHAN and NASPGHAN

[M M Tabbers](#) ¹, [C DiLorenzo](#), [M Y Berger](#), [C Faure](#), [M W Langendam](#), [S Nurko](#), [A Staiano](#),
[Y Vandenplas](#), [M A Benninga](#);

[European Society for Pediatric Gastroenterology, Hepatology, and Nutrition](#);

[North American Society for Pediatric Gastroenterology](#)

Functional (95%) and Organic Causes (5%)



- Hirschsprung disease: 1 out of 5,000 newborns
- Anorectal Malformations: 1 out of 5,000 newborns
- Spina Bifida: 1 in 2,500 newborns
- Tethered cord: 1 in 4,000 children
- Cystic fibrosis: 1 in 2,500 white newborns; 1 in 17,000 black newborns, 1 in 31,000 Asian newborns
- Hypothyroidism: 1 in 4,000 to 5,000 newborns








Key aspects of history

- What was the age when constipation first started?
- What were the circumstances/ events around the initial constipation event?
- Bowel habits
- Incontinence
- Urinary symptoms

Common Associations with Constipation

Type of Risk Factor	Example
Dietary	Transition from breast-milk to formula or to cow's milk Starting rice cereal Lack of fiber
Psychosocial	Toilet training Birth of sibling Starting school Parental strife/divorce Toilet phobia Sexual abuse Depression/anxiety
Medications	Antidepressants ADD/ADHD medications

Bristol stool

Type 1		Separate hard lumps, like nuts (hard to pass)
Type 2		Sausage-shaped but lumpy
Type 3		Like a sausage but with cracks on its surface
Type 4		Like a sausage or snake, smooth and soft
Type 5		Soft blobs with clear-cut edges (passed easily)
Type 6		Fluffy pieces with ragged edges, a mushy stool
Type 7		Watery, no solid pieces, Entirely liquid

Some “Red flags” on history and physical

- Symptoms that commence from birth or in the first few weeks
 - Failure or delay (>first 48 hours at term) in passing meconium
 - Ribbon stools, leg weakness or locomotor delay
 - Abdominal distension with vomiting
 - Abnormal examination findings including:
 - Abnormal appearance of anus
 - Gross abdominal distension
 - Abnormal gluteal muscles, scoliosis, sacral agenesis, discoloured skin, naevi or sinus, hairy patch, or central pit
 - Lower limb deformity including talipes
 - Abnormal lower limb reflexes or neuromuscular signs unexplained by existing conditions
 - Other symptoms that cause concern
- 99% of healthy term neonates pass their first meconium before 48 hours
 - ~30% of neonates with Hirschsprung’s disease (HD) can pass meconium within 48 hours
 - only about 50% of children with HD are diagnosed by 1 year of age, and 80% are diagnosed by 7 years

Rectal exam

Pediatric Rectal Exam: Why, When, and How

Susan R. Orenstein¹ · Arnold Wald²



- May not be necessary for routine screening
- Can help to identify anal stenosis or anorectal malformations ; fecal mass in the rectum or rectal dilatation
- Lack of anal tone - > ? spinal cord lesion
- Forceful stool expulsion upon finger removal -> ? Hirschsprung disease
- Extreme fear - > ? trauma, abuse

<https://www.open-medis.com/>

Curr Probl Pediatr Adolesc Health Care 2020;50:100802

Curr Gastroenterol Rep. 2016 Jan;18(1):4. doi: 10.1007

Role of imaging - radiography



The Journal of Pediatrics
Volume 161, Issue 1, July 2012, Pages 44-50.e2



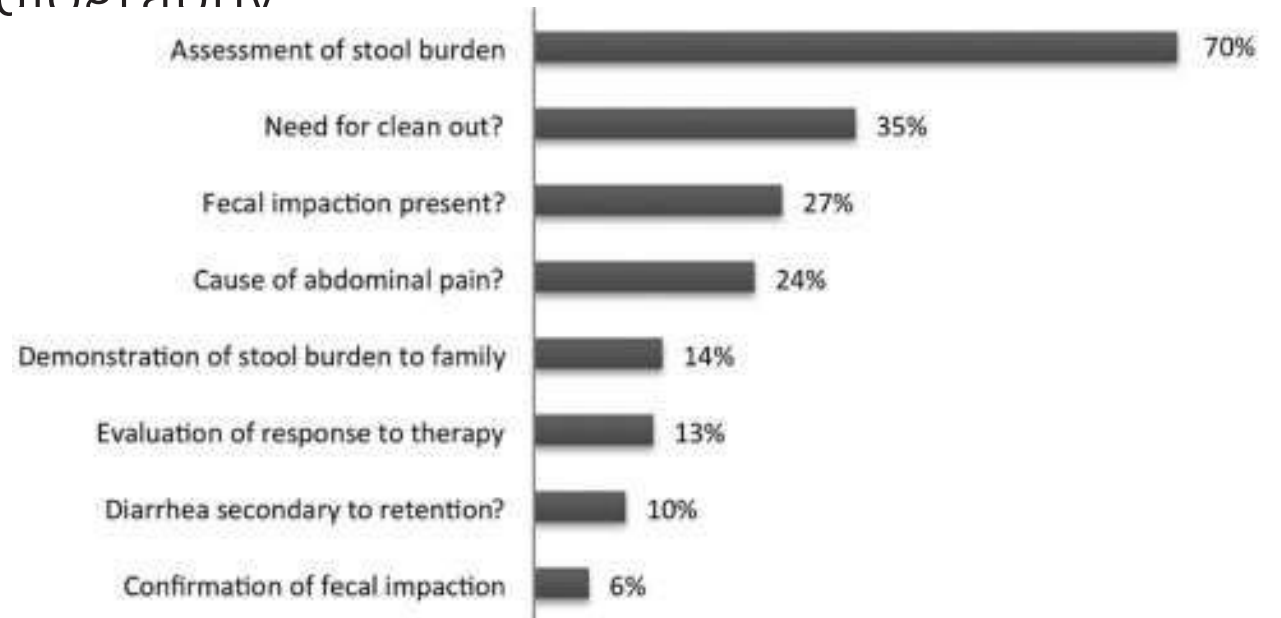
Original Article

Value of Abdominal Radiography, Colonic Transit Time, and Rectal Ultrasound Scanning in the Diagnosis of Idiopathic Constipation in Children: A Systematic Review

[Marjolain Y. Berger PhD, MD¹](#), [Merit M. Tabbers MD²](#), [Miranda J. Kurver MD³](#),
[Nicole Boluyt PhD, MD¹](#), [Marc A. Benninga PhD, MD²](#)

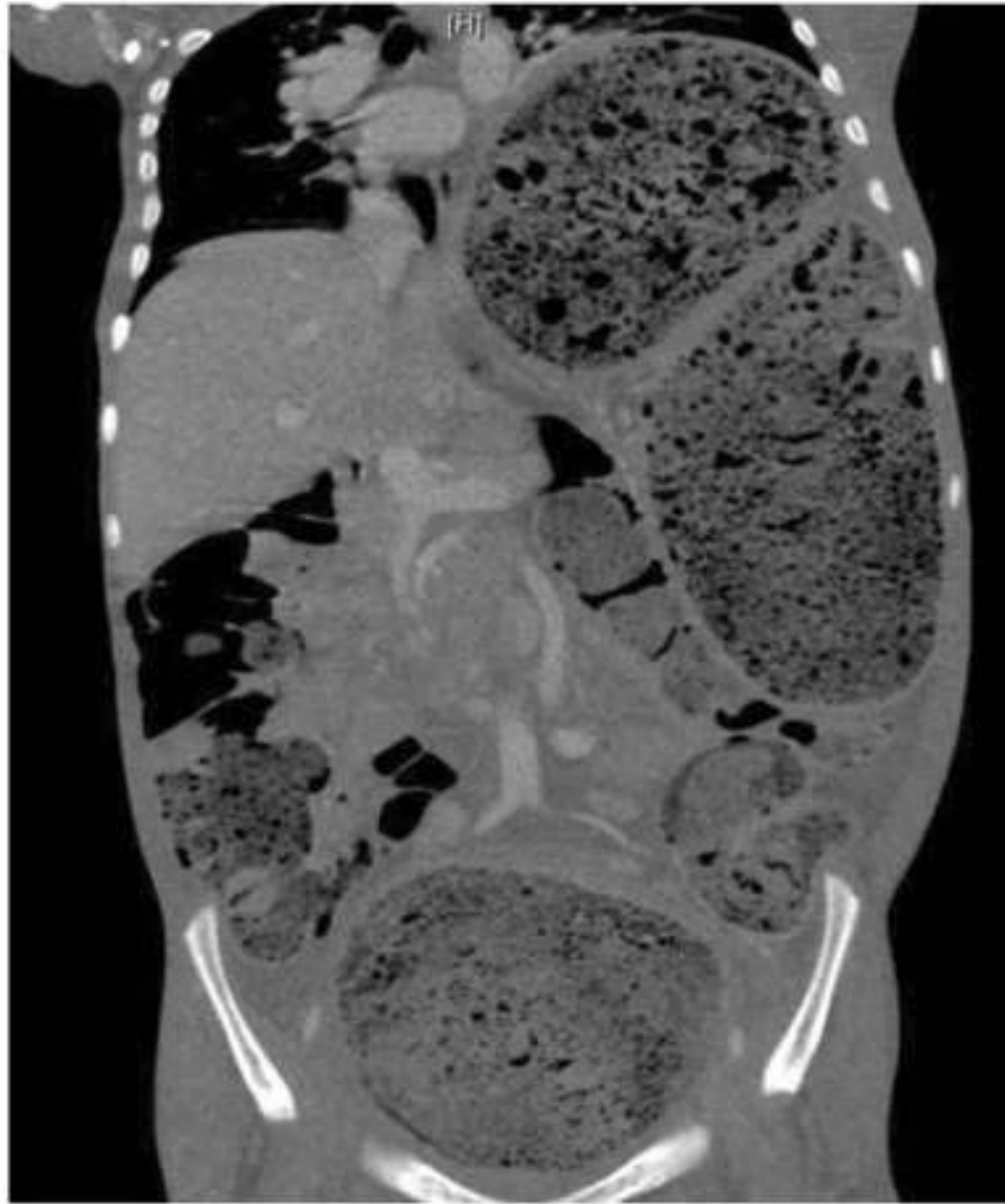
- 6 studies (700 children of all ages)
- Comparison of fecal loading on X-rays vs. Rome criteria or clinical assessment
- Sensitivity of abdominal x-ray ranged from 60 to 80%
- Specificity ranged from 43 to 99%

Appropriateness and caveats of radiographs

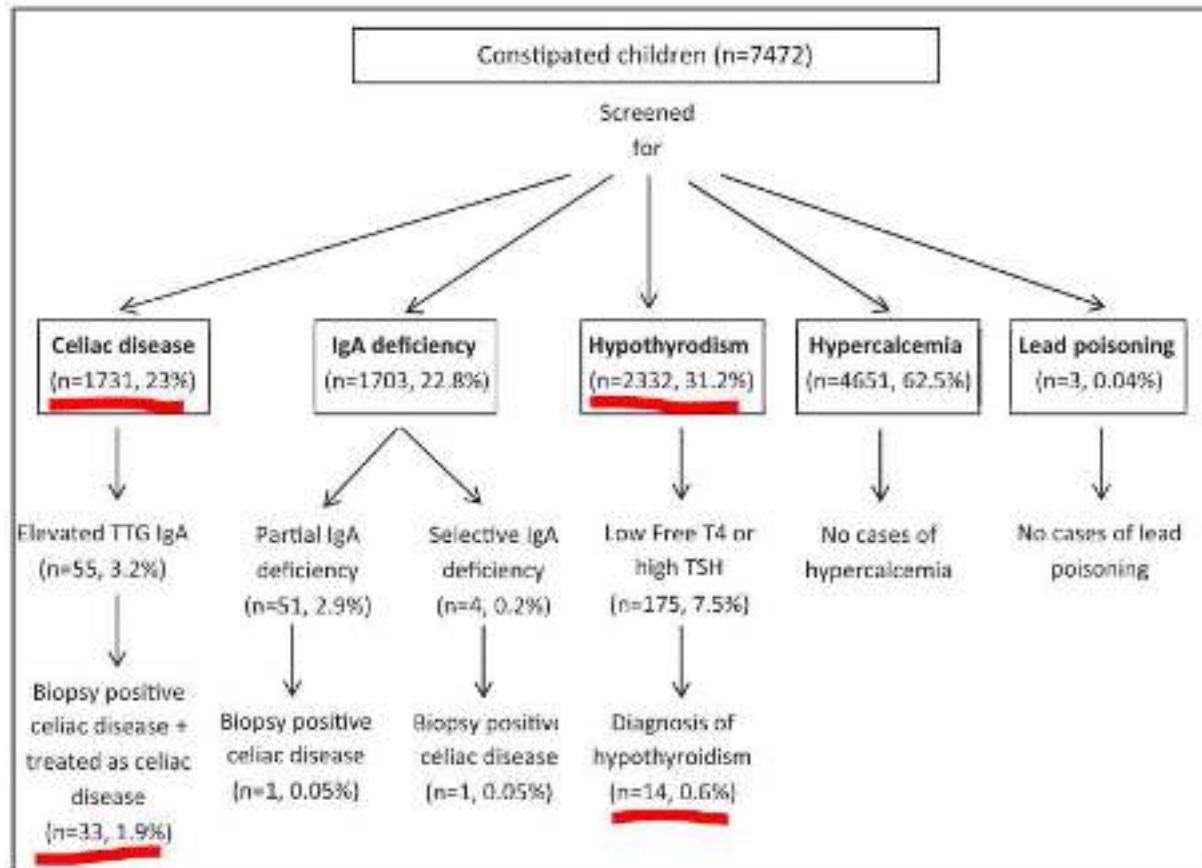


Prospective survey of 24 pediatric gastroenterology providers (18 attendings, 4 NPs, 1 fellow) who ordered x-rays on 72 patients

- X-ray poorly correlates with clinical symptoms or severity of fecal retention, and the interrater reliability of their interpretation is poor
- Diagnosis of constipation by x-ray may overlook medical/surgical conditions. University of Toronto study: 20/3685 (0.5%) ED patients had appendicitis, intussusception, obstruction

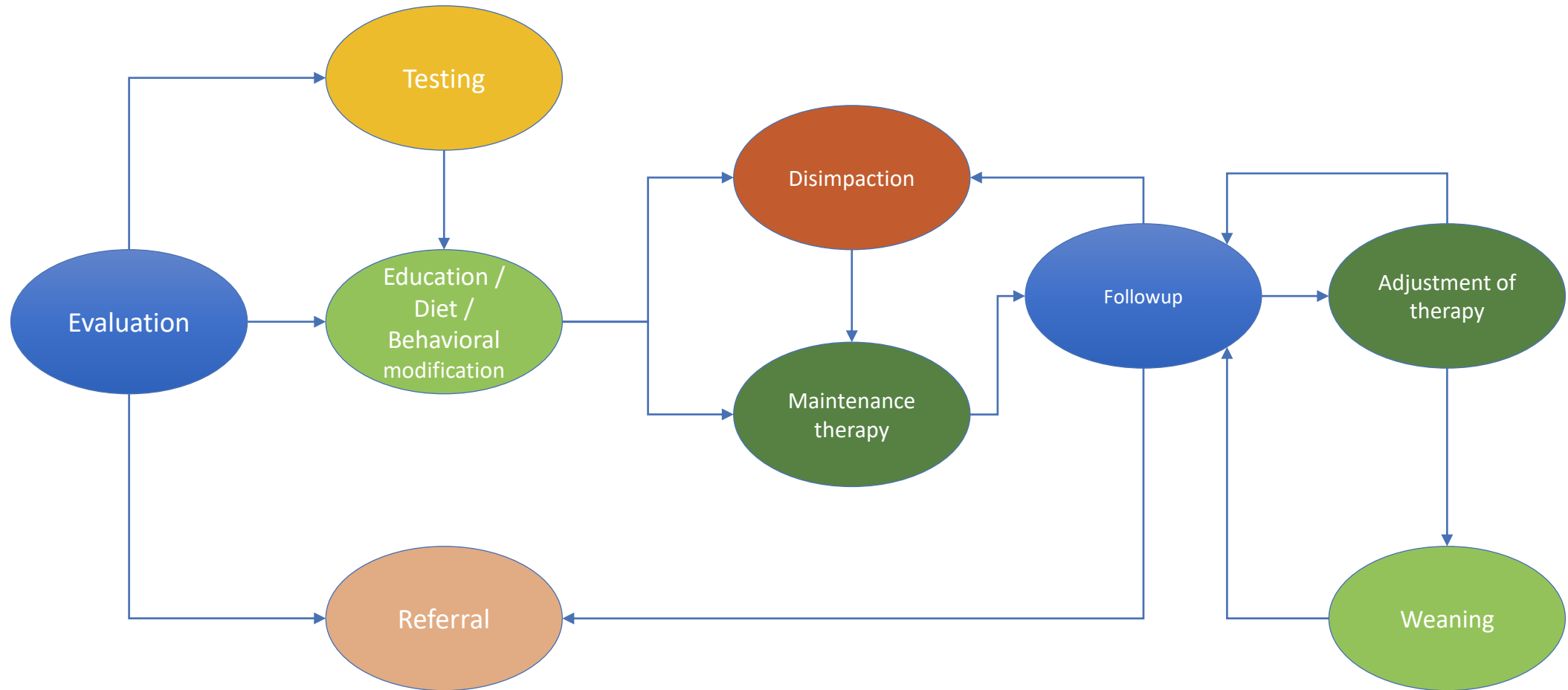


Role of labs

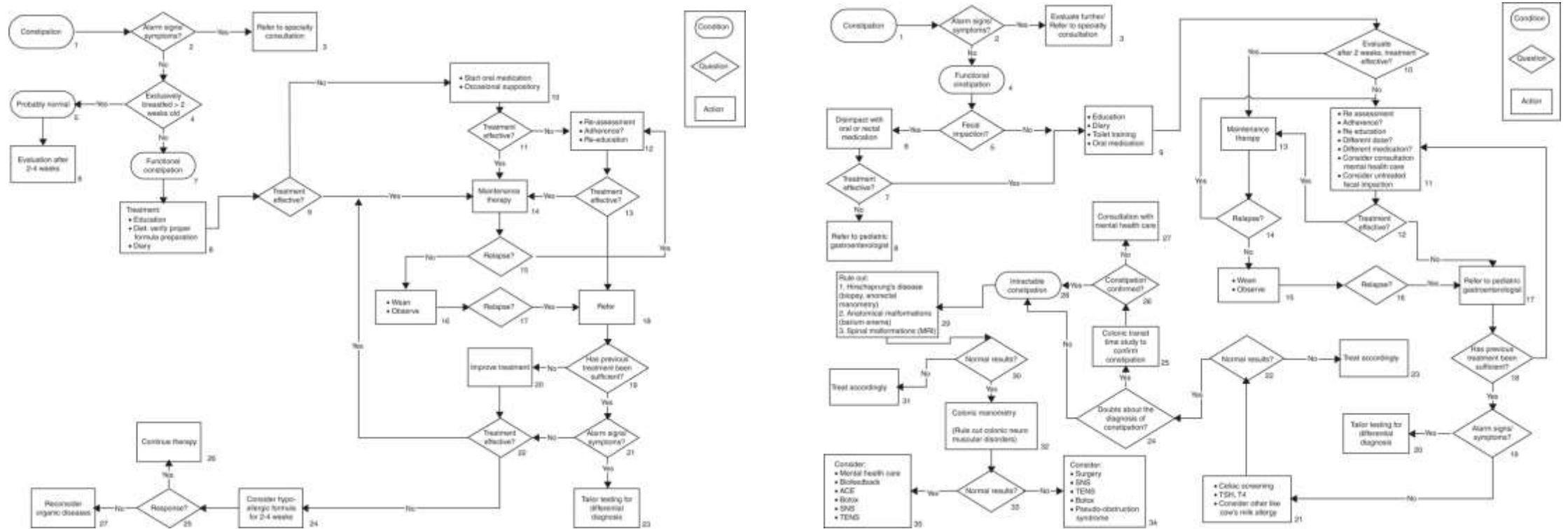


- Lack of evidence to support obtaining thyroid function tests, celiac screening, serum electrolytes, including calcium, in the absence of red flags
- Rare to find organic diseases in children presenting only with constipation

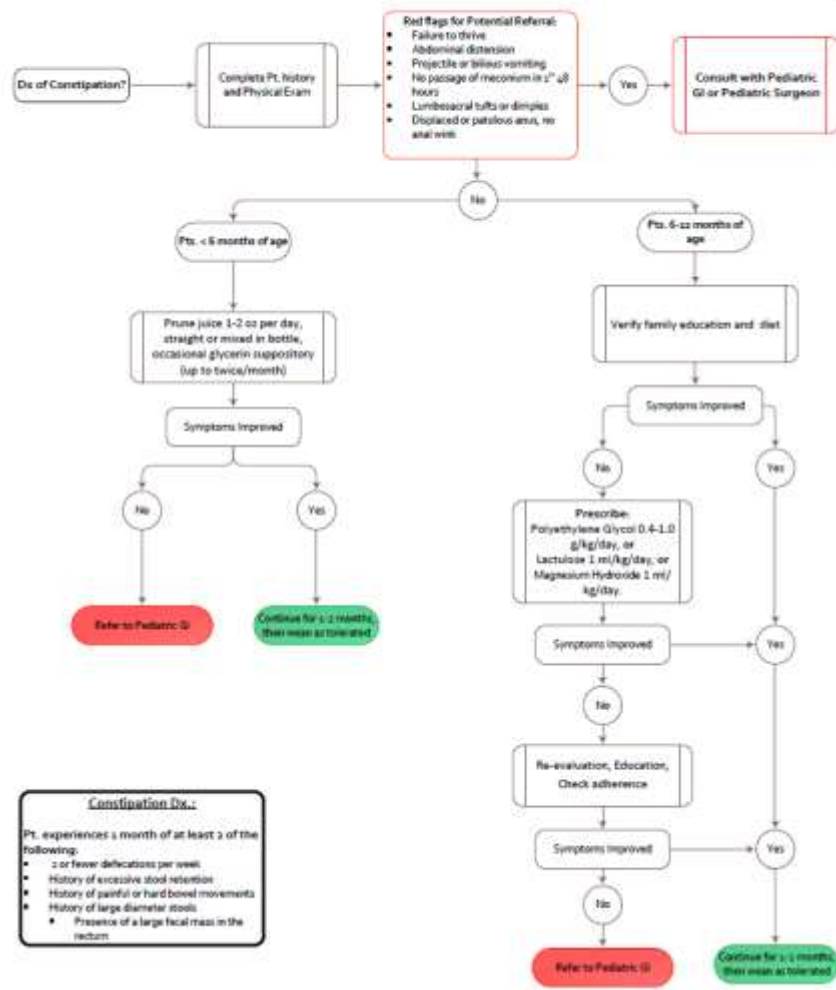
Principles of management



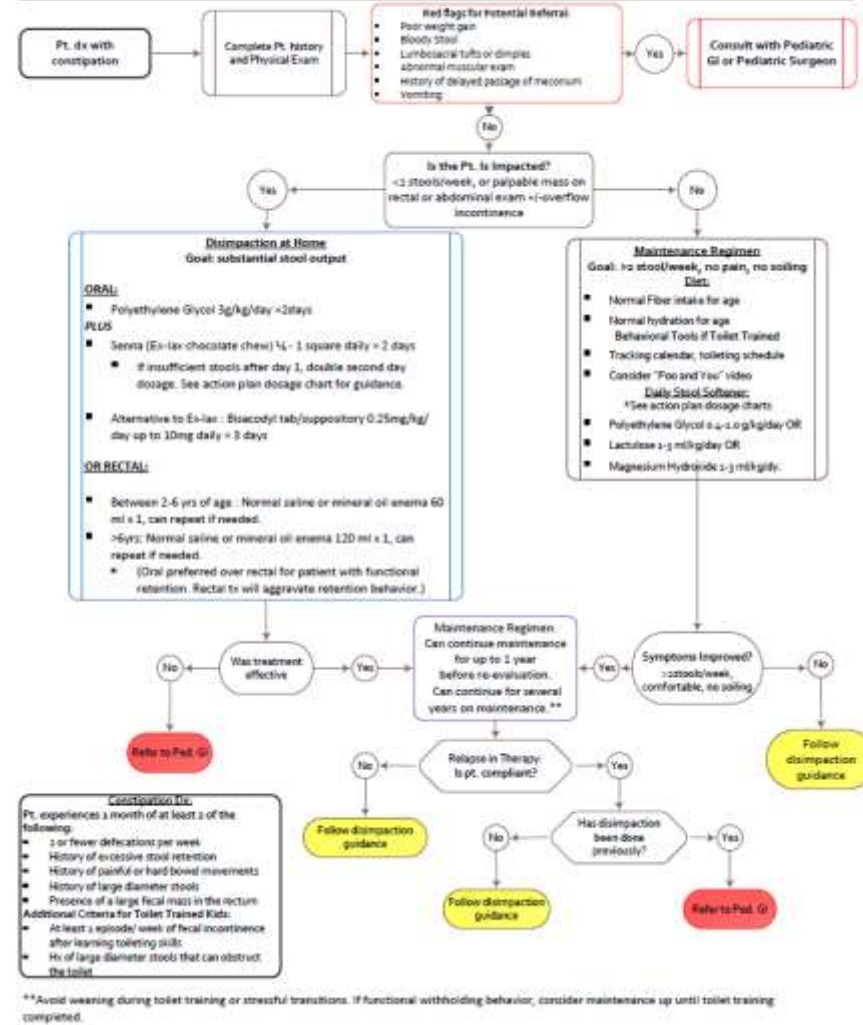
Algorithms from ESPGHAN / NASPGHAN guidelines



Constipation Algorithm Patients < 1 Years Old

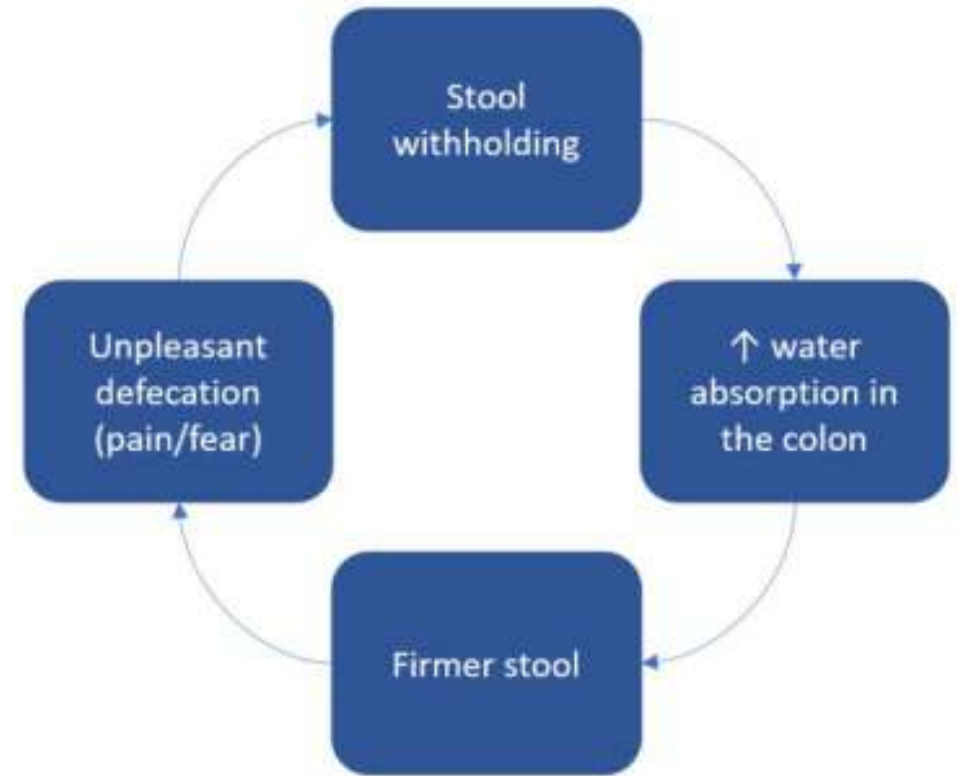


Constipation Algorithm Patients > 1 Years Old



Therapeutic aspects to discuss with family

- Healthy diet, adequate fiber intake
- Toilet training / education on stool withholding
- Oral laxatives – doses should be individualized
- Rectal enemas / suppositories - essential for disimpaction. Can be used as-needed
- Parent/child input on choosing medications
- Need to give medications regularly and for a long time
- Unfounded concern for developing “dependence”





Understanding the Physics of Functional Fibers in the Gastrointestinal Tract: An Evidence-Based Approach to Resolving Enduring Misconceptions about Insoluble and Soluble Fiber

Johnson W. McRorie, Jr, PhD; Nicola M. McKeown, PhD

liquid stool is $\approx 90\%$ water content; soft stool is $\approx 77\%$ water; formed stool is $\approx 75\%$ water, and hard stool is $\leq 72\%$ water

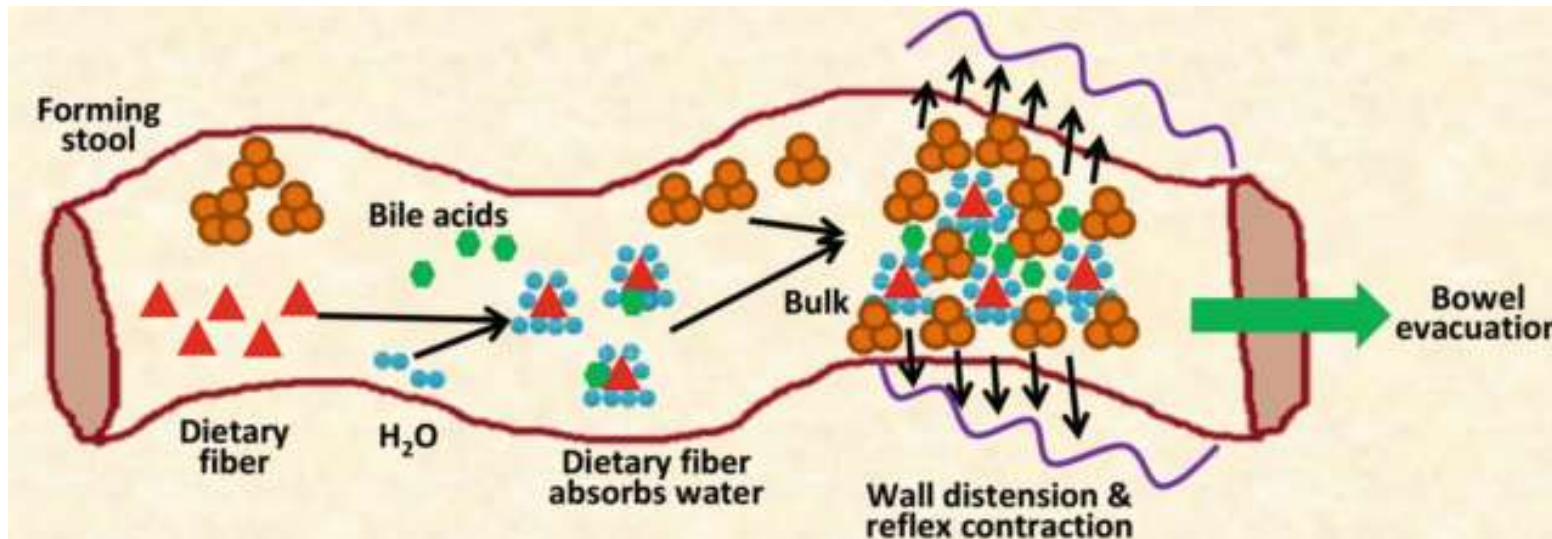
200 x difference in viscosity

J Acad Nutr Diet. 2017 Feb;117(2):251-264.

- large/coarse **insoluble** fiber particles (eg, wheat bran) have a mechanically irritating effect on colonic mucosa, stimulating secretion of water and mucus
- small/smooth insoluble fiber particles may be constipating
- **soluble** gel-forming fiber (eg, psyllium) has a high water-holding capacity
- **fermentable fibers** would not work

Psyllium

- gel-forming psyllium is not fermented in the gut
- retains its high water-holding capacity
- provides bulky/soft stools that are easy to pass



Aliment Pharmacol Ther. 1998 May;12(5):491-7

J Acad Nutr Diet. 2017 Feb;117(2):251-264.

- **Fibers**
- Dietary fiber intake of “age plus 5 g” is usually recommended
- Evidence does not support the use of extra fiber supplements

Characteristic	No Water-Holding Capacity			Water-Holding Capacity			
	Insoluble Wheat bran	Soluble No Viscosity		Viscous Methylcellulose	Viscous/Gel-Forming		
		Wheat dextrin	Inulin		Partially hydrolyzed guar gum	b-glucan	Psyllium
Example	All Bran ^a	Benefiber ^b	Fiber Choice ^c	MiraFiber Citrucel ^d	Generic	Quaker Oats ^e	Metamucil ^f
Source	Wheat	Chemically altered wheat starch	Chicory root	Chemically altered wood pulp	Guar beans	Oats, barley	Blonde psyllium seed husk
Natural?	Natural	Semisynthetic	Natural	Semisynthetic	Processed (↓ viscosity)	Natural	Natural
Degree of fermentation	<u>Poorly fermented</u>	Readily fermented	Readily fermented	<u>Nonfermented</u>	Readily fermented	Readily fermented	<u>Nonfermented</u>
Cholesterol lowering					± ^g	+ ^h	+
Improved glycemic control					± ^g	+ ^h	+
Constipation/stool softener	+ ⁱ			± ^j			+
Diarrhea/stool normalizer							+

Comr

TABLE 6. Dosages of most frequently used oral and rectal laxatives

Oral laxatives	Dosages
Osmotic laxatives	
Lactulose	1–2 g/kg, once or twice/day
PEG 3350	Maintenance: 0.2–0.8 g · kg ⁻¹ · day ⁻¹
PEG 4000	Fecal disimpaction: 1–1.5 g · kg ⁻¹ · day ⁻¹ (with a maximum of 6 consecutive days)
Milk of magnesia (magnesium hydroxide)	2–5 y: 0.4–1.2 g/day, once or divided
	6–11 y: 1.2–2.4 g/day, once or divided
	12–18 y: 2.4–4.8 g/day, once or divided
Fecal softeners	
Mineral oil	1–18 y: 1–3 mL · kg ⁻¹ · day ⁻¹ , once or divided, max 90 mL/day
Stimulant laxatives	
Bisacodyl	3–10 y: 5 mg/day
	>10 y: 5–10 mg/day
Senna	2–6 y: 2.5–5 mg once or twice/day
	6–12 y: 7.5–10 mg/day
	>12 y: 15–20 mg/day
Sodium picosulfate	1 mo–4 y: 2.5–10 mg once/day
	4–18 y: 2.5–20 mg once/day
Rectal laxatives/enemas	
Bisacodyl	2–10 y: 5 mg once/day
	>10 y: 5–10 mg once/day
Sodium docusate	<6 y: 60 mL
	>6 y: 120 mL
Sodium phosphate	1–18 y: 2.5 mL/kg, max 133 mL/dose
NaCl	Neonate <1 kg: 5 mL, >1 kg: 10 mL
	>1 y: 6 mL/kg once or twice/day
Mineral oil	2–11 y: 30–60 mL once/day
	>11 y: 60–150 mL once/day