Neurogenic Bowel

Katya Radkevich, MD
SCI Staff Physician
VA Puget Sound Healthcare System

Outline

• Definition
• Normal physiology and anatomy of the gastrointestinal (GI) tract
• Neurological control of the GI system
• Gastrointestinal tract changes following spinal cord injury (SCI)
• Bowel management
• Complications

Neurogenic Bowel

• Describes colon and pelvic dysfunction resulting from any nervous system damage or developmental defect
  – Lack of perception of need to defecate
  – Increased transit time
  – Incontinence
  – Dyscoordination of fecal elimination
  – Abdominal distention
  – Visceral pain

Symptoms

• Common GI symptoms in persons with SCI
  – Dysphagia
  – Heartburn
  – Bloating
  – Early satiety
  – Constipation
  – Abdominal distention and cramping
  – Difficulty with passing flatus
  – Perineal burning
  – Fecal incontinence
  – Social activity limitation
Neurogenic Bowel

- Has been noted to be a significantly disabling feature for patients with:
  - Stroke
  - Amyotrophic lateral sclerosis
  - Multiple sclerosis
  - Diabetes mellitus
  - Myelomeningocele
  - Muscular dystrophy
  - SCI

Normal Physiology and Anatomy

- Mastication
- Swallowing (Deglutition)
- Digestion
- Absorption
- Storage
- Defecation

Mastication

- Aids digestion by increasing the exposed surface area of food particles to digestive enzymes
- Oral health maintenance and preventative care
- Barriers:
  - Difficulty in performing daily mechanical plaque removal
  - Xerostomia
    - Tizanidine, baclofen, amitriptyline and oxybutynin
  - Gingivitis, periodontal disease

Deglutition

- Voluntary, pharyngeal and esophageal stages
- Dysphagia after acute injury occurs in up to 20% of cases
- Risk factors:
  - Supine position
  - Halo immobilization
  - Tracheostomy
  - Anterior approach to cervical spinal surgery
### Stomach
- Functions:
  - Food storage
  - Mixing food products with gastric secretions
  - Regulates delivery of food into duodenum
- Prolongation of gastric emptying
  - Metoclopramide
- Gastric ulcers

### Small Intestine
- Digestion and absorption of nutrients with assistance of products from the liver and pancreas.
- Superior mesenteric artery syndrome
  - Functional obstruction of the third segment of the duodenum between the superior mesenteric artery and the aorta
  - Epigastric pain
  - Postprandial fullness, nausea, vomiting

### Large Intestine
- Ascending colon
  - Absorbs electrolytes and water
- Descending colon
  - Stores fecal material until evacuation
  - Secrets mucus for lubrication
  - Forms the stool
  - Supports the growth of symbiotic bacteria

### Large Intestine
- Normal colonic transit time is 12-30 hours from the ileocecal valve to the rectum
- Haustrations are circular muscular contractions of the colon that cause mixing of the colonic contents
  - Generally do not cause forward movement of the stool
- Mass movements are large areas of muscular contractions that propel stool forward
  - Last 10-30min and occur only a few times a day
Neurological Control of the GI System

• Enteric
• Autonomic
  – Parasympathetic
  – Sympathetic
• Somatic

Enteric Nervous System (ENS)

• Intrinsic nervous system
• The myenteric (Auerbach)plexus
  – Controls motor activities that assist in propelling stool throughout the colon
• Submucosal (Meissner) plexus
  – Controls local secretion and absorption
• ENS can function independently but is partially influenced by the autonomic nervous system

Enteric Nervous System

• The sympathetic and parasympathetic systems modulate the ENS but do not directly control the smooth muscle of the bowel
• Smooth muscles of the bowel have their own electromechanical automaticity, which is directly modulated by the inhibitory control of the ENS

Parasympathetic Nervous System

• Vagus nerve supplies the PS innervation from the esophagus to the midtransverse colon
• Pelvic nerve, originates in the lateral anterior gray column or spinal cord segments S2-4
  – Provides innervation from the midtransverse colon to the rectum
• There is only minimal PS innervation of the small intestine
### Parasympathetic

- **Function**
  - increases peristalsis
  - stimulates secretions
  - relaxes sphincters
  - increases gut motility

### Sympathetic Nervous System

- **Intermediolateral column of the spinal cord between T5 and T12**
- **Mesenteric (T5-T12) nerve**
- **Hypogastric (T12-L3)**
- **Function:**
  - Decrease peristalsis
  - Inhibit secretions
  - Contract sphincters

### GI Tract Reflexes

- **Gastrocolic**
- **Colocolic**
- **Rectocolic**
- **Rectoanal inhibitory**
- **Anorectal excitatory**

### Reflexes

- **Gastrocolic**
  - Increase in colonic activity after ingestion of a meal
  - Cholinergically-mediated
- **Colocolic**
  - Muscles above a dilation constrict, below the dilation – relax, thus propelling the stool caudally
  - Controlled by the myenteric plexus
Reflexes

• Rectocolic
  – Pelvic nerve
  – Responsible for colonic peristalsis that occurs in response to chemical or mechanical stimulation of the rectum or anal canal
• This reflex is the basis for the use of digital stimulation and suppositories in performing the bowel program after SCI

Reflexes

• Rectoanal inhibitory
  – Reflex relaxation of the internal sphincter on rectal distention
  – Rectal contraction to begin defecation
• Anorectal excitatory
  – Rectal contractions are maintained by stool passing through anal canal

Anal Sphincters

• Internal anal sphincter
  – Smooth muscle
  – Involuntary
  – Provides continence in the resting state
• External anal sphincter
  – Striated muscle
  – Innervated by pudendal nerve S2-4
  – Voluntary

Continence

• Maintained by:
  – Internal anal sphincter
  – External anal sphincter
  – Puborectalis muscle
• Internal anal sphincter provides pressure in the anal canal at rest
• External anal sphincter provides continuous contraction that increases in response to mechanical stimulation
  – Contracts to retain stool if the rectum is rapidly dilated - Holding reflex
Normal Defecation

- Colonic contractions
- Movement of stool from the colon to the rectum
- Distention of the rectum
- Stretch of the puborectalis muscle
- Reflex relaxation of the internal anal sphincter
  - Rectoanal inhibitory reflex
- Conscious urge to defecate
- Under voluntary control the external anal sphincter and puborectalis relax
- Abdominal musculature aids defecation

Changes Following SCI

- Dysphagia
- Esophageal function generally remains intact
- Changes in gastric motility (tetraplegia)
- Increase in gallbladder disease
- Lesions above T1, there is prolonged mouth to cecum transit time
- Delayed left colon and rectal transit times
- Decreased colonic motility

Upper and Lower Motor Neuron Bowel

- Anal sphincter tone is directly related to the SCI level
- Above conus medullaris (T12) – UMN bowel
  - Spastic sphincter
  - Voluntary control is lost
  - Reflex activity is intact
- SCI below T12 – LMN bowel
  - Flaccid sphincter
  - No voluntary or reflex activity

Constipation

- Decreased colonic motility
  - Especially of the descending colon
- Loss of normal autonomic control
- Immobility
- Loss of abdominal musculature
- Spastic sphincter (in UMN bowel)
- Absence of peristalsis of the descending, sigmoid colon in LMN bowel (due to denervation)
Bowel Management

- Bowel program goals:
  - Predictability
  - Regularity
  - Thorough evacuation
  - Prevention of incontinence
  - Prevention of complications (abdominal distension, obstruction, impaction, diarrhea)

- Considerations:
  - Diet, availability of caregivers, adaptive equipment, accessibility, lifestyle, school/work schedule

Bowel Program

- Regularly performed routine intended on effective evacuation of bowels in a timely and predictable manner

- Factors to consider when establishing a schedule:
  - UMN or LMN bowel
  - Pre-injury pattern of elimination
  - Lifestyle
  - Caregiver schedule

Bowel Program

- Position:
  - Optimal: sitting on a padded commode
  - In bed lying on a side

- Daily or every other day

- Should take 45-60min

AD During Bowel Program

- In a study all patients enrolled had an increase in SBP by 20mm Hg above baseline

- 70% of patients had increase of >40mm above baseline

- 40% reached SBP >170mm during their bowel program

- Hypertensive episodes are usually transient with VS returning to baseline without 5 minutes

- Greatest period of hypertension occurred during manual removal of stool

- Topical anesthetic may help minimize AD symptoms
UMN Bowel Program

- Spinal-mediated sacral reflex activity is preserved
- Stool softeners (docusate sodium) 2-3 times per day
- Stimulants (Senna)
- Suppository
- To utilize the gastrocolic reflex, patients should perform bowel program 20-30 min after eating
- Caffeine may act as a stimulant and may be used prior to a bowel program to help facilitate evacuation
- Perform on the same time of the day

UMN Bowel Program

- Stool evacuation occurs by means of reflex activity of the rectum in response to a stimulus administered in the rectum
- Digital stimulation
  - Insertion of a well-lubricated gloved finger or an adapted plastic device into the rectum
  - Rotation of the finger or the device to provide stimulation to the rectal wall to evacuate the stool
  - Perform every 10-15 min for 15-20 seconds
  - Check for stool in the vault until there is closure around the finger by the internal sphincter or no results after two stimulations

LMN Bowel

- Flaccid rectum
- Absence of reflex activity
  - No reflex mediated peristalsis
  - No holding reflex
  - Absence of EAS reflex contraction
- Increased risk of incontinence
  - Pelvic floor laxity -> decreased puborectalis tone -> decreased anorectal angle
  - Intact rectoanal inhibitory reflex
  - Absence of EAS reflex contraction

LMN Bowel Care

- Manual removal of stool is usually required
- May require twice daily bowel program
- Stool softeners and bulking agents may be necessary to maintain stool consistency
- Contact irritant suppositories are ineffective
- Digital stimulation may trigger proximal segmental peristalsis to help propel stool out
**LMN Bowel Care**

- Assistive techniques:
  - Valsalva maneuver
  - Abdominal massage
  - Completing bowel program on a commode
  - Bowel care can be timed to follow a meal to take advantage of the gastrocolic reflex
- Avoid valsalva during transfers
- Support of the pelvic floor and anal sphincter by using tight underwear/bicycle pants
  - Promotes gluteal adduction

**Completion of Bowel Care**

- Indications that defecation is complete:
  - Absence of palpable stool
  - Passage of mucus
  - Tightening of the internal anal sphincter
  - Absence of stool results from the last two digital rectal stimulations

**Bowel Care**

- If changes are made to the bowel program the routine should be maintained for three to five bowel cycles before deciding if changes are effective

**Bowel Care Options**

- Anterograde continence enema (ACE), the Malone procedure
  - Uses a segment of bowel (appendix) to create a tunnel into the ascending colon to administer an enema
- Colostomy
- Transanal colonic irrigation
<table>
<thead>
<tr>
<th>Pharmacological Agents</th>
<th>Stool Softeners</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Facilitate an effective overall bowel program but are not required or necessary long term</td>
<td>• Docusate sodium (Colace)</td>
</tr>
<tr>
<td>• Stool softeners</td>
<td>• Docusate calcium (Surfak)</td>
</tr>
<tr>
<td>• Bulk formers</td>
<td>• Mechanism of action:</td>
</tr>
<tr>
<td>• Peristaltic stimulants</td>
<td>– Surface-active agents that emulsify fat in the GI tract and decrease the reabsorption of water in the colon</td>
</tr>
<tr>
<td>• Contact irritants</td>
<td>• Appropriate fluid intake is necessary to be effective</td>
</tr>
<tr>
<td>• Laxatives</td>
<td><strong>Bulk Formers</strong></td>
</tr>
<tr>
<td><strong>Dietary Fiber</strong></td>
<td><strong>Dietary Fiber</strong></td>
</tr>
<tr>
<td>• Plant component</td>
<td>• Plant component</td>
</tr>
<tr>
<td>• In abled-bodies persons, increased dietary fiber is recommended to promote regular bowel movements and to decrease constipation</td>
<td>• In abled-bodies persons, increased dietary fiber is recommended to promote regular bowel movements and to decrease constipation</td>
</tr>
<tr>
<td>• Increases stool water content, increases stool bulk and results in decreased intestinal transit time</td>
<td>• Increases stool water content, increases stool bulk and results in decreased intestinal transit time</td>
</tr>
</tbody>
</table>
### Dietary fiber in SCI

- No studies have shown evidence that increased dietary fiber results in improved bowel function or better results with bowel program
- Possible has the opposite effect in SCI persons:
  - Delayed colonic transit time
- High fiber diet (20-30mg fiber) should be avoided

### Peristaltic Stimulants

- Enhance bowel peristalsis and colonic transit by direct stimulation of the colonic intramural plexus
- Senna (Senokot)
  - Stimulates Auerbach plexus
  - Facilitates a bowel movement about 6-12hrs after administration
  - Long-term use can cause melanosis coli and cathartic colon (dilated, atonic bowel)

### Prokinetic Agents

- Metoclopramide (Reglan)
- Mechanism of action:
  - Cholinergic agonist
  - Dopamine antagonist
- Increases gastric motility without affecting colonic motility
- Extrapyramidal side effects

### Contact Irritants

- Bisacodyl suppository
  - Dulcolax, oil base
  - Magic Bullet, polyethylene glycol (PEG) base
- Enemeez
  - Docusate sodium, PEG and glycerin
- Glycerin suppository
  - Contact irritant and a lubricant
  - Milder agent
- Active agent need to reach the bowel wall to be effective
Laxatives

• Saline laxatives:
  – Milk of magnesia
  – Magnesium citrate
  – Draw fluid into the small intestine thus stimulating colonic motility
• Hyperosmolar laxatives
  – Lactulose, sorbitol, PEG (Golytely, Miralax, CoLyte)
  – Act osmotically to draw fluid into the colon after being metabolized into short chain amino acids

GI Complications

• Caries, tartar
• Dysphagia
• Gastroesophageal reflux
• Gastric emptying prolongation
• Superior mesenteric artery syndrome
• Acute abdomen
• Ileus
• Cholelithiasis
• Hemorrhoids
• Pancreatitis

GERD

• Reduced diaphragm strength results in chronic elevation
• Reduced lower esophageal sphincter pressure
• Supine or semi-upright position
• Heartburn may not be present, if lesion is above T7

Gastritis

• Peptic ulcers and gastritis are frequently reported complications, both in the acute and chronic periods
• Risk increases with higher neurologic level and completeness of injuries
• Prophylaxis with H2 blockers or PPIs is usually recommended for at least 4 weeks
### Acute Abdomen

- Acute abdominal emergencies have been reported in as high as 5% of new SCI persons
- Absence of the usual signs and symptoms due to impaired sensory, motor and reflex functions
- Suspicious findings:
  - Abdominal spasticity
  - Shoulder pain
  - Abdominal pain with bloating
  - Constipation
  - Disappearance of bowel sounds

### Ileus

- An adynamic ileus
- In the acute period – 8% incidence
- Frequently occurs within the first 24-48 hours
- Often resolves without 2-3 days of onset
- Likely due to the loss of both para- and sympathetic activity during spinal shock
- NPO, NG tube decompression, metoclopramide

### Ogilvie Syndrome

- Acute colonic pseudo-obstruction
  - Significant dilation of the large bowel (>12 cm)
  - Absence of distal intestinal obstruction
  - Cecum is at risk for perforation
- Chronic SCI
- Etiology is poorly understood
  - ? Imbalance between the sympathetic and parasympathetic NS causing impaired peristalsis
- Symptoms: abdominal distention, discomfort
- Diagnosis: KUB, abdominal CT
- GI and surgical consults

### Hemorrhoids

- Around 57% of individuals more than 5 years post-injury have symptomatic hemorrhoids
- Symptoms:
  - Bleeding
  - Pain
  - Prolapse
    - Chronic secretion of fluid
    - Skin breakdown
- Treatment:
  - Hydrocortisone suppositories/creams after completion of a bowel program
  - Larger hemorrhoids or prolapse:
    - Sclerotherapy
    - Band ligation
    - Hemorrhoidectomy
Cholelithiasis

- Many individuals with gallstone disease are asymptomatic
- True incidence and prevalence is unknown
- Possibly double or triple the risk of a non-SCI population
- Theories why the risk is higher:
  - Abnormal gallbladder motility -> bile stasis
  - Impaired enterohepatic circulation
  - Abnormal biliary lipid secretion

References


Pancreatitis

- Most common in the first month post-injury
- Etiology:
  - May be related to high-dose steroid use
  - Sphincter of Oddi dysfunction
  - Vagal dominant innervation of the pancreatic gland
- Should be on a differential diagnosis with unresolving ileus or recurrence
- Diagnosis is based on laboratory studies
- Treatment similar to non-SCI population
  - Resting the gut, NG tube, correction of fluid and electrolyte abnormalities

Pancreatitis

- Pain, radiating to the right shoulder
- Right upper quadrant pain and tenderness
- Should be considered if adynamic ileus does not resolve or recurs
- GI and surgery consults
Question #1
Which treatment is NOT appropriate for management of neurogenic bowel in persons with SCI?
A. Docusate sodium (Colace)
B. Dietary fiber
C. Psyllium (Metamucil)
D. Senna (Senokot)

Question #2
Which presentation is NOT common in patients with SCI and cholelithiasis?
A. Right upper quadrant pain
B. Right shoulder pain
C. Ileus
D. Heartburn
Question #3
Which is NOT recommended during a bowel program?
A. Drinking a caffeinated beverage
B. Sitting on a padded commode
C. Lying in bed on one’s back
D. Lying in bed on a side

Question #4
Which gut reflex is the basis for the use of digital stimulation in performing the bowel program after SCI?
A. Rectoanal inhibitory
B. Gastrocolic
C. Rectocolic
D. Anorectal excitatory
Question #5
Which symptom is indicative of a lower motor neuron bowel?
A. Spastic sphincter
B. Intact reflex activity
C. Voluntary control of external anal sphincter
D. Flaccid sphincter

Question #5
Which symptom is indicative of a lower motor neuron bowel?
A. Spastic sphincter
B. Intact reflex activity
C. Voluntary control of external anal sphincter
D. Flaccid sphincter