

WELCOME



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RIDING THE WAVES OF  
**Excellence**  
in SCl Care

# Neurogenic Bowel Review

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# DISCLOSURES

None

# LEARNING OBJECTIVES

At the conclusion of this presentation, the learner will:

1. Review the relevant physiology of GI system
2. Review management of acute and delayed symptoms of neurogenic bowel dysfunction
3. Highlight changes from 2010 → 2020 clinical practice guidelines

# Nervous Control

## Enteric nervous system

Serosa

Longitudinal & circumferential muscular layers

Auerbach's (myenteric) plexi stimulate motility

Submucosal layers

Meissner's plexi stimulate secretion

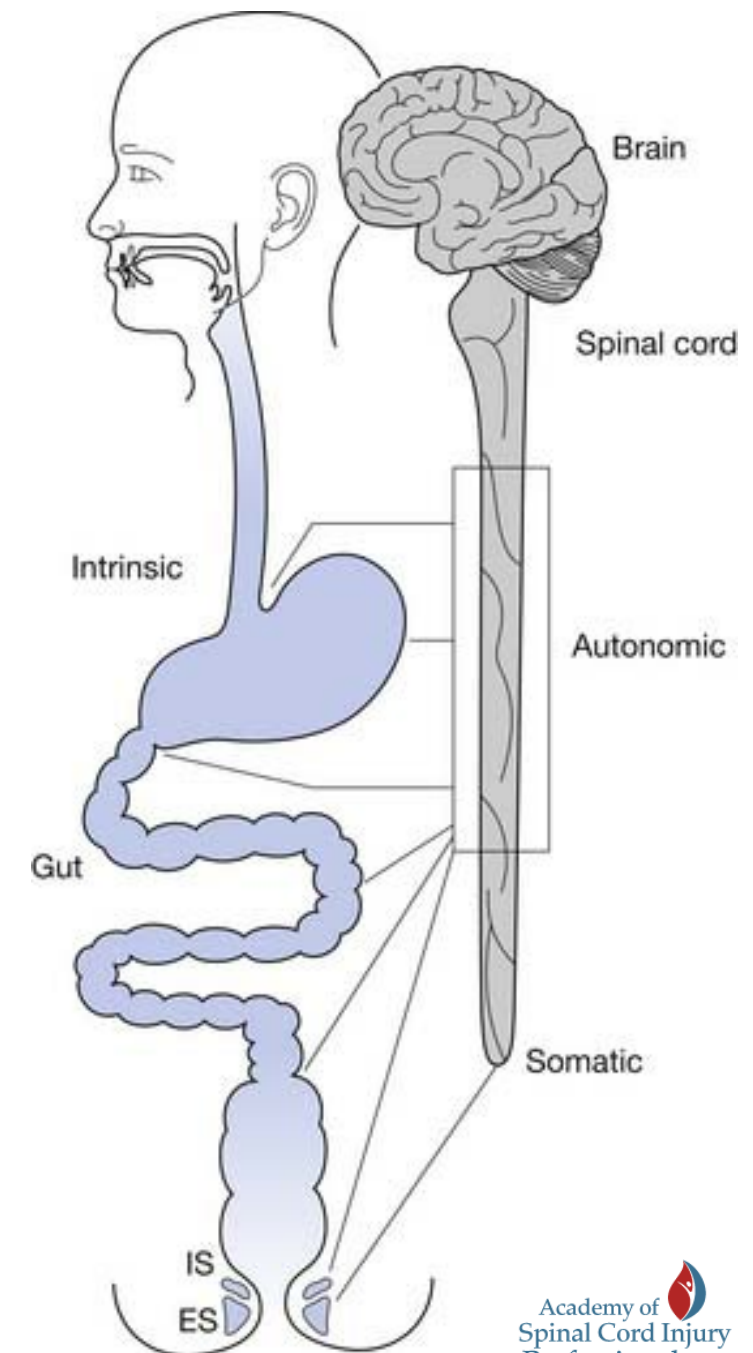
Mucosa

## Autonomic nervous system

Modulates the enteric nervous system

## Somatic nervous system

Adds volitional control of external anal sphincter



# Important Innervations

## Enteric

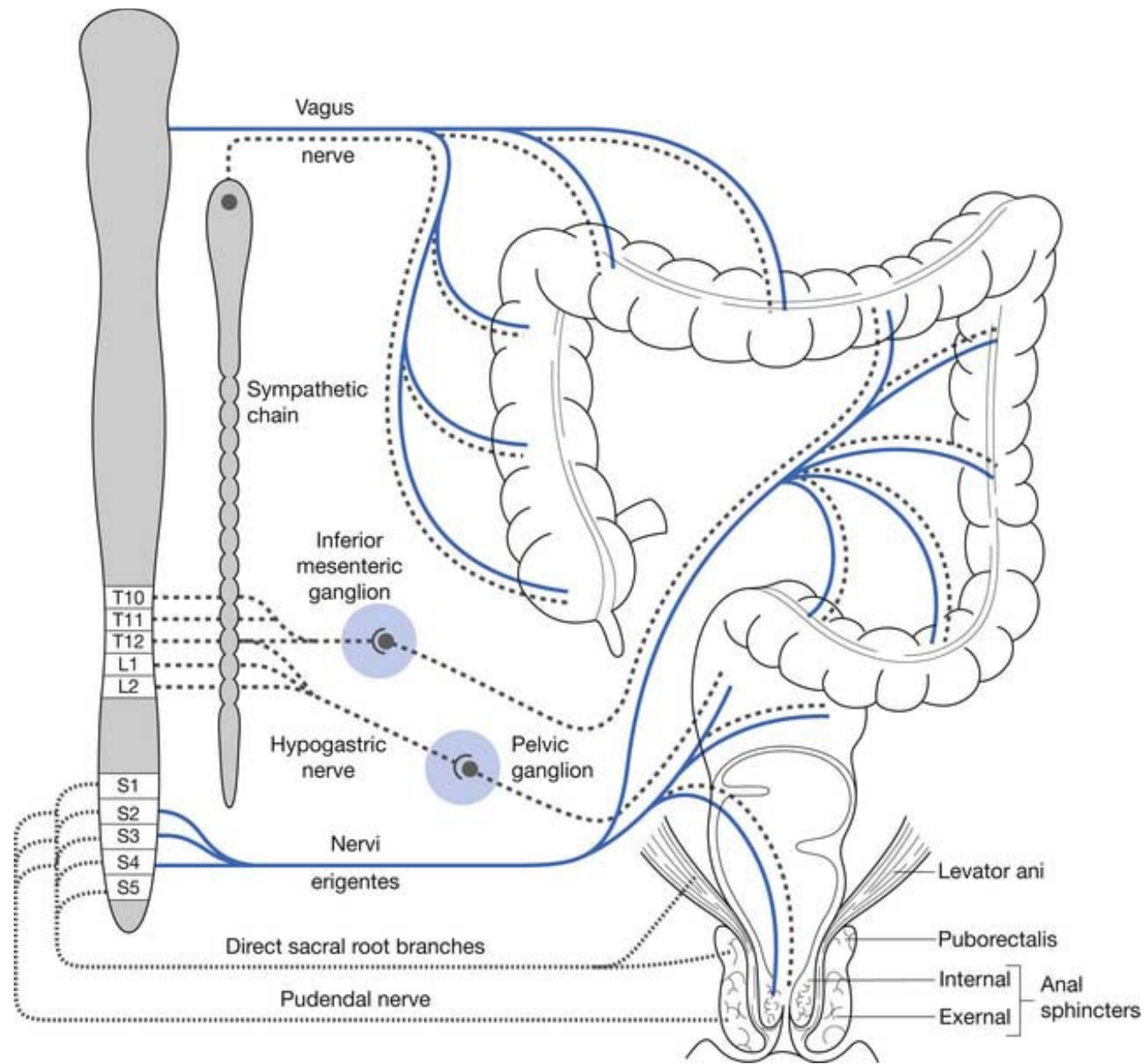
- Interstitial cells of Cajal → pacemaker cells that generate migrating motor complexes in stomach and small bowel
- Hormones (gastrin, CCK, motilin, etc)

## Autonomic

- Parasympathetic
  - **Vagus** innervates **esophagus to mid-transverse colon**
  - **S2-4** innervates **mid-transverse colon to rectum** via **Pelvic nerve**
  - Promotes peristalsis + secretions, relaxes sphincters
- Sympathetic
  - **T9-L2** via **Inf mesenteric** and **Hypogastric nerves**
  - Decreases peristalsis and secretions, contracts GI sphincters

## Somatic

- **S2-4** innervates external anal sphincter via **pudendal nerve**
- puborectalis sling also pudendal innervated



# Colonic reflexes

## Gastrocolic

- Gastric stretching from meal causes increased colonic activity
- Basis behind why bowel care is recommended 15-30 mins after meal

## Rectocolic

- Rectal stretching/fullness causes distal colonic peristalsis
- Pelvic nerve mediated
- Mechanism of how digital stimulation works

## Rectoanal inhibitory reflex

- Rectal fullness causes reflex INTERNAL anal sphincter relaxation (contrary to Kirschblum/Lin Chapter)
- Allows “sampling” of rectal contents so brain can decide to pass gas or defecate
- In neurointact, is counteracted by voluntary EXTERNAL anal sphincter contraction to maintain continence
- Hyposensitive reflex may lead to constipation while prolonged reflex may result in incontinence



# Phenotypes

- Lesions above S2 have intact colonic reflexes and sphincter tone (assuming out of spinal shock)
  - Peristalsis present but not coordinated/effective → constipation
  - Rectum-sphincter dyssynergia may exist
- Lesions below S2 have impaired colonic reflexes and poor rectal tone
  - Poor peristalsis due to lack of psymp outflow → constipation
  - Pelvic floor (e.g. puborectalis) and external sphincter laxity → incontinence
  - Must use manual evacuation as digital stimulation cannot trigger rectocolic reflex
- CPG guidelines favoring **reflexive** vs **areflexic** bowels instead of UMN vs LMN

# Epidemiology Quick Facts

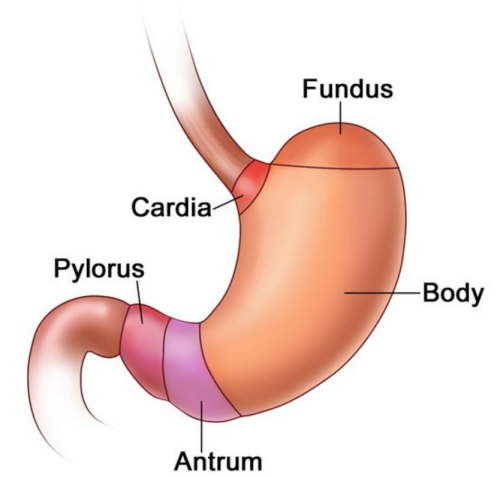
- ~80% prevalence of neurogenic bowel dysfunction
- Mod-severe symptoms in 40-50% with impact on depression and QoL
- Symptoms tend to correlate with injury severity (complete vs incomplete)
- No clear correlation with injury level (tetra vs para)
- Symptoms (e.g. constipation or time for bowel care) may worsen with SCI chronicity but not risk of fecal incontinence

# Acute Complications

# Dysphagia

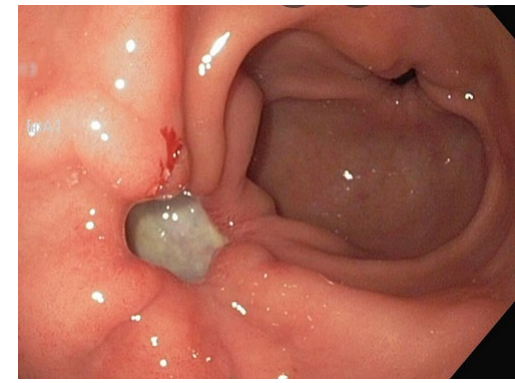
- Remember risk factors
  - Tracheostomy
  - Prolonged intubation
  - ACDF
  - C-collar
  - Esophageal dysmotility

# Gastroparesis



- Pathophysiology still being researched
  - Vagus normally promotes gastric peristalsis
  - Pyloric sphincter tonically contracted until gastric distension + enteric hormones signal it to open
- After SCI, dyscoordination between antral stomach and proximal duodenum occurs → impaired emptying → early satiety, N/V
- Dx with gastric emptying study is gold standard
  - Breath test using radiolabeled carbon 4-6 hrs post-meal also option
  - Wireless motility capsule is also newer testing modality
- Metoclopramide (D<sub>2</sub> receptor antagonist) only FDA-approved tx
  - Remember extrapyramidal side-effect and QTc prolongation risk
  - FYI: D<sub>2</sub> receptors relax the lower esophageal sphincter and stomach, antagonism improves tone for higher gastric pressure and stronger propulsion. Does NOT improve colonic motility.
  - Erythromycin sometimes listed as treatment option but has tachyphylaxis within 4 wks and also prolongs QT

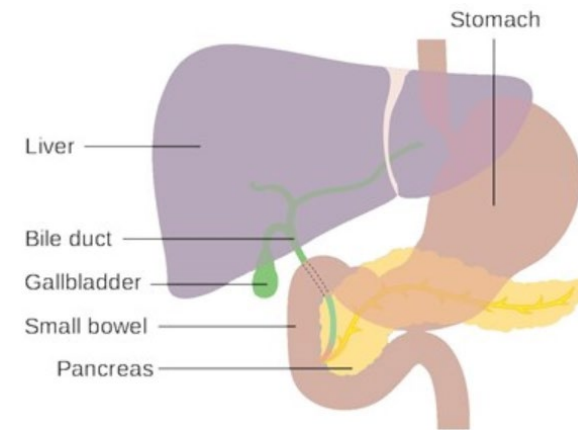
# Peptic Ulcer Dz



- Early on may be due to stress from trauma and delayed feeding
  - Highest GI bleed risk first 2 wks after acute SCI
  - Highest stomach ulcer perforation first 4 wks
- Long-term PUD risk is not higher than general population but may not be caught until more advanced dz if impaired sensation present
- In general population, systemic steroids only weakly increase incidence of GI bleeding and only in hospitalized patients. The few studies in SCI do NOT show a correlation.
  - Risk goes up significantly if on concomitant NSAIDs
- **Stress ulcer prophylaxis x 4 wks recommended**
  - Remember PPIs have higher C. diff complication rate

# Cholelithiasis & Biliary stasis

- Higher rates of cholelithiasis vs normal controls in multiple studies but unclear reason, not necessarily more symptomatic
- Gallbladder primarily driven by CCK hormone but responds to autonomic input (sympathetic input from T7-10) so stasis suspected cause
- Pancreatic stasis risk also associated with TPN or systemic steroids
- Check amylase & lipase, consider imaging if severe



# Adynamic ileus (AKA Large bowel obstruction)

- Common early on especially first 1-2 days during spinal shock but when chronic may be labeled as megacolon
- **Intestinal pseudo-obstruction (Ogilvie syndrome)**
  - Characterized by large bowel dilation > 12 cm without radiographic obstruction
  - Cecum is classically involved and most likely site to rupture
- Standard small bowel obstruction treatment (bowel rest & decompression + surgical consult)
- Can consider **IV neostigmine** (acetylcholinesterase inhibitor) if persists but not severe enough to warrant surgery





# SMA Syndrome

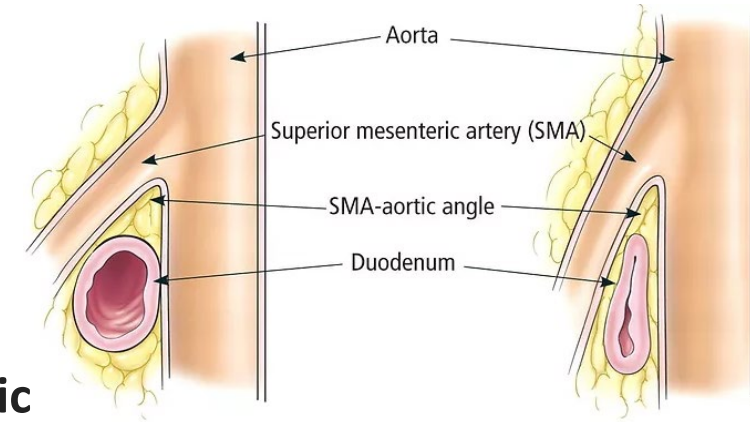
SMA originates from the descending aorta at the L1 spinal cord level, usually angle of 38-65°. **SMA syndrome occurs when the aortomesenteric angle decreases, usually as result of retroperitoneal fat loss, resulting in vascular compression of the duodenum.**

Symptoms include postprandial epigastric pain, early satiety, bilious emesis, significant weight loss, nausea, and gastric reflux. May look like bowel obstruction

Patients classically report **alleviation of symptoms with positional variation, specifically in the prone or left side-lying position**

**Upper GI/Small bowel follow through** series shows cessation of barium in third part of duodenum

Treatment is symptomatic with antiemetics and repositioning with goal of improving wt loss, abd binder can help push abd contents upwards. Duodenojejunostomy in severe cases.



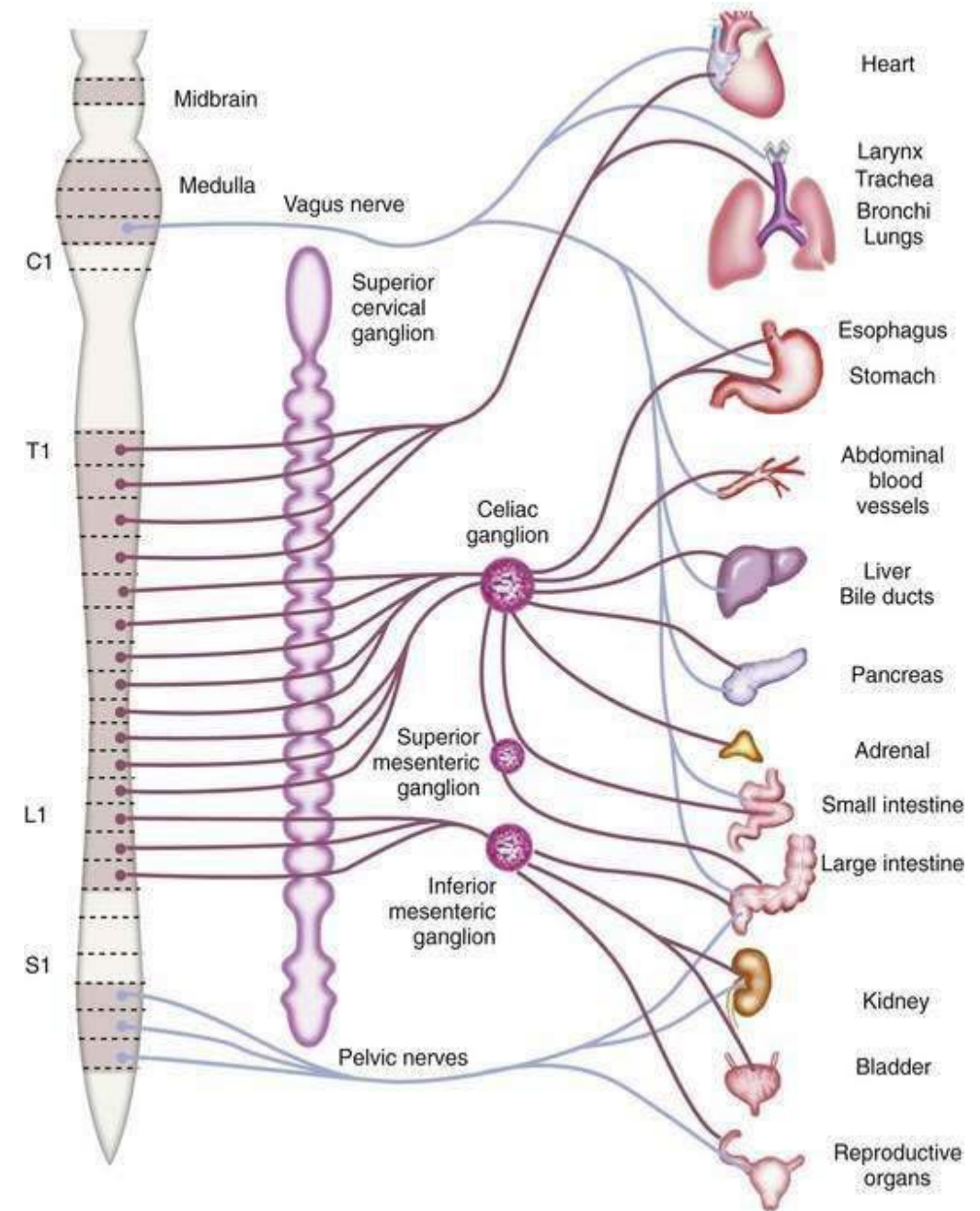
# Acute Abdomen

Highest risk during initial admission and first month post-injury

Impaired visceral sensation esp in tetraplegics and complete injuries results in delayed dx and higher morbidity

Common causes:

- Peptic ulcer perforation
- Intestinal obstruction
- Cholecystitis
- Appendicitis
- Peritonitis

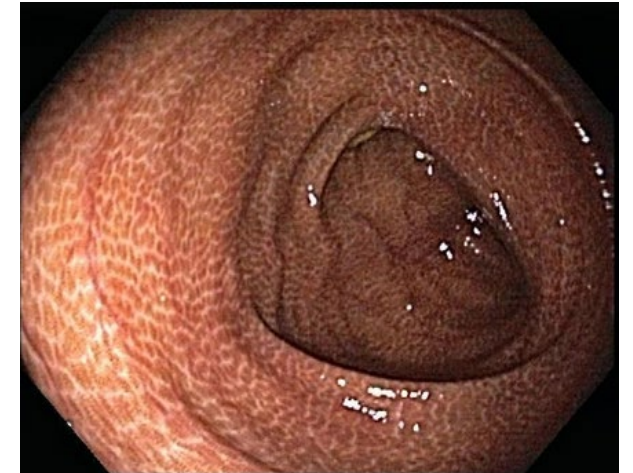


# Chronic Complications

- Constipation

# Oral Medications

Class	Medications
Stool Softeners/Emulsifiers	Docusate Mineral oil
Bulk formers	Fiber supplements Psyllium Calcium polycarbophil Methylcellulose Wheat dextrin Dietary (oat, bran, prune juice)
Stimulant/Prokinetic	Sennosides Bisacodyl
Osmotic	Polyethylene glycol Lactulose Magnesium (citrate, hydroxide)



Melanosis coli from senna

# Newer Medications

Novel (i.e. expensive) treatments	<p>Lubiprostone (Amitiza®) – PGE<sub>1</sub> derivative</p> <ul style="list-style-type: none"><li>• Stimulates chloride excretion via mucosal chloride channels</li></ul> <p>Linaclotide (Linzess®) – guanylate cyclase agonist</p> <p>Plecanatide (Trulance™)</p> <ul style="list-style-type: none"><li>• Increased cGMP increases chloride and bicarb secretion into intestinal lumen via CFTR channel</li></ul> <p>Prucalopride (Motegrity®) – serotonin 5-HT<sub>4</sub> receptor agonist</p> <ul style="list-style-type: none"><li>• Stimulates acetylcholine release and therefore peristalsis</li></ul> <p>Used for chronic idiopathic constipation, IBS, or opioid-induced constipation. Only prucalopride has a RCT for SCI and that had 50% drop out rate.</p>
Peripheral μ-receptor antagonists	<ul style="list-style-type: none"><li>• Naloxegol (Movantik™)</li><li>• Methylnaltrexone (Relistor®)</li><li>• Alvimopan (Entereg®)</li></ul> <p>Primarily indicated for opioid-induced constipation</p>

# Rectal Medications

- Glycerin
- Bisacodyl + vegetable oil base
- Bisacodyl + PEG base (Magic bullet™)
  - Faster acting than vegetable oil base bisacodyl (32 mins vs 58 mins)
- Docusate minienemas (Enemeez®, DocuSol®)
  - **Formally recommended over glycerin, mineral oil, or vege oil based bisacodyl**
  - No conclusive head-to-head comparison vs Magic bullet™ formulation yet

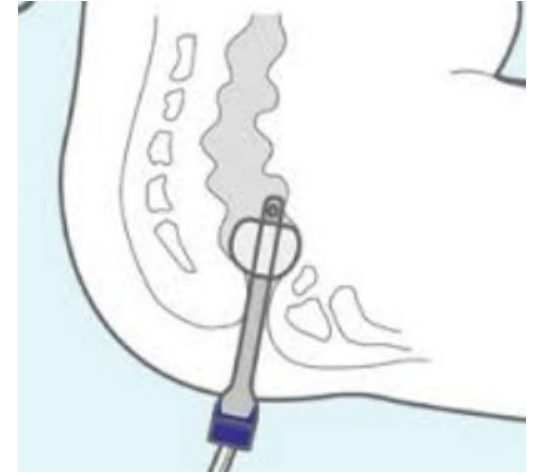
Digital stimulation is both a non-pharmacologic rectal stimulant and the only modality that mechanically opens the sphincter for stool passage

# Transanal irrigation

- Large volume enemas usually not routinely recommended d/t poor retention and risk of electrolyte abnormalities esp with phosphate formulation (i.e. Fleets)
- Transanal irrigation is the exception and is formally recommended as an option for those failing basic bowel management
  - Usually 3-600 ml of warm tap water used
  - Reduces bowel care time (e.g. 47 mins vs 74.4 mins)
  - Continence rates > 50%
  - Particularly pertinent option for areflexic bowels

# Transanal irrigation

Relative contraindications	<ul style="list-style-type: none"><li>Severe diverticulosis</li><li>Hx diverticulitis</li><li>Rectal surgery</li><li>Long term steroid medication</li><li>Fecal impaction</li><li>Pregnancy</li><li>Anticoagulation more than ASA or plavix</li><li>Severe AD</li></ul>
Absolute contraindications	<ul style="list-style-type: none"><li>Anal/rectal stenosis</li><li>Active IBD flare (Crohn's/UC)</li><li>Acute diverticulitis</li><li>Colorectal cancer</li><li>Ischemic colitis</li><li>Rectal surgery &lt; 3 mo</li><li>Endoscopic polpectomy &lt; 1 mo</li></ul>

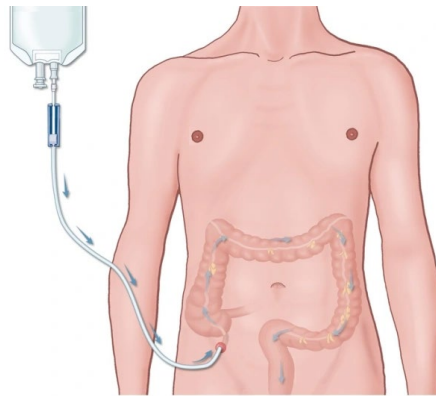




# Surgical Mgmt

## Malone Antegrade Continence Enema (MACE)

- Uses appendix to create catheterizable channel to flush enema fluid in direction stool normally travels
- Can substitute mic-key button or pigtail catheter (Chait tube) if appendix not usable



## Colostomy

- Recommended for those who have failed basic bowel mgmt. or have had significant complications
- Can be early choice for those who simply prefer it after thorough education

# Bowel Management

Goal is to create **scheduled BMs** with **complete distal colonic emptying** to create **predictable periods of continence**

- Stool consistency ← fluids, fiber, dose of laxatives
- Stool frequency ← timing of laxatives, completeness of emptying, activity level, pre-SCI motility
- Complete emptying ← positioning (bed vs seated), rectal stimulant interventions

Typically start daily dig stim with your laxatives of choice and adjust from there

Start at bed-level and progress to commode/toilet as their function improves

# Important considerations

- Ability to learn or self-direct care upon discharge
- Sitting balance or side-lying tolerance (shoulder pain, wounds, neuropathic pain common barriers)
- UE function and proprioception
- Transfer skills
- Spasticity
- Body habitus, truncal flexibility (remember many s/p fusion)
- Skin integrity (shearing injury risk, pressure ulcers, incontinence contamination of dressings)
- Home accessibility for DME
- Autonomic dysreflexia risk
- Patient life schedule, duties, and QoL

Have to decide which factors you can modify and which bowel management program is going to be sustainable on discharge

# 2020 CPG Highlights

- More detail on initial and annual evaluation components
  - **Standardized reporting** (AIS + Bristol scale + Questionnaires)
  - Initial troubleshooting recommendation with AXR with escalation to CT Abd if needed
  - **Advanced bowel testing options** (outlined in upcoming slide)
- Basic bowel management (BBM) explained in detail
  - Recommendations against abdominal massage & valsalva emptying
  - Recommended equipment (see next slide)
- Formal recommendation for TAI for those failing BBM
- **Nutritional recs**
  - **Guidance on elimination diets (specifically low FODMAP)**
  - **Recommendation against routine probiotics unless on antibiotics**
- Official stance on standing programs
- **Recommendation against FES systems** (SARS/SNS/PTNS)
- Hemorrhoid recommendations (i.e. avoid excisional surgery)
- Screening recommendations (AD, skin, caregiver involvement, psychosocial)
- Education components (table 8 of CPG)

**Table 5. Potential Functional Performance and Adaptive Equipment by Level of Injury**

Level of Injury	Potential Functional Performance Outcome for Bowel Care <sup>a</sup>	Bathroom Equipment Options	Assistive Device Options <sup>b</sup>
C1-5	Independent in providing verbal instruction; dependent for performance of bowel care; dependent for transfers	<ul style="list-style-type: none"> <li>- Padded, tilt-in-space roll-in shower/ commode chair with positioning/ safety accessories</li> <li>- Padded, upright roll-in shower/ commode chair</li> <li>- Perform in bed</li> </ul>	<ul style="list-style-type: none"> <li>- Mechanical lift and sling</li> <li>- Transfer board</li> </ul>
C6	Independent in providing verbal instruction; assistance with clothing; modified independent performance of bowel care; possibly independent with transfers	<ul style="list-style-type: none"> <li>- Padded, upright roll-in shower/ commode chair with perianal cutout</li> <li>- Padded, elevated toilet seat</li> <li>- Grab bar            - Perform in bed</li> </ul>	<ul style="list-style-type: none"> <li>- Digital stimulator</li> <li>- Suppository inserter</li> <li>- Adaptive equipment for clothing management</li> <li>- Transfer board</li> <li>- Mechanical lift</li> <li>- Mirror</li> </ul>
C7	Modified independent with all components	<ul style="list-style-type: none"> <li>- Padded, upright roll-in shower/ commode chair with perianal cutout</li> <li>- Padded, elevated toilet seat</li> <li>- Grab bar            - Perform in bed</li> </ul>	<ul style="list-style-type: none"> <li>- Digital stimulator</li> <li>- Suppository inserter</li> <li>- Adaptive equipment for clothing management</li> <li>- Transfer board</li> <li>- Mirror</li> </ul>
C8-T1	Modified independent to independent with all components	<ul style="list-style-type: none"> <li>- Padded, upright roll-in shower/ commode chair with perianal cutout</li> <li>- Padded, elevated toilet seat</li> <li>- Grab bar            - Perform in bed</li> </ul>	<ul style="list-style-type: none"> <li>- Digital stimulator</li> <li>- Suppository inserter</li> <li>- Transfer board</li> <li>- Mirror</li> </ul>
T2-T6	Independent with all components	<ul style="list-style-type: none"> <li>- Padded, upright roll-in shower/ commode chair with perianal cutout</li> <li>- Padded, elevated toilet seat</li> <li>- Grab bar            - Perform in bed</li> </ul>	<ul style="list-style-type: none"> <li>- Transfer board</li> </ul>
T7-L2	Independent with all components	<ul style="list-style-type: none"> <li>- Padded, upright roll-in shower/ commode chair with perianal cutout</li> <li>- Padded, elevated toilet seat</li> <li>- Grab bar            - Perform in bed</li> </ul>	<ul style="list-style-type: none"> <li>- Transfer board</li> </ul>

Drop-Arm Bedside Commode



Rolling shower/commode chair



Tilting shower/shower chair



Elevated toilet frame



Suppository Inserter



# Sacral neuromodulation

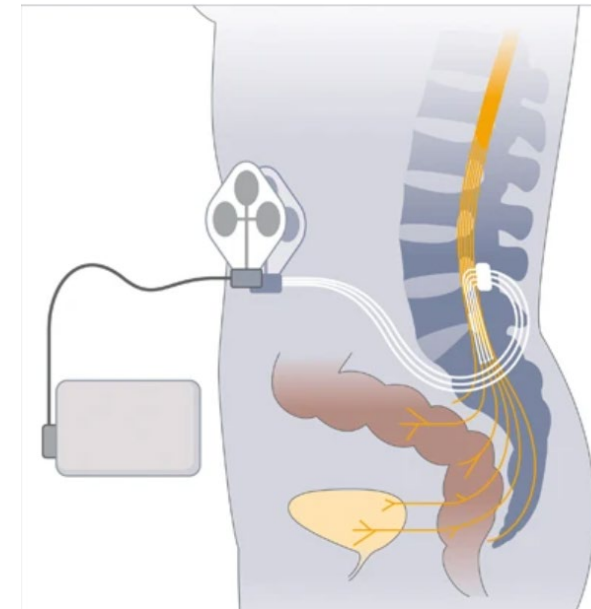
## Sacral anterior root stimulator (SARS)

- Originally indicated for neurogenic bladder with subsequent bowel benefits noted
- Electrodes placed at S2-4 anterior roots
- **Typically paired with S2-5 dorsal rhizotomy to abolish reflexive bladder contractions → abolishes reflexive erectile and ejaculation functions in men** (does not affect sexual function in women based on available studies)
- Most studies formally looking at neurogenic bowel function usually < 25 patients
  - Rasmussen 2015 surveyed 333 SCI pts of which 166 didn't use, got subsequent colostomy, or had explanted = 50% success rate

## Sacral nerve stimulator (SNS)

- **Direct low-voltage current via electrode placed at S3 foramen posteriorly without rhizotomy**
- High placebo effect, sham controlled studies show no difference
- High explant/drop out rate long-term (48% @ 5 yrs)
- Most studies in female-predominant population with idiopathic constipation, only few under-powered studies in neurogenic bowel

**Not recommended for routine use by CPG**



# Bowel tests

Test	Considerations
Gastric emptying study	Work up nausea and abdominal pain Helps differentiate gastroparesis from GERD or constipation
Colonic transit time (total vs segmental)	Can help identify where motility most impaired (small bowel vs right vs left colon) but wide variability in transit times even day-to-day in same patient
Capsule motility study	Provides information on gastric pH and small vs large bowel motility without any radiation exposure Don't confuse with capsule endoscopy
Anorectal manometry	Helps determine patient's rectal sensation, stool propulsive force, pelvic floor coordination/impaired relaxation, and presence of recto-sphincter reflexes
Pudendal/Pelvic floor EMG	Helps identify pelvic floor dysfunction and UMN vs LMN injury, can combine with manometry










# Validated Bowel Measures/Questionnaires

- Bristol Stool Form Scale
  - 7-point scale to standardize stool consistency reporting
- International SCI Bowel Function Basic Data Set
  - 16 items asking about bowel function, bowel care procedures, medications, symptoms and complications
  - **Most recommended by the new Clinical Practice Guidelines**
- Neurogenic bowel dysfunction score
  - Measures symptoms and bowel management routines with weighting on impact on QoL
- SCI-QoL Bowel subscale
  - QoL questionnaire focusing on bowel accidents and psychosocial impact

# Bristol Stool Scale

- UMN bowel - goal type 4
- LMN bowel - goal type 2-3

Be able to convert back-forth  
from number vs description

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 the surface
Type 4		Like a sausage or snake, smooth and soft
Type 5		Soft blobs with clear-cut edges
Type 6		Fluffy pieces with ragged edges, a mushy stool
Type 7		Watery, no solid pieces. <b>Entirely Liquid</b>

# Nutritional recommendations

- Recommendation of 15g dietary fiber daily, can titrate slowly based on patient tolerance
  - 15g is lower than 20-30g commonly recommended in general population
- Must be accompanied by adequate fluid intake to prevent constipation (2-3L if bladder program can tolerate)
- Consider low FODMAP diet if abdominal gas symptoms bothersome
- Recommends euhydration with starting point formulas
  - 1 mL water/kcal consumed
  - 30 mL water per kg body weight
  - [100 ml/kg for first 10 kg] + [50 mL/kg for second 10 kg] + [15 mL per kg after first 20]

<b>High FODMAPs</b>	Apples, Blackberries, Cherries, Dates, Grapefruit, Mango, Pear, Watermelon	Artichoke, Asparagus, Cauliflower, Garlic, Mushrooms, Onion/shallots /leeks, Sugar snap peas	Barley, Rye, Wheat	Cottage Cheese, Frozen yogurt, Ice cream, Milk, Soy milk, Yogurt	Most beans/legumes, Processed meats <sup>a</sup>	Sodas & juices containing high-fructose corn syrup, Rum, Tea: chamomile, oolong, fennel, and chai
<b>Low FODMAPs</b>	Banana (unripe), Grapes, Kiwifruit, Lemon, Lime, Mandarin Orange, Papaya, Pineapple	Bok choy, Broccoli, Carrots, Chives, Cucumber, Eggplant, Kale, Lettuce, Olives, Radish, Spinach, Tomato	Corn tortilla, Gluten free-pastas, crackers and breads <sup>a</sup> , Oatmeal, Potato, Popcorn, Rice, Sourdough bread, Quinoa	Almond milk, Cheese, Coconut Yogurt, Lactose-free ice cream, milk, yogurt, <sup>a</sup> cottage cheese	Beans/legumes: edamame, lentils, Canned/rinsed: Coffee, Sucrose chickpeas, black beans, diet soft drinks, Beef, Chicken, Egg, Fish/Seafood, Pork, Turkey, Tempeh, Tofu: firm	Alcohol: wine (most), beer, spirits, sweetened or Tea (except those listed above), Water

**Abbreviation:** FODMAPs, fermentable oligosaccharides, disaccharides, monosaccharides, and polyols.

# Role of Standing

- Poor standardization of regimens (duration, frequency, device, etc)
  - 30 mins 3x/wk recommendation for “general health”
- Predominantly improves subjective measures of bowel function with the only prospective study done vs seated arm ergometry showing no between group differences (Hubscher 2021)
- Few comparative studies against other interventions
- **Can be considered given subjective benefits but weigh against safety (e.g. osteoporosis, orthostasis) and alternative interventions**

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THANK YOU!

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